WORKING TEXT

WT-385_draft1
ITU-T PON YANG Modules

Revision: 01
Revision Date: May 2017

Revision History

Revision Number	Revision Date	Revision Editor	Changes
00	March 2017	Robert Peschi, Joey Boyd, Samuel Chen	Initial draft.
01	May 2017	Robert Peschi, Joey Boyd, Samuel Chen	This revision is being made publicly available as WT-385_draft1.

Comments or questions about this Broadband Forum Working Text should be directed to help@broadband-forum.org.

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Executive Summary

This Working Text defines YANG data models for ITU-T Passive Optical Networks (PON) as defined in [ITU-T G.984.x], [ITU-T G.987.x], [ITU-T G.989.x], [ITU-T G.9807.x] and potentially others. They are used for managing the Optical Line Termination (OLT) and subtending Optical Network Units (ONU), and applied to the northbound interface of an OLT.

1 Purpose and Scope

1.1 Purpose

This Working Text defines YANG data models for ITU-T Passive Optical Networks (PON) as defined in [ITU-T G.984.x], [ITU-T G.987.x], [ITU-T G.989.x], [ITU-T G.9807.x] and potentially others. They are used for managing the Optical Line Termination (OLT) and subtending Optical Network Units (ONU), and applied to the northbound interface of an OLT.

1.2 Scope

The data models defined by this Working Text form the set of core models for PON management. They are referred as “xPON YANG Modules” throughout this document. The xPON YANG Modules address the configuration, fault management and performance management for Transmission convergence (TC) layer operation, Physical Media Dependent (PMD) layer parameters, PON resources (PON link, Alloc-ID, GEM, ONU, etc.), and so on.

It is intended that data models that are application specific can be built on, reference, and/or function alongside the xPON YANG Modules. For example, the BBF Common YANG Modules [20] can be used along with the xPON YANG Modules to provision variety of services and features for PON, such as Ethernet services, equipment management, configuration management for the control plane functions like IGMP, DHCP, etc.

The xPON YANG Modules allow optional components and future extensions.

2 References and Terminology

2.1 Conventions

In this Working Text, several words are used to signify the requirements of the specification. These words are always capitalized. More information can be found be in RFC 2119 [1].

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 Working Text. At the time of publication, the editions indicated were valid. All references are subject to revision; users of this Working Text 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]	RFC 2119	*Key words for use in RFCs to Indicate Requirement Levels*	IETF	1997
[2]	RFC 7950	*The YANG 1.1 Data Modeling Language*	IETF	2016
[3]	RFC 6991	*Common YANG Data Types*	IETF	2013
[4]	RFC 7317	*A YANG Data Model for System Management*	IETF	2014

[5]	RFC 7223	*A YANG Data Model for Interface Management*	IETF	2014
[6]	draft-ietf-netmod-entity	*A YANG Data Model for Hardware Management*	IETF	2017
[7]	G.984.2 Amendment 2	*GPON: Physical Media Dependent (PMD) layer specification*	ITU-T	2008
[8]	G.984.3	*G-PON: Transmission convergence layer specification*	ITU-T	2014
[9]	G.987	*XG-PON systems: Definitions, abbreviations and acronyms*	ITU-T	2012
[10]	G.987.3	*XG-PON: Transmission convergence (TC) layer specification*	ITU-T	2014
[11]	G.988	*ONU management and control interface (OMCI) specification*	ITU-T	2012
[12]	G.989	*NG-PON2: Definitions, abbreviations and acronyms*	ITU-T	2015
[13]	G.989.2	*NG-PON2: Physical Media Dependent (PMD) layer specification*	ITU-T	2014
[14]	G.989.3	*NG-PON2: Transmission convergence layer specification*	ITU-T	2015
[15]	G.9807.1	*10-Gigabit-capable symmetric passive optical network (XGS-PON)*	ITU-T	2016
[16]	TR-101 Issue 2	*Migration to Ethernet-Based Broadband Aggregation*	BBF	2011
[17]	TR-142 Issue 2	*Framework for TR-069 enabled PON Devices*	BBF	2010
[18]	TR-156 Issue 3	*Using GPON Access in the context of TR-101*	BBF	2012
[19]	TR-167 Issue 1	*GPON-fed TR-101 Ethernet Access Node*	BBF	2010
[20]	TR-383	*Common YANG Modules*	BBF	2017
[21]	WT-352	*Multi-wavelength PON Inter-Channel-Termination Protocol (ICTP) Specification*	BBF	2017
[22]	TR-255 Issue 1	*GPON Interoperability Test Plan*	BBF	2013
[23]	TR-309 Issue 1	*XG-PON1 TC Layer Interoperability Test Plan*	BBF	2013
[24]	WT-nnn	*NG-PON2 TC Layer Interoperability Test Plan*	BBF	2017

2.3 Definitions

The following terminology is used throughout this Working Text.

Model	A data model.
Module	A YANG module defines the hierarchy of data for the data model.
Submodule	A YANG module may be broken up into a multiple submodules for ease of maintainability. The overall data model is comprised of a module and zero or more submodules.
Channel Group	A set of channel pairs carried over a common fiber. Defined in ITU-T G.989 [12].
Channel Pair	A set of one downstream wavelength channel and one upstream wavelength channel that provides connectivity between an OLT and one or more ONUs. Defined in [ITU-T G.989] [12].
Channel Partition	Any of the operator-specified non-overlapping subsets of TWDM or PtP WDM channels in an NG-PON2 system. Defined in [ITU-T G.989] [12].
Channel Termination	A logical function that resides at the OLT network element and that terminates a single TWDM channel in a TWDM system. Defined in [ITU-T G.989] [12]. In the XGS-PON context, the term channel termination refers to a logical function associated with an OLT port that terminates an XGS-PON.
Optical Distribution Network	A point-to-multipoint optical fiber infrastructure. Defined in [ITU-T G.989] [12].
Optical Line Termination	A network element in an ODN-based optical access network that terminates the root of at least one ODN and provides an OAN SNI. Defined in [ITU-T G.989] [12].
Optical Network Unit	A network element in an ODN-based optical access network that terminates a leaf of the ODN and provides an OAN UNI. Defined in [ITU-T G.989] [12].
Aggregating ONU	An ONU with bridging function.
Non-aggregating ONU	An ONU with no bridging function (i.e., TR-156 ONU).
Type B Protection	Type B protection configuration involves a single channel group where each individual channel pair has two OLT channel terminations. Defined in [ITU-T G.989] [12].
Type WL Protection	Type WL refers to a PON protection architecture that is exclusive to multi-wavelength PON systems, is dependent on availability of at least two OLT CTs operating on different downstream and upstream wavelength channels while being attached to one and the same ODN, and allows to protect against the failure of one OLT CT and/or of the segment of fiber specific to that OLT CT by retuning the affected ONUs to the downstream and upstream wavelength channels associated with another OLT CT. Defined in[BBF WT-352][21].

2.4 Abbreviations

This Working Text uses the following abbreviations:

AES	Advanced Encryption Standard
Alloc-ID	Allocation Identifier
BE	Best Effort
BER	Bit Error Ratio
CG	Channel Group
CIR	Committed Information Rate
CP	Channel Pair
CT	Channel Termination
DBA	Dynamic Bandwidth Assignment
EIR	Excess Information Rate
FEC	Forward Error Correction
GEM	G-PON Encapsulation Method
G-PON	Gigabit Passive Optical Network
ICTP	Inter Channel Termination Protocol
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
NE	Network Element
NG-PON2	Next Generation Passive Optical Network 2
ODN	Optical Distribution Network
OLT	Optical Line Termination
OMCI	Optical Network Unit Management and Control Interface
ONT	Optical Network Termination
ONU	Optical Network Unit
PIR	Peak Information Rate
PM	Performance Monitoring
PMD	Physical Media Dependent
PON	Passive Optical Network
QoS	Quality of Service
SN	Serial Number
SNI	Service Node Interface
TC	Transmission Convergence
T-CONT	Transmission Container
TOD	Time of Day
TR	Technical Report
UC	Use Case
UNI	User-Network Interface
VLAN	Virtual Local Area Network
WDM	Wavelength Division Multiplexing
WG	Working Group
WL	Wavelength
WLCP	Wavelength Channel Protection
XGEM	XG-PON Encapsulation Method
XG-PON	10 Gigabit Passive Optical Network

XGS-PON	10-Gigabit-capable Symmetric Passive Optical Network
XGTC	XG-PON Transmission Convergence (protocol layer)

3 Working Text Impact

3.1 Energy Efficiency

WT-385_draft1 has no impact on energy efficiency.

3.2 IPv6

WT-385_draft1 has no impact on IPv6.

3.3 Security

WT-385_draft1 has no impact on security.

3.4 Privacy

Any issues regarding privacy are not affected by WT-385_draft1.

4 xPON YANG Modules Description

4.1 Overview

The figure below provides a high level view of the functionality covered by this Working Text (blue background):

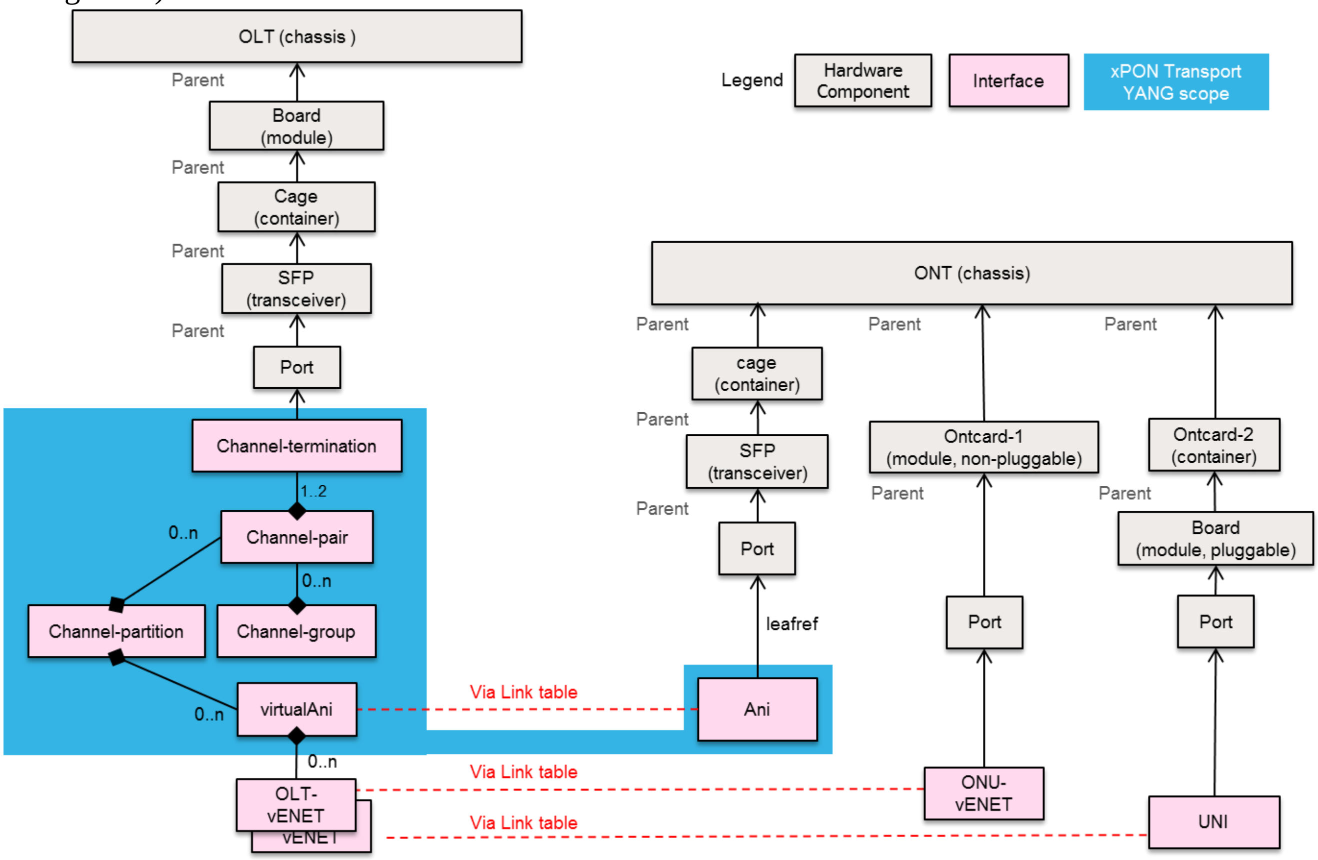

Figure 1 –Interface and Hardware Entities Relationships

4.2 Fundamentals

4.2.1 Management Modes

The xPON YANG Modules support two management modes:

- Combined-NE mode: managing the OLT and subtending ONUs as one single combined [OLT-ONUs] network element (NE), i.e. having a single NETCONF management interface. The model and its NETCONF management interface are hosted by the OLT. This Working Text does not specify the management interface between the OLT and the ONU physical entities; it can be OMCI, NETCONF, or other options. Refer Figure 2.
- Separated-NE mode: managing the OLT and ONUs as separate NEs, each NE has its own NETCONF management interface. Refer Figure 3.

The management flexibility is achieved by defining distinct OLT-vANI, OLT-vENET, ONU ANI and ONU-vENET objects. The OLT-vANI and OLT-vENET objects model the per-ONU PON resources (e.g. T-CONTs, GEM ports) to be configured on the OLT side. The ONU ANI and ONU-vENET objects model the resources on the ONU side.

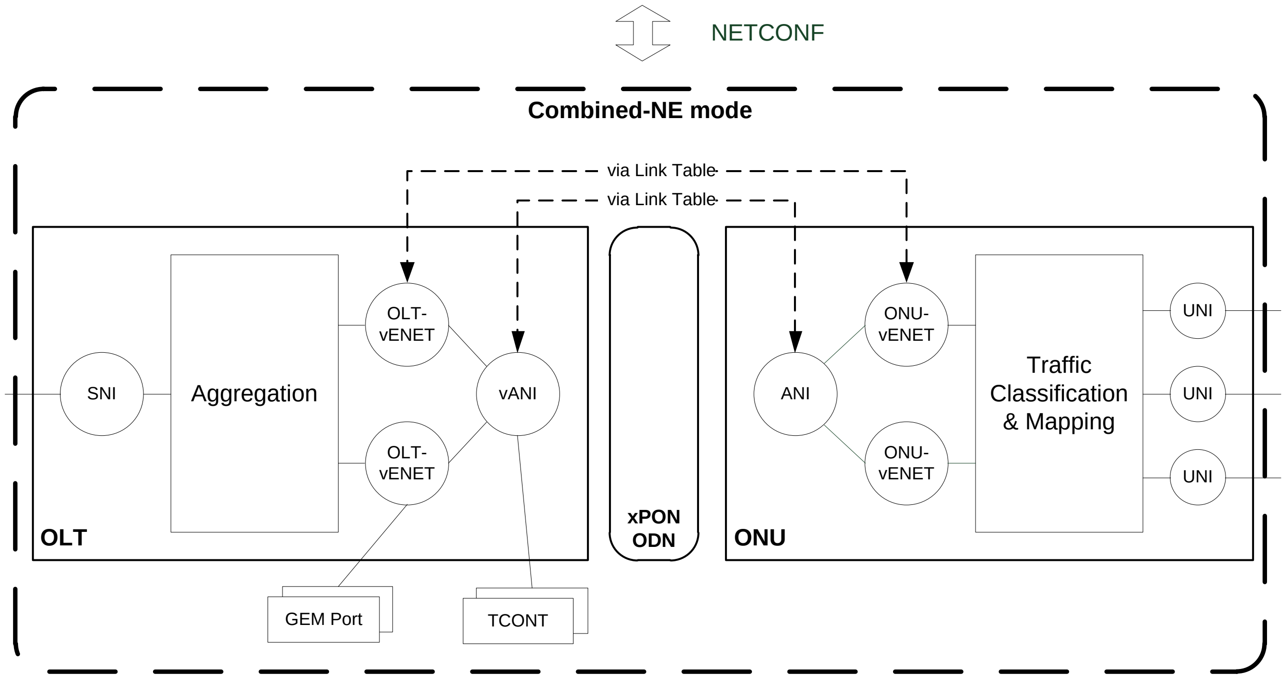

Figure 2 – Combined-NE Management Mode

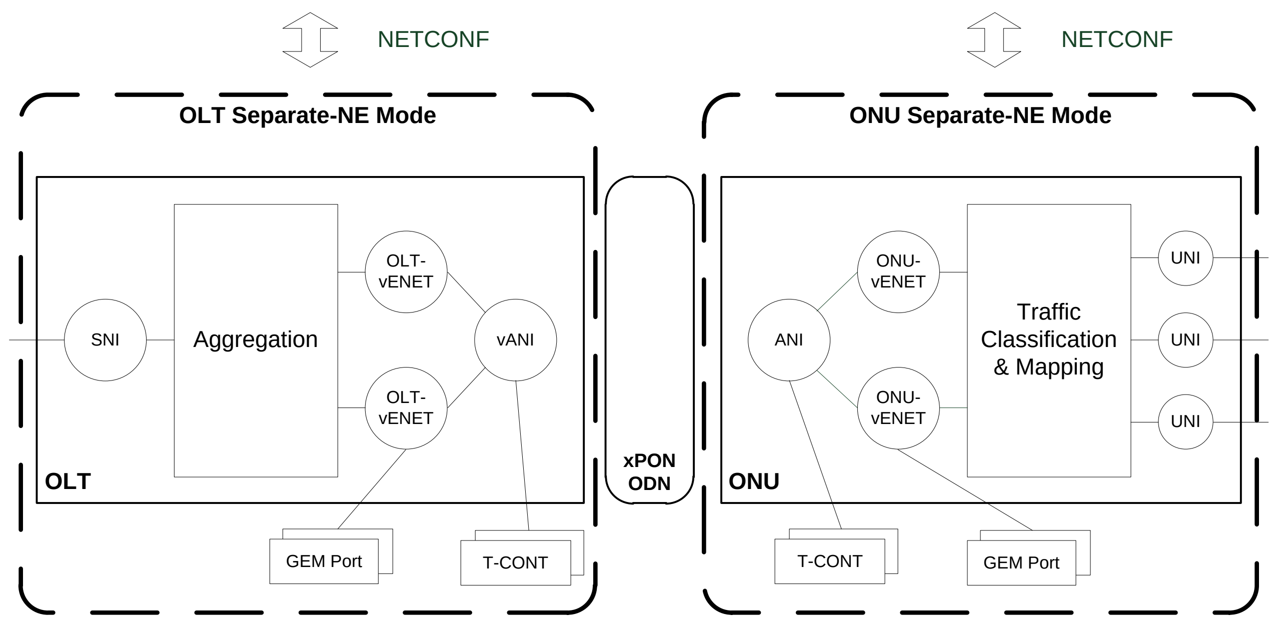

Figure 3 – Separated-NE Management Mode

The object instantiation processes are different in each management mode:

- Combined-NE mode
  - All of the OLT-vANI, OLT-vENET, ONU ANI and ONU-vENET objects are instantiated in the [OLT-ONUs] combined model hosted by the OLT.
  - GEM ports and T-CONTs objects are instantiated and linked with OLT-vANI, OLT-vENET only. The link table binding between the OLT-vANI/ONU-ANI and OLT-vENET/ONU-vENET interfaces allows the ONU to inherit the T-CONT and GEM port configuration from its OLT-side counterpart.
  - Since the combined model contains objects specifically pertaining to the ONUs hardware (e.g. ONU ANI, ONU-vENET, etc.) the OLT implements a mediation function between those objects in the model and the ONU hardware via an OLT-ONU management channel. As indicated above, such an OLT-ONU management channel can be OMCI as defined in [ITU-T G.988], but other management interfaces are possible as well for this purpose.
- Separated-NE mode
  - Objects specifically intended for the operation of the OLT physical entity (e.g. OLT-vANI and OLT-vENET) are only instantiated on the model hosted by the OLT NE.
  - Objects specifically intended for the operation of the ONU physical entity (e.g. ONU ANI and ONU-vENET) are instantiated on the model hosted by the ONU NE.

4.2.2 Interfaces

{Editor's note: Need to engage IANA about adding these new types to iana-if-type. Also need to check whether the OLT/ONU-vENET interface definition needs a new interface type.}

The xPON YANG Modules contain a collection of augmentations to ietf-interfaces [5]. The presence of such augmentation indicates the interface type, and holds the corresponding configuration and operations state data.

The xPON YANG Modules define the following new interface types:

- channelgroup: xPON channel group as defined in [ITU-T G.989][12].
- channelpartition: xPON channel partition as defined in [ITU-T G.989][12].
- channelpair: xPON channel pair as defined in [ITU-T G.989][12].
- channeltermination: xPON channel termination as defined in [ITU-T G.989][12].
- ontani: xPON ONT ANI.
- v-ontani: xPON virtual ONT ANI.

4.2.3 PON Types

The xPON YANG Modules use same set of objects to model different underlying PON types defined in [ITU-T G.984.x], [ITU-T G.987.x], [ITU-T G.989.x], [ITU-T G.9807.x] and potentially others. Non-[ITU-T G.989.x] systems are considered as a special case of [ITU-T G.989.x] with one Channel Pair and one Channel Partition.

An ONU is always configured on a Channel Partition. This reflects that fact that an ONU subscribes to a given access service, invariant to which Channel Pair is actually used by the ONU within the channel Partition.

4.2.4 Relationship with Other YANG Modules

4.2.4.1 IETF Hardware

{TODO: add text description here.}

4.2.4.2 BBF Common YANG

{TODO: add figure and text description here.}

4.3 Summary of Key Functions

{Editor's note: Some functions are still under development.}

Category	Feature
PON types	Passive Optical Networks (PON) as defined in [ITU-T G.984.x], [ITU-T G.987.x], [ITU-T G.989.x], [ITU-T G.9807.x] and potentially others.
	IEEE 802.3 PON
Management modes	Combined-NE mode: managing the OLT and subtending ONUs as one single combined [OLT-ONUs] network element (NE).
	Separated-NE mode: managing the OLT and ONUs as separate NEs, each NE has its own NETCONF management interface.
ONU activation and authentication	
	Serial number based authentication.
	Logical ONU ID (LOID) based authentication.
	Registration-ID based authentication.
	Secure Mutual Authentication – OMCI-based. [ITU-T G.987.3] Annex C, [ITU-T G.989.3] Annex C, and [ITU-T G.9807.1] Annex C.C, [ITU-T G.988] 9.13.11 "Enhanced security control".
	Secure Mutual Authentication – 802.1x. [ITU-T G.987.3] Annex D, [ITU-T G.989.3] Annex D, and [ITU-T G.9807.1] Annex C.D. 802.1x itself is out of the scope of xPON YANG.
	ONU state.
	ONU indications (new ONU discovered; ONU activated, ONU deactivated, etc.) are useful when the authentication process is done outside of the OLT.
Rogue ONU mitigation	Deactivate ONU (operation).
	Disable Serial number (operation) (disable discovery, deny upstream access).
FEC	Downstream FEC (per PON link).
	Upstream FEC (per ONU).

ONU TC data configuration	ONU-ID, Alloc-ID, GEM, Multicast GEM, management GEM port.
Data encryption configuration	Encryption indication per GEM port.
	Encryption key ring attribute for each GEM port: in which direction encryption applies (downstream only or both downstream and upstream), and which data encryption key type (unicast or broadcast)
	Broadcast key exchange between the OLT and the ONU via the management GEM port.
	Key exchange interval configuration.
Dynamic Bandwidth Allocation (DBA)	Per T-CONT DBA parameters.
	DBA reporting mode, Queue occupancy reporting granularity, etc. Refer [G.988] Clause 9.2.1 ANI-G.
Distance	Maximum logical reach of a PON. [G984.3] clause 10.4.3.4.
	Maximum differential logical reach.
	ONU distance. [ITU-T G.9807.1] clause C.13.1.8, [ITU-T G.989.3] clause 13.1.8, [ITU-T G.987.3] clause 13.1.8, and [ITU-T G.984.3] clause 10.3.6.
Time of Day distribution	[ITU-T G.988] clause 9.12.2, [ITU-T G.984.3] clause 10.4.6, [ITU-T G.987.3] clause 13.2, [ITU-T G.989.3] clause 13.2, and [ITU-T G.9807.1] clause C.13.2.
ONU Power management modes	[G.9807.1] clause C.16.1, [G.989.3] clause 16, [G.987.3] clause 16 and [G.984.3] Annex E.
Protection switching	Type B protection
	Type C protection (Note: the Type C specification maturity is not at the same level as the Type B. May not be included inWT-385 Issue 1.)
Performance monitoring parameters	[ITU-T G.984.3] clause 11.2, [ITU-T G.987.3] clause 14.1, [ITU-T G.989.3] clause 14.1 and [ITU-T G.9807.1] clause 14.1.
Alarms	Alarms and responding thresholds are defined in [ITU-T G.984.3] clause 11.1, [ITU-T G.987.3] clause 14.2, [ITU-T G.989.3] clause 14.2 and [ITU-T G.9807.1] clause C.14.2.
Optical line supervision-related measurement	[ITU-T G.9807.1] Appendix B.II, [ITU-T G.989.2] Appendix II, and [ITU-T G.984.2] Appendix IV.
Ethernet services	TR-156 based (unicast, multicast, QoS, etc.)
	TR-167 based (unicast, multicast, QoS, etc.)
NG-PON2 specific functions	Wavelength channel handover
	Change power level
	Type WL protection
	ICTP protocol

4.4 Basic Operations

This section explains the basic operations using the xPON YANG Modules.

4.4.1 ONU Activation and Authentication

4.4.2 T-CONT, QoS and GEM Association

{TODO: add text description here. Update the diagram to illustrate the T-CONT/GEM port association. }

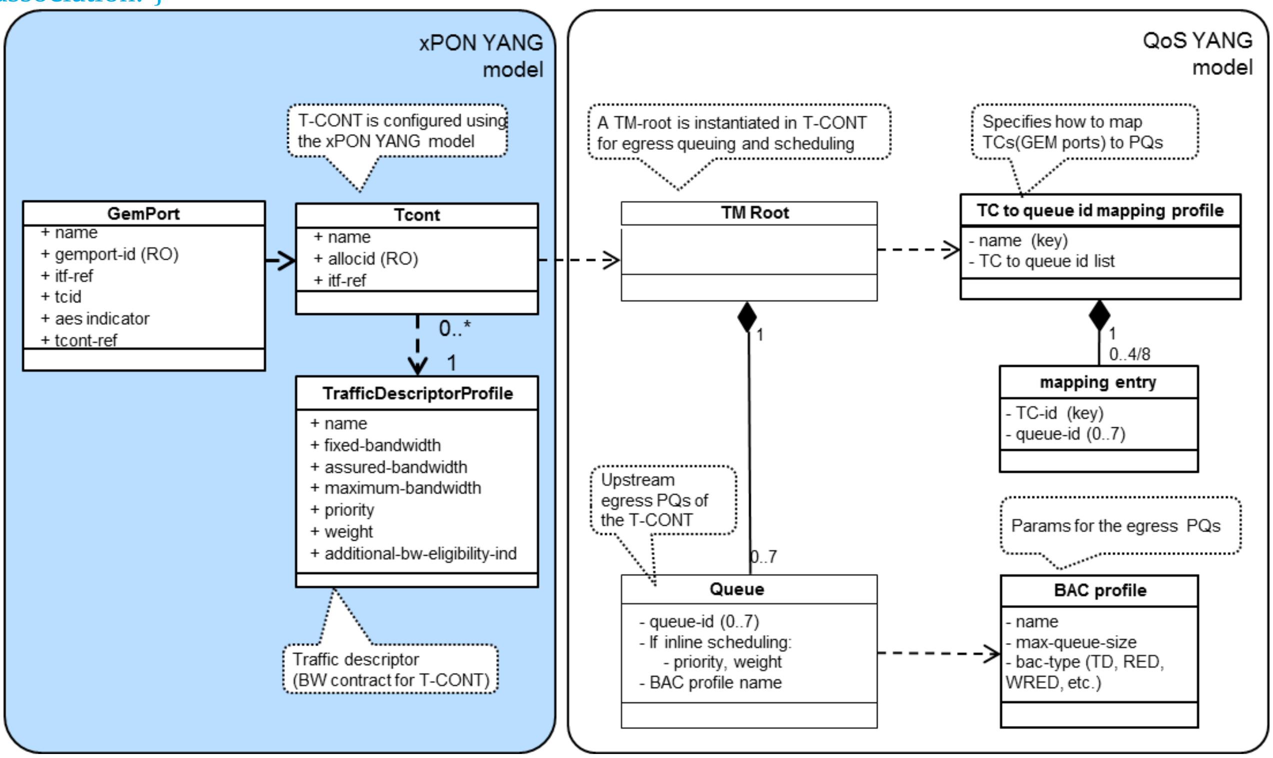

Figure 4 – ONU T-CONT Scheduling, Queueing and GEM Association

4.4.3 Ethernet Service Configuration

The xPON YANG Modules can be used along with the BBF TR-383 Common YANG Modules [20] to provision the Ethernet services over the PON, independent of the exact nature of the UNI (Ethernet, xDSL, FAST, etc.).

As illustrated in
Figure 5, the OLT and the ONU are broken logically into two parts: PON-specific entity and non-PON-specific entity. The Common YANG Modules configure the traffic classification and forwarding; while the xPON YANG Modules configures the GEM adaptation function, which performs the mapping for transport of Ethernet over xPON.

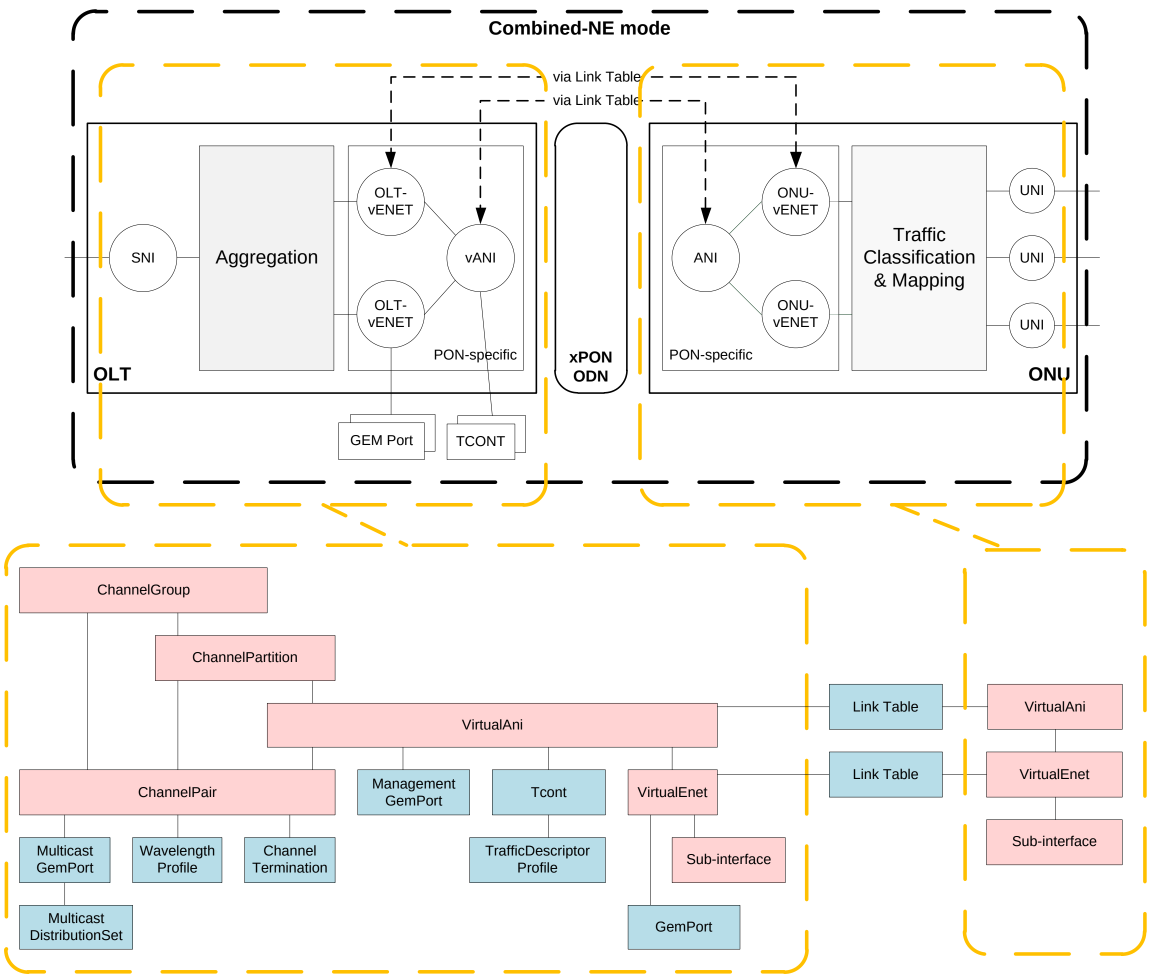

Figure 5 – Ethernet Service Configuration using xPON YANG and Common YANG

The Common YANG Modules and the xPON YANG Modules can be used in various combinations to achieve different connectivities. This section describes three basic possibilities, illustrated in Figure 6 to Figure 8.

Figure 6 shows the Ethernet service configuration model for an Aggregating ONU. On U interface ingress, frames are first classified by the ingress sub-interfaces, and forwarded to the egress sub-interfaces by the forwarders; VLAN manipulations are performed on the ingress or egress sub-interfaces. The forwarders can be used to handle 1:1 VLAN, N:1 VLAN and N:M VLAN applications.

Each ONU-vENET interface or an associated sub-interface may be associated with one or multiple GEM ports. Frames are mapped into GEM ports based on the traffic class.

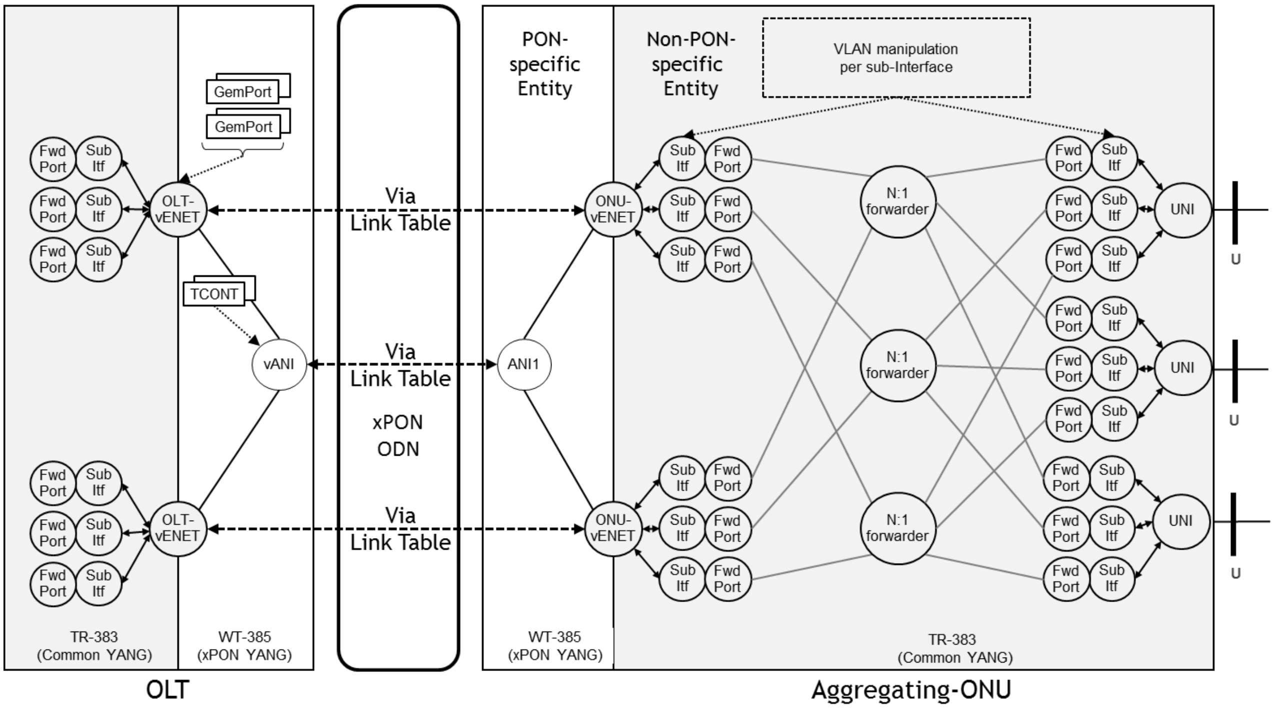

Figure 6 –Ethernet Service Model (Combined-NE mode with Aggregating ONU)

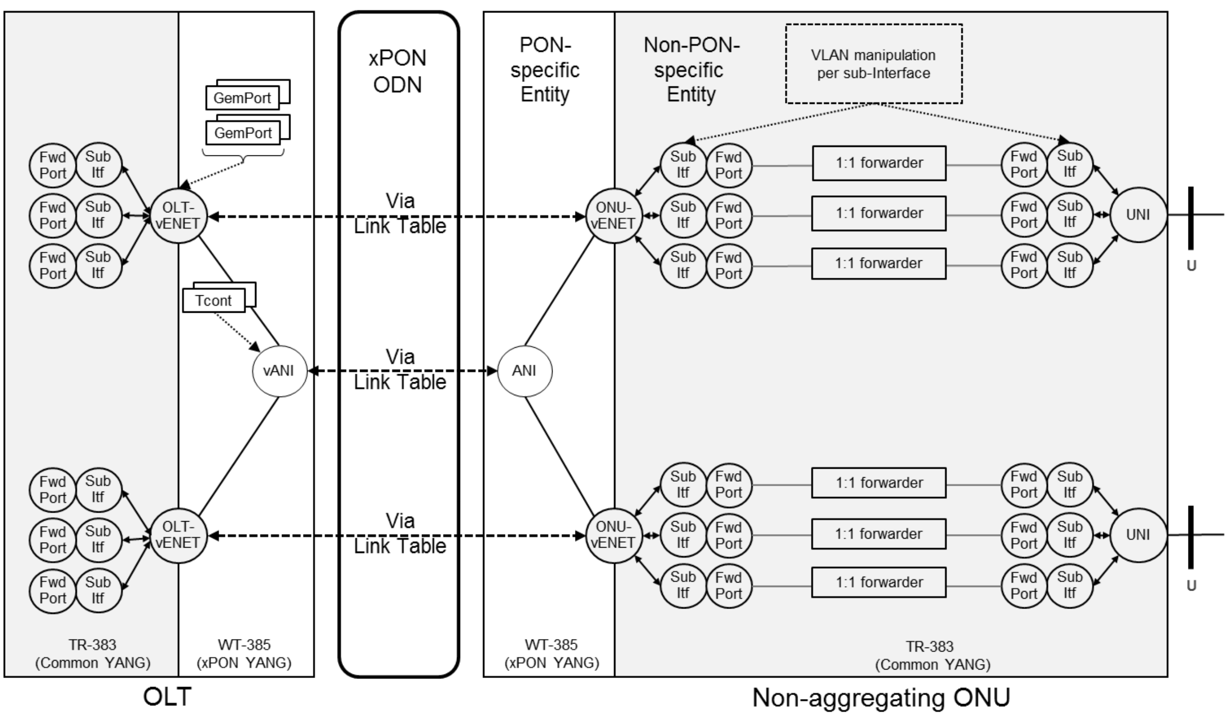

Figure 7 – Ethernet Service Model (Combined-NE mode with Non-aggregating ONU)

Figure 7 shows the Ethernet service configuration model for a non-aggregating ONU. A non-aggregating ONU does not need to perform bridging functions. In this case, the physical UNI ports and the ONU-vENET interfaces are 1:1 mapped, and the forwarder just provides the means to associate the sub-interfaces.

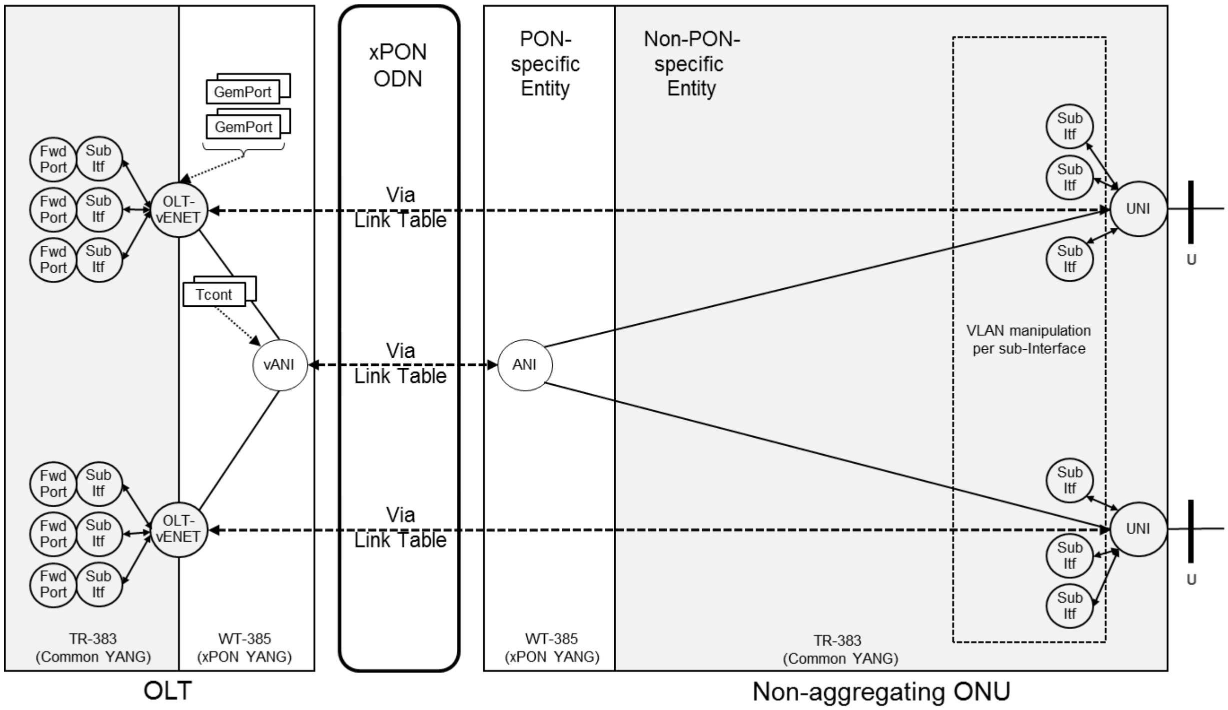

Figure 8 – Ethernet Service Model Example (Simplified Combined-NE mode with Non-aggregating ONU)

{Editor's note: the simplified Ethernet service configuration model is pending on the discussion and resolution with Common YANG.}

Figure 8 shows a simplified Ethernet service configuration model for a non-aggregating ONU. This model eliminates the ONU-vENET interfaces, and also eliminates the forwarders and forwarder ports. The simplification is based on the fact that

- In the upstream direction, the non-aggregating ONU only needs to perform the xPON adaptation function, i.e., to maps the traffic into GEM port based on the UNI interface (or the sub-interface) and the traffic class.
- In the downstream direction, the ONU maps the traffic from a GEM port directly to an UNI port.

In this simplified model, the sub-interfaces are configured on the UNI interfaces, and the OLT-vENET is directly linked with the UNI.

4.4.4 Upstream and downstream QoS

{TODO: add text description here.}

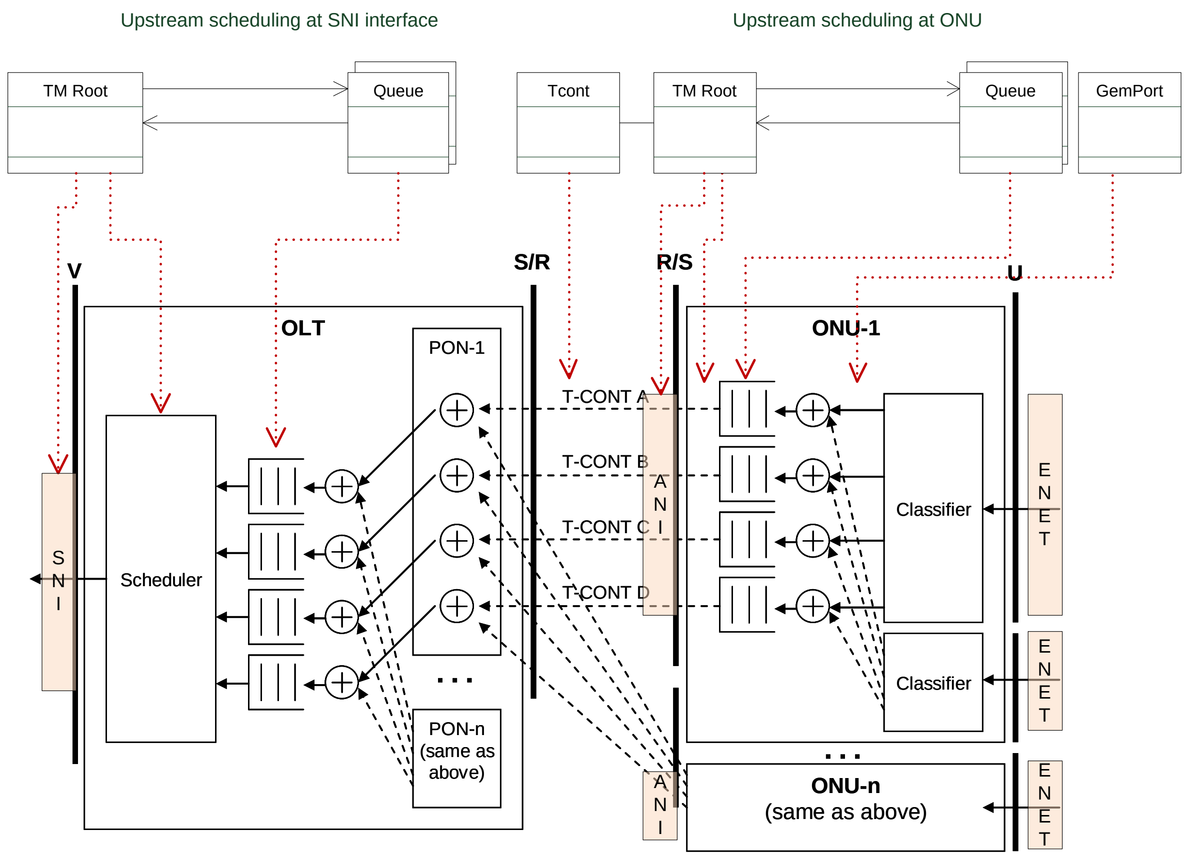

Figure 9 – Upstream Scheduling and Queueing Model Example

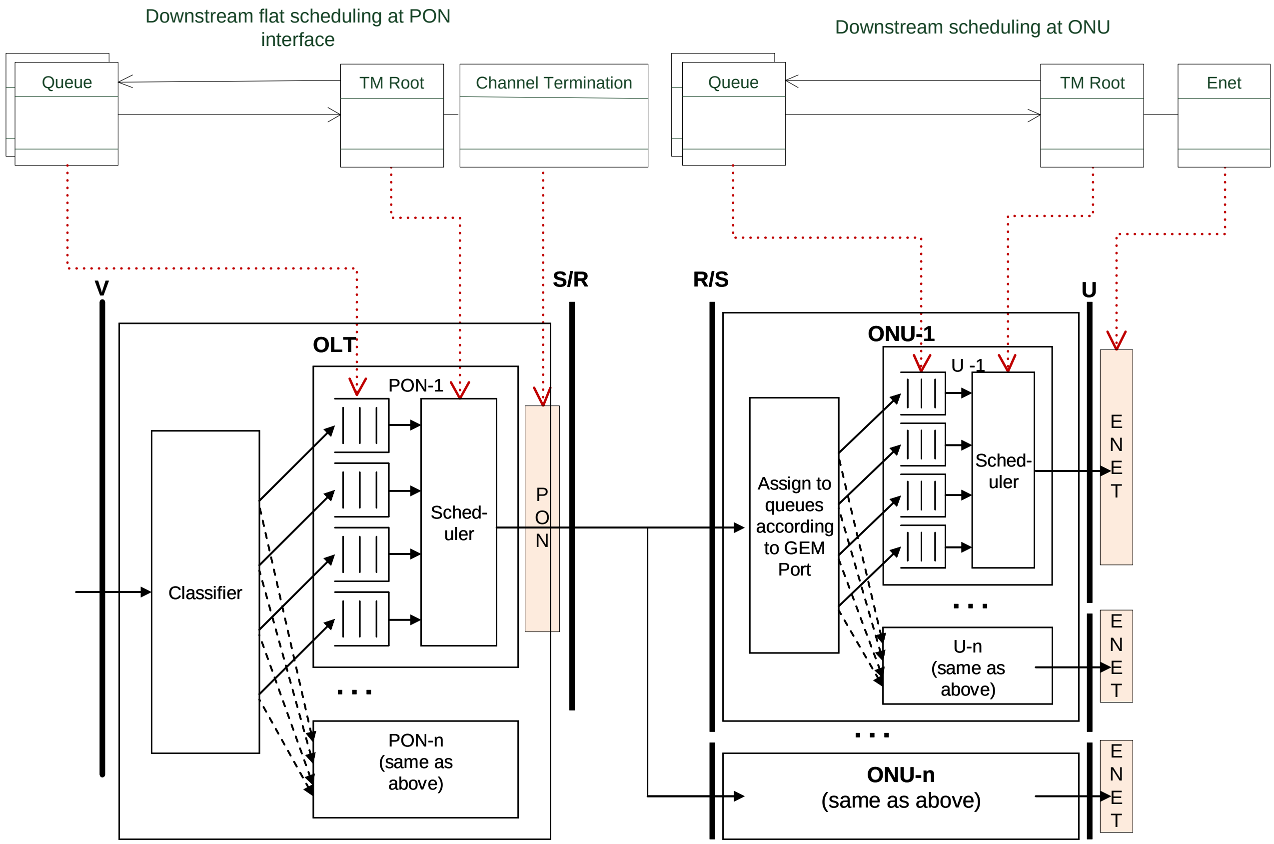

Figure 10 – Downstream Scheduling and Queueing Model Example

4.4.5 Type B protection

{TODO: add text description here.}

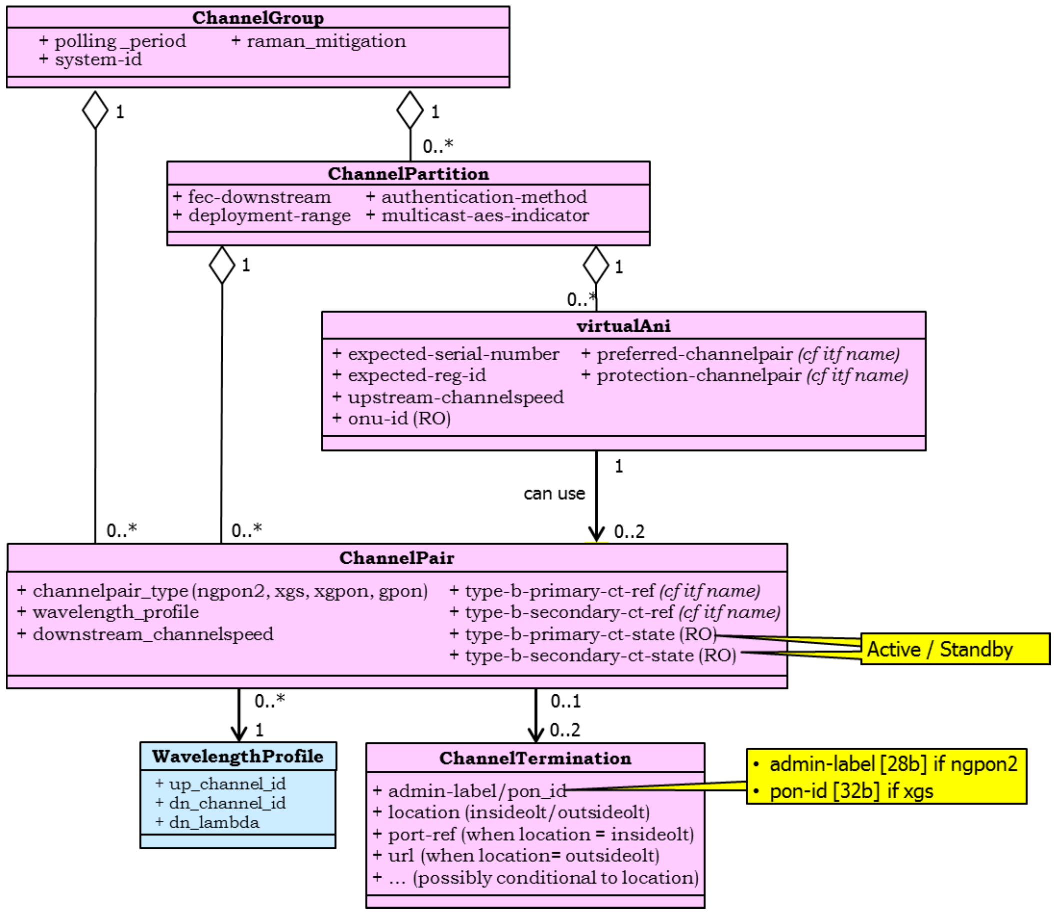

Figure 11 – Type B Protection

4.4.6 TR-142 and TR-167 Applications

As illustrated in Figure 12, the xPON YANG Modules can be also used for the configuration of TR-142 and TR-167 devices.

A TR-142 device embeds the ONU and Residential Gateway functions in a single physical device. In this case, the xPON YANG Modules are used for the configuration and management of xPON ONU specific features, while the Residential Gateway functions are configured and managed by either TR-069, or other protocols. The (*) in Figure 12 corresponds to the "virtual UNI" U reference point in TR-142.

A TR-167 device embeds the ONU and TR-101 access node in a single physical device. In this case, the xPON YANG Modules are used for the configuration and management of xPON ONU entity specific features, while the Ethernet Access Node functions are configured and managed by either NETCONF, or other protocols. The (*) in Figure 12 corresponds to the V reference point in TR-167.

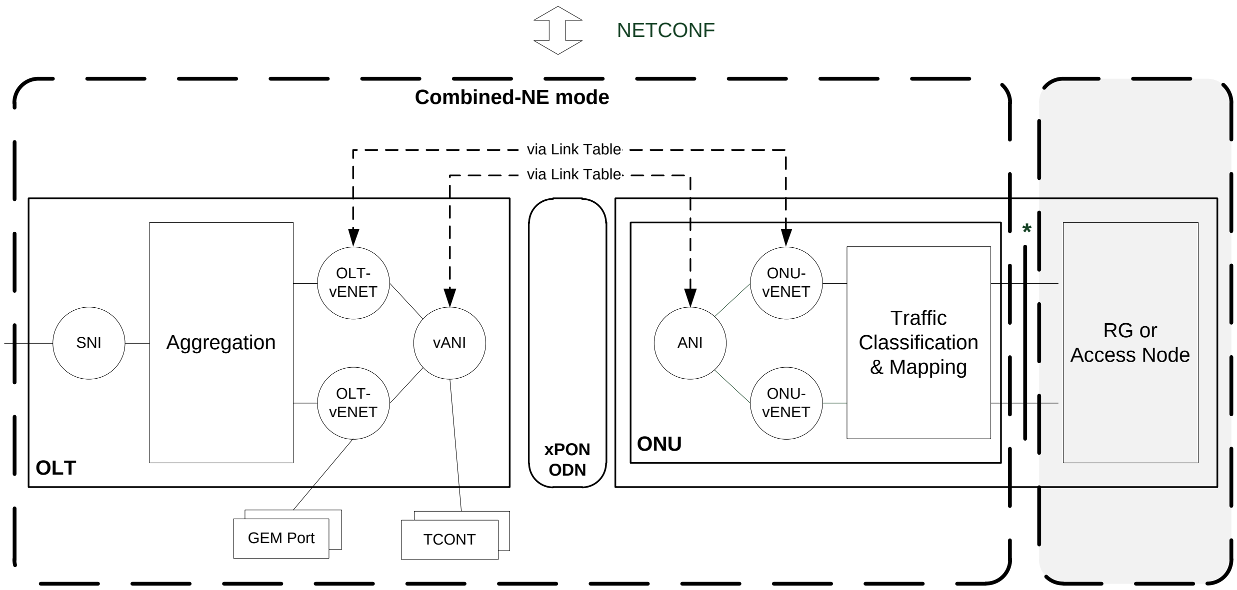

Figure 12 – TR-142 and TR-167 Applications

5 Modules

The YANG modules contained in WT-385_draft1 are briefly described here.

5.1 UML Model

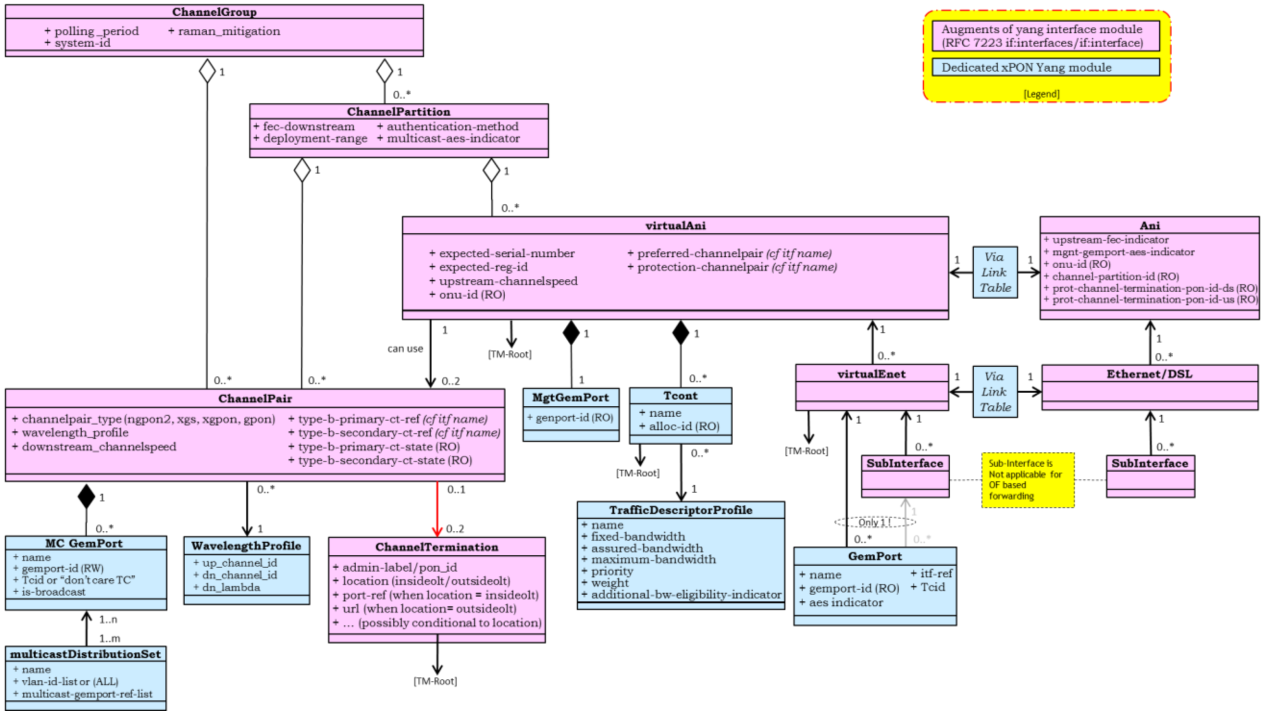

Figure 13 – xPON YANG UML Model

5.2 Definitions

5.2.1 bbf-fiber-types

This module defines identities and data types used by the xPON YANG Modules.

5.2.2 bbf-fiber-if-type

This module defines xPON interface types, including channelgroup, channelpartition, channelpair and channeltermination.

5.2.3 bbf-fiber

5.2.3.1 This module is comprised of the following submodules. bbf-fiber-base

This submodule contains a collection of YANG definitions and augmentations to ietf-interfaces [5] for managing the top level xPON configuration.

5.2.3.2 bbf-fiber-channelgroup-body

This submodule defines configuration data for a channel group. It also includes state data for allocated upstream and downstream channel IDs.

5.2.3.3 bbf-fiber-channelpair-body

This submodule defines configuration and state data for a channel pair. Each channel pair references to a channelgroup instance and a channelpartition instance.

5.2.3.4 bbf-fiber-channelpartition-body

This submodule defines configuration data for a channel partition. The configuration parameters include downstream FEC, authentication method and downstream multicast encryption, etc.

5.2.3.5 bbf-fiber-channeltermination-body

This submodule defines configuration and state data for a channel termination. Each channel termination references to a channel pair instance. The configuration parameters include NG-PON2 admin label, BER detection time period, Type B protection primary/secondary roles and states, PON ID, etc.

5.2.3.6 bbf-fiber-traffic-descriptor-profile-body

This submodule defines traffic descriptor profiles for DBA. References are [ITU-T G.984.x] clause 7.4, [ITU-T G.987.x] clause 7, [ITU-T G.989.x] clause 7, and [ITU-T G.9807.x] clause C.7.

5.2.3.7 bbf-fiber-ontani-body

This submodule defines configuration and state data for an ONU. The configuration parameters include upstream FEC, GEM port encryption, etc. When the xPON YANG Modules works in the Combined-NE mode, GEM ports and T-CONTs configured on that ONU is implicitly inherited from bbf-fiber-v-ontani-body defined in the next section.

5.2.3.8 bbf-fiber-v-ontani-body

This submodule defines the ONU configuration and state data on the OLT side.

5.2.3.9 bbf-fiber-tcont-body

This submodule defines configuration and state data for T-CONTs on an ONU. Each T-CONT references to an existing traffic descriptor profile instance, and uses a tm-root instance that defines schedulers and queues inside a T-CONT.

The OLT internally allocates and assigns an Alloc-ID value for a T-CONT instance.

5.2.3.10 bbf-fiber-gemport-body

This submodule defines configuration and state data for GEM ports on an ONU.
The OLT internally allocates and assigns a GEM port ID value for a GEM port instance.

5.2.3.11 bbf-fiber-multicast-gemport-body

This submodule defines configuration and state data for multicast GEM ports on a channel pair.

5.2.3.12 bbf-fiber-management-gemport-body

This submodule defines configuration and state data for management GEM ports on an ONU.

5.2.3.13 bbf-fiber-wavelength-profile-body

This submodule defines configuration and state data for wavelength profiles. A channel pair instance may refer a wavelength profile.

5.2.3.14 bbf-fiber-multicast-distribution-set-body

This submodule defines configuration and state data for multicast distribution set. A multicast distribution set defines the association between the multicast VLANs and the multicast GEM ports.

5.2.4 bbf-link-table-body

This module defines a generic link table where each entry links two IETF interfaces. The link relations are used horizontally between the counterpart interfaces on the OLT and the ONU in Combined-NE mode. Possible usages are:

- To link an ontani interface defined in 5.2.3.7 with a v-ontani interface defined in 5.2.3.8. The binding allows the ONU-side ontani to inherit the T-CONT configuration data from its OLT-side v-ontani counterpart.
- To link an ONU-vENET interface with an OLT-vENET interface. The binding allows the ONU-side vENET to inherit the GEM port configuration data from its OLT-side vENET counterpart. It may be used when the frame mapping between GEM ports and an ENET interface is based on the combination of ENET interface and traffic class.
- To link an ONU-side UNI interface with an OLT-vENET interface. The binding allows the UNI interface to inherit the GEM port configuration data from its OLT-side vENET counterpart. It may be used for the simplified non-aggregating ONU model discussed in 4.4.3.
- To link an ONU-side sub-interface with an OLT-side sub-interface. It may be used when the frame mapping between GEM ports and an ENET interface is based on the combination of sub-interface and traffic class.

In the link table, the “itf-from” field defines the querying interface (ex., ONU-vENET), the “inf-to” defines the queried interface (ex., OLT-vENET). One direction relation is sufficient.

Note the link relations are not used vertically to denote interface stack hierarchies (e.g. between an interface and a sub-interface).

6 Documentation

There are "README.md" files; these are short text files giving brief descriptions of the contents of the directories they are in.

Documentation for each module can be found in the *docs* folder of the corresponding directory, e.g. *networking*. There are two types of documents per each top level module.

- *.tree: Provides a tree diagram of the module.
- *.xml: Provides an XML schema representation of the module.

Each .tree and .xml file are named according to each model's module name along with –full to indicate it the full tree and not just the nodes defined in a given module (in the case of submodule support), e.g. bbf-fiber-full.tree and bbf-fiber-full.xml.

7 Dependencies on Related YANG Modules and Standards

WT-385_draft1 is based on YANG 1.1 (RFC 7950 [2]).

The following IETF YANG modules are used by WT-385_draft1:

- ietf-interfaces.yang [5]
- ietf-yang-types.yang [3]

The following BBF YANG modules are used by WT-385_draft1:

- bbf-qos-traffic-mngt.yang [20], which imports ietf-interfaces, iana-if-type and bbf-yang-types.

The following BBF YANG modules can be used along with the xPON YANG Modules to provision variety of services and features for PON, such as Ethernet services, equipment management, etc.

- BBF TR-383 Common YANG modules [20]

8 Guidelines and Examples

This section provides general guidelines for xPON YANG Modules. It also illustrates how the xPON YANG Modules are used to provision some fundamental xPON functions and services. The examples in this section are not meant to be exhaustive; they are given for informative purposes in order to further clarify the basic usage of xPON YANG Modules.

8.1 Guidelines

{TODO}

8.1.1 Constraints under PON Types

{TODO: add text to describe the supported PON types, how the constraints for different technologies are enforced, etc.}

8.2 Examples

{TODO: review the list of examples; add ICTP and NG-PON2 specific use cases in the examples; add content; incorporate actual XML into the examples.}

8.2.1 Infrastructure configuration

Description
This use case illustrates the infrastructure configuration where the channel group, channel partition, channel pair and channel termination interfaces are created. It uses XGS-PON mode as example.
Pre-conditions

- None.

Operations

- Create wavelength profile “wavelengthprofile.A”.
  - upstream-channelid = “0”.
  - downstream-channelid = “0”.
- Create interface “channelgroup.1”.
- Create interface “channelparttion.1”.
  - channelgroup-ref = “channelgroup.1”.
  - channelpartition-index = “0”.
  - closest-ont-distance = “0”.
  - max-differential-fiber-distance = “20”.
  - authentication-method = “serial-number”.
- Create interface “channelpair.1”.
  - channelpartition-ref = “channelparttion.1”.
  - wavelength-prof-ref = “wavelengthprofile.A”.
  - channelpair-type = “xgs”.
  - gpon-ponid-odn-class = “class-auto”.
- Create interface “channeltermination.1”.
  - channelpair-ref = “channelpair.1”.

  - xgs-ponid =”1”.
- Read interface “channelpair.1”
  - actual-downstream-wavelength = “157700”.

8.2.2 ONU Configuration

Description
This use case illustrates the procedure to add an ONU to a channel partition, in Combined-NE mode.
Pre-conditions
- The ONU “ABCD00000001” is not connected to the OLT.
- The “channelgroup.1”, “channelpair.1”, “channelpartition.1” and “channeltermination.1” interfaces have been created. Refer section 8.2.1 for the procedure.

Operations
- Create interface “v-ontani.2” for the ONU.
  - parent-ref = “channelpartition.1”.
  - expected-serial-number = “ABCD00000001”.
  - preferred-chanpair = “channelpair.1”.
- Create interface “ontani.1.2” for the ONU.
- Create an entry in the link table list for the ONU.
  - itf-from = “ontani.1.2”.
  - itf-to = “v-ontani.1.2”.
- Connect ONU “ABCD00000001” to the OLT. The ONU “ABCD00000001” is ranged, activated, and assigned with ONU-ID 32.
- Read interface “v-ontani.1.2”
  - v-ontani-oper.onu-id = 32.

8.2.3 T-CONT and GEM Port Configuration

Description
This use case illustrates the procedure to configure a T-CONT and a GEM port (encrypted), in Combined-NE mode.
Pre-conditions
- The “channelgroup.1”, “channelpair.1”, “channelpartition.1” and “channeltermination.1” interfaces have been created. Refer section 8.2.1 for the procedure.
- The ONU “ABCD00000001” has been configured on a channel partition, the corresponding ONU interfaces are “v-ontani.1.2” and “ontani.1.2”. Refer section 8.2.2 for the procedure.
- Scope of TR-383: A traffic-class to queue-id mapping profile entry “tc2queue-mapping-a” has been created.

Operations
- Create OLT vENET interface “olt-venet.1.2.1” and ONU vENET interface “onu-venet.1.2.1” for { channelpartition.1: ONU 2: Ethernet port 1}.
- Create an entry in the link table list for the ONU Ethernet interface.
  - itf-from = “onu-venet.1.2.1”.

    - itf-to = “olt-venet.1.2.1”.
- Create T-CONT “tcont.1.2.1”.
    - tm-root
        - queues.
        - tc2queue-mapping-name=”tc2queue-mapping-a”.
    - itf-ref = “v-ontani.1.2”.
- Create GEM port “gemport.1.2.1”.
    - itf-ref = “olt-venet.1.2.1”.
    - traffic-class = “0”.
    - aes-indicator = “true”.
    - tcont-ref = “tcont.1.2.1”.
- OLT assigns Alloc-ID 678 for “tcont.1.2.1”, and GEM port ID 2048 for “gemport.1.2.1”.
- Read T-CONT.
    - name = “tcont.1.2.1”, alloc-id = 678.
- Read GEM Port.
    - name = “gemport.1.2.1”, gemport-id = 2048.

8.2.4 TR-255 Test case 6.2.2.3

Description

This use case illustrates the procedure to configure the OLT and ONU for TR-255 Test case 6.2.2.3 in Combined-NE mode. In test case 6.2.2.3, traffic is mapped into GEM ports and queues based on VID & p-bit values in the upstream direction.

Pre-conditions

- The “channelgroup.1”, “channelpair.1”, “channelpartition.1” and “channeltermination.1” interfaces have been created. Refer section 8.2.1 for the procedure.
- The ONU “ABCD00000001” has been configured on a channel partition, the corresponding ONU interfaces are “v-ontani.1.2” and “ontani.1.2”. Refer section 8.2.2 for the procedure.
- The ONU Ethernet interface has been configured. The corresponding interface names are “olt-venet.1.2.1” and “onu-venet.1.2.1”.
- Scope of TR-383: four sub-interfaces associated with the ONU Ethernet interface have been created. They are “olt-venet.1.2.1.100” and “onu-venet.1.2.1.100” for CVID1 = 100, “olt-venet.1.2.1.200” and “onu-venet.1.2.1.200” for CVID2 = 200, “olt-venet.1.2.1.300” and “onu-venet.1.2.1.300” for CVID3 = 300, “olt-venet.1.2.1.400” and “onu-venet.1.2.1.400” for CVID4 = 400. The ONU-side VLAN tagging, p-bit remarking rules and resulting traffic classes have been configured on those sub-interfaces for the corresponding flows.
- Scope of TR-383: The ONU-side tm-root configuration for T-CONTs and Ethernet interfaces.
- Scope of TR-383: The OLT-side classification, VLAN tagging, forwarding and QoS rules between the SNI interfaces and “olt-venet.1.2.1” have been configured on the OLT side.

Operations

- Create T-CONTs “tcont.1.2.1”, “tcont.1.2.2”, “tcont.1.2.3”, and “tcont.1.2.4”. Refer section 8.2.3 for the procedure.
- Create GEM ports “gemport.1.2.1”, “gemport.1.2.2”, “gemport.1.2.3”, and “gemport.1.2.4” that are associated with “olt-venet.1.2.1”. Refer section 8.2.3 for the procedure. The

configuration below illustrates the GEM ports are pointing to “olt-venet.1.2.1”. In case flows from different sub-interfaces have overlapping resulting traffic class values, it is necessary to configure the GEM ports pointing to sub-interfaces, “olt-venet.1.2.1.100” and “olt-venet.1.2.1.200”, etc.

- GEM port “gemport.1.2.1”
  - itf-ref = “olt-venet.1.2.1”.
  - traffic-class = “0”.
  - tcont-ref = “tcont.1.2.1”.
- GEM port “gemport.1.2.2”
  - itf-ref = “olt-venet.1.2.1”.
  - traffic-class = “1”.
  - tcont-ref = “tcont.1.2.2”.
- GEM port “gemport.1.2.3”
  - itf-ref = “olt-venet.1.2.1”.
  - traffic-class = “2”.
  - tcont-ref = “tcont.1.2.3”.
- GEM port “gemport.1.2.4”
  - itf-ref = “olt-venet.1.2.1”.
  - traffic-class = “3”.
  - tcont-ref = “tcont.1.2.4”.

8.2.5 TR-255 Test case 6.3.7: IGMPv3 transparent snooping functions

8.2.6 Type B protection

8.2.7 Read all ONUs on a PON link

8.2.8 Read assigned GEM ports and Alloc-IDs of an ONU

8.2.9 Read alarms and performance parameters of an ONU

8.2.10 Read alarms and performance parameters of a PON link

End of Broadband Forum Working Text WT-385_draft1