

# QSW-9010 CLI Configuration Manual

QSW-9010-08, QSW-9010-16

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QTECH LLC

Address: BC "West Plaza", 26 (building 2), Ryabinovaya st., Moscow, Russia, 121471

Tel: +7(495)797-33-11

E-mail: sales@qtech.ru

Website: www.qtech.ru

## Table of contents

1 PREFACE	11
1.1 Overview	11
1.2 Product Version	11
1.3 Brief Introduction	11
1.4 Explanation of Special Symbols	11
1.5 Revision History	12
2 GPON FEATURES	13
2.1 Introduction	13
2.2 Reference Standards and Protocols	13
2.3 System Overview	14
2.3.1 GPON Principles	14
2.4 T-CONT Concept	15
2.4.1 The Principle of Service Multiplexing	15
2.5 Key GPON Technologies	15
2.5.1 Ranging	15
2.5.2 Burst Optical/Electrical Technology	16
2.5.3 DBA	16
2.5.4 FEC	17
2.5.5 AES Encryption	17
2.6 ONU Authentication and Management	18
2.6.1 ONU Authentication	18
2.6.2 ONU Management	19
3 SYSTEM FUNCTION MANAGEMENT	20
3.1 Management Mode Configuration	20
3.2 Series Port	20
3.3 Telnet	20
3.4 NMS	20
3.4.1 Series Port	20
3.4.2 Telnet	21
3.5 NTP System Time Synchronization Configuration	23
3.6 System Time Configuration	24
3.7 Operations of System Configuration	25
3.7.1 Configuration Saving	25

3.7.2 Reboot	25
3.7.3 Restore the Default Configuration	26
3.7.4 System Diagnosis Information Uploading	26
3.7.5 Configuration Saving and Recovery	27
<b>3.8 Upload Steps</b>	<b>27</b>
3.8.1 Show the Current Configuration	28
3.8.2 Monitoring Records of Command Line	28
3.8.3 VTY Logout Time Settings	28
3.8.4 System Host Name Configuration	29
<b>3.9 OLT Software Upgrade</b>	<b>29</b>
3.9.1 Software Upgrade	29
3.9.2 View Software Version	30
3.9.3 Software Version Rollback	30
<b>3.10 Operating User Management</b>	<b>31</b>
3.10.1 Description of Operating User Permissions	31
3.10.2 Create Operating User	31
3.10.3 Modify User Attributes	32
3.10.4 Delete User	33
<b>3.11 CPU and Memory Usage Monitoring</b>	<b>33</b>
<b>3.12 Monitoring the System Chip Temperature</b>	<b>34</b>
3.12.1 Real-Time Temperature Query for Device Chips	34
3.12.2 High Temperature Restart Protection Strategy for Device	34
<b>3.13 Broadcast Storm Suppression</b>	<b>35</b>
<b>3.14 Optical Module Parameter Query</b>	<b>35</b>
<b>3.15 Uplink Mode Switching</b>	<b>36</b>
<b>3.16 Global VLAN Configuration</b>	<b>37</b>
<b>3.17 PON Protection Function</b>	<b>38</b>
<b>4 BASIC SERVICE CONFIGURATION</b>	<b>41</b>
<b>4.1 GPON Profiles</b>	<b>41</b>
4.1.1 Configure ONU Type Profiles	41
4.1.2 Configure DBA Profile	43
4.1.3 Service Template	44
4.1.4 ONU Authentication and Registration	45
4.1.5 Modify ONU registration information	47
4.1.6 Query of ONU Status Information	48

<b>5 REMOTE ONU FUNCTION CONFIGURATION</b>	<b>50</b>
5.1 ONU Automatic Discovery Function	50
5.2 ONU Automatic Registration Function	50
5.3 ONU Activation and Deactivation	51
5.4 Show ONU Information	51
5.5 The situation show the short term of ONU's up and down line	52
5.6 ONU UNI Port Status	52
5.7 Query ONU Capability Set	53
5.8 The parameter query of optical module	54
5.9 Threshold Configuration of Optical Module and ONU Optical Power	55
5.10 Restarting and Reseting Remote ONU	56
5.11 AES Configuration	56
5.11.1 The Interactive Enable and Interactive Interval Configuration of the Key to the Downstream Messages	56
5.11.2 Enable Service Flow Encryption of Upstream Message Through Gem Port	56
5.12 Configuration and Query of Logical Distance	57
5.13 Upstream and Downstream FEC Configuration	57
5.14 ONU End MAC Address Filtering	58
5.15 Remote ONU Upgrade	59
5.16 ONU TR069 Management Configuration	61
5.17 ONU ACS Configuration	62
5.18 Isolation Function of PON port	62
5.19 ONU CATV Port Management	63
<b>6 UNICAST SERVICE CONFIGURATION</b>	<b>64</b>
6.1 MAC Address Management	64
6.1.1 Aging Time of Dynamic MAC Address	64
6.1.2 Static MAC Configuration	65
6.2 Batch Configuration Service	65
6.2.1 Batch Configuration Service Profile	65
6.2.2 Show Batch Configuration Profile	66
6.2.3 Configure Batch Issued ONU Services	66
6.2.4 Configure Batch Deletion of ONU Services	66
6.3 Configure VLAN	67
6.3.1 Configure the Upstream Port and Plan VLAN	67

6.4 PON Port VLAN	71
6.5 Configure Various Service Type	71
6.5.1 Transparent Transmission Service	71
6.5.2 VLAN Conversion Service	73
6.5.3 Add SVLAN Service	75
6.6 Remote ONU configuration	78
6.6.1 Remote service configuration	78
6.6.2 Remote UNI Configuration	79
6.7 Automatic Configuration of ONU Services	79
<b>7 MULTICAST SERVICE CONFIGURATION</b>	<b>81</b>
7.1 Multicast IGMP Configuration	82
7.1.1 General Multicast Configuration	82
7.1.2 IGMP Over vlan Multicast	84
7.1.3 IGMP Controllable Multicast	86
7.1.4 Show IGMP configuration	86
7.2 Description of Related Parameters	88
7.3 Description of Related Parameters	89
7.3.1 Global IGMP Version Control	90
7.4 Multicast MLD Configuration	91
7.4.1 General Multicast Configuration	91
7.4.2 MLD Over VLAN Multicast	93
7.4.3 MLD Controllable Multicast	95
7.5 CTC Enable	95
7.6 Multicast Bandwidth Downlink Rate Limit	96
7.7 Static Multicast Table Configuration	97
7.8 Multicast group of filtering configuration	97
7.9 Multicast Prejoin Function	98
<b>8 QOS SERVICE CONFIGURATION</b>	<b>101</b>
8.1 Simple Scheduling Mode	102
8.2 Hierarchical Scheduling	102
8.3 Profiles Configuration	104
8.3.1 CoS-Queue-Map	104
8.3.2 QoS-Queue-Scheduler	106
8.3.3 QoS-Queue-Traffic	109
8.3.4 QoS-ONU-Bandwidth	112

8.3.5 QoS-ONU-Weight	113
8.4 Upstream QoS Configuration	114
8.4.1 PON Port Configuration	114
8.4.2 Configuration of the upper link end	114
8.4.3 Optional configuration	114
8.5 Downlink Simple QoS Scheduling Configuration	114
8.5.1 PON Port Configuration	115
8.5.2 Uplink Configuration	115
8.5.3 Optional Configuration	115
8.6 Downstream Hierarchical QoS Scheduling Configuration	116
8.6.1 PON Port Configuration	116
8.6.2 ONU Configuration	116
8.6.3 Optional Configuration	119
9 ACL SERVICE CONFIGURATION	120
9.1 Principle of ACL Implementation	120
9.2 ACL Categories	120
9.3 ACL Rule Configuration	122
9.4 ACL Action Configuration	125
9.4.1 Packet-Filter	126
9.4.2 Traffic-Limit	126
9.4.3 Traffic-Mirror	126
9.4.4 Traffic-Priority	127
9.4.5 Traffic-Redirect	127
9.4.6 Traffic-Statistic	128
10 STP SERVICE CONFIGURATION	129
10.1 STP, RSTP	129
10.2 MSTP	131
11 DHCP SERVICE CONFIGURATION	134
11.1 DHCP-Snooping Features	134
11.2 DHCPv4-Option82	136
11.3 DHCP-Relay Features	137
11.4 IP Source Guard Function	138
12 ROUTER	141
12.1 Static Routing	141
12.2 ARP	143

13	PPPOE+ SERVICE CONFIGURATION	145
13.1	Global PPPoE Configuration	145
13.2	PPPoE Configuration of Specific VLAN	148
14	SNMP CONFIGURATION	150
14.1	SNMP Basic Configuration	150
14.2	SNMP User Configuration	152
14.3	SNMP Trap Configuration	155
15	LAG SERVICE CONFIGURATION	169
15.1	Static Aggregation Mode	169
15.2	Dynamic Aggregation Mode	169
15.3	Dynamic Aggregation Configuration	169
15.4	Static Aggregation Configuration	171
15.5	Load Balancing	172
16	ALARM MANAGEMENT	173
16.1	RSSI Alarm	176
16.2	ONU MAC Address Spoofing Alarm	177
16.3	ONU Loop Detection Alarm	178
16.4	Show Alarm	179
17	PORT STATISTICS & PM MANAGEMENT	180
17.1	Statistics on Port Messages	180
17.1.1	Information statistics of the uplink port	180
17.1.2	Message Statistics of the PON Port	183
17.2	PM Statistics	186
17.2.1	PM Statistics of PON Port	186
17.2.2	ONU PM Statistics	193
17.2.3	GEM PM Statistics	194
17.2.4	UNI PM Statistics	195



## List of Tables

Table 2-1 Data Configuration.....	22
Table 2-2 Description of Operating User Permissions .....	31
Table 2-3 Description of User Attributes .....	32
Table 4-1 Hardware Capability Parameter Information of ONU .....	54
Table 6-1 General Multicast Configuration.....	82
Table 6-2 IGMP over VLAN Multicast.....	84
Table 6-3 General Multicast Configuration.....	91
Table 6-4 MLD Over VLAN Multicast .....	93
Table 8-1 ACL Categories .....	120
Table 14-1 Alarm Information .....	173
Table 15-1 Parameter Description of Message Statistics for the Upstream Port.....	182
Table 15-2 P Statistical Parameters of PON Packets.....	184
Table 15-3 Statistical Parameters of PON Port Data Packets .....	188
Table 15-4 Statistical Parameters of PON Port Protocol Packets .....	191
Table 15-5 Description of ONU performance statistics .....	194
Table 15-6 Description of ONU GEM performance statistics .....	195
Table 15-7 Description of ONU UNI performance statistics .....	196

## List of Figures

Figure 2-1 GEMGEM Frame structure .....	14
Figure 2-1 Series Port.....	20
Figure 2-2 GPON Type B Protection .....	39
Figure 6-1 Network Level and Devices .....	82
Figure 7-1 simple scheduling model .....	101
Figure 7-2 Hierarchical scheduling model .....	103
Figure 8-1 ACL Implementation Principle .....	120
Figure 8-2 ACL Rule Configuration .....	122
Figure 8-3 ACL Action Configuration.....	125
Figure 15-1 Statistics on Each Port & PM Management Diagram .....	180

# 1 PREFACE

## 1.1 Overview

QSW-9010-08/16 is GPON OLT equipment developed and produced by QTECH for GPON access network.

## 1.2 Product Version

Product Number	Version Number
QSW-9010-08	V5.3.23
QSW-9010-16	V5.3.23

### Target Readers

This manual is intended for the following engineers:



1. Network Planning Engineer
2. Testing Engineer
3. Data Configuration Engineer
4. Field Maintenance Engineer
5. System Maintenance Engineer




## 1.3 Brief Introduction

This document describes the technical features used by the QSW-9010-08 & QSW-9010-16 (1U) devices and CLI command line operations to provide users with reference information for understanding, application, management, and maintenance of the QSW-9010-08 & QSW-9010-16 (1U) devices. To simplify the description, the QSW-9010-08 & QSW-9010-16 (1U) is described below as OLT.

## 1.4 Explanation of Special Symbols

The following symbols may appear in this manual, which represent the following meanings.

Symbol	Description
 Danger	Indicates an imminently hazardous situation that, if not avoided, could result in serious injury.
 Warning	Indicates a potentially hazardous situation that, if not avoided, could result in data loss or equipment damage.

 Prompt	Indicates operations or information to which special attention should be paid to ensure successful operations or stable running of equipment.
 Tips	Indicates a suggestion or hint to help you resolve a problem or save your time.
 Note	Provides additional information to emphasize or supplement important points of the main text.

## 1.5 Revision History

The revision history records the description of each document update. The latest version of the document includes the update content of all the previous document versions.

Released Date	Update Description
2017.5.28	Released for the first time
2018.1.22	Functional changes for the R5.3.00 software version.
2018.4.3	Functional changes for the R5.3.10 software version.
2018.5.31	Functional changes for the R5.3.22 software version.
2018.12.30	Functional changes for the R5.3.23 software version.

## 2 GPON FEATURES

Gigabit passive optical network (GPON) is one of the PON (Passive Optical Network) technologies. It is a gigabit PON follows the ITU-T G.984.x & g.988 Series standard. A GPON-capable device supports high-bandwidth transmission. GPON effectively solves the bandwidth bottleneck problem in the twisted-pair access and meets users demands on high-bandwidth services.

### 2.1 Introduction

With the popularization of broadband service, operators put forward more and more high requirements for the transmission distance, bandwidth, reliability and low operating cost of the business. The following features of GPON (Gigabit passive Optical Network) address these issues.

- ❖ Farther transmission Distance: the access layer covers up to 20km, the maximum logical distance of 60km by optical fiber transmission.
- ❖ Higher Bandwidth: single user maximum downlink rate 2.5gbit/s, maximum uplink rate 1.25gbit/s theoretically.
- ❖ QOS (Quality of service) guaranteed full-service access: Carrying Gem (GPON Encapsulation Mode) frames to provide a good transmission service.
- ❖ Optical distribution network: the fibers access to the home are distributed by 1 single fiber from Bureau. The GPON Network architecture saves fiber optic resources, reduces the number of optical devices on the bureau side, and reduces operating and maintenance costs.

### 2.2 Reference Standards and Protocols

- ❖ ITU-T G.984.1: General characteristics, General Characteristics. This protocol mainly describes the basic features and major protection modes of GPON.
- ❖ ITU-T G.984.2: Physical Media Dependent (PMD) Layer Specification. This protocol mainly describes the PMD layer parameters, including physical parameters (such as the transmit optical power, receiver sensitivity, and overload optical power) of optical transceivers, and also defines optical budget of different levels, for example, the most common Class B+.
- ❖ ITU-T G.984.3: Transmission Convergence Layer Specification. This protocol mainly describes the TC layer specifications, including the upstream and downstream frame structures and GPON principle.
- ❖ ITU-T G.984.4: ONT Management And Control Interface Specification. This protocol mainly describes the GPON management and maintenance protocols, such as OAM, PLOAM, and OMCI.
- ❖ ITU-T G.984.5: Enhancement Band. This protocol mainly describes the GPON wavelength planning, including reserving bands for next-generation PON.
- ❖ ITU-T G.984.6: Reach Extension. This protocol mainly describes several long reach PON schemes for extending GPON transmission distance.
- ❖ ITU-T G.988: ONU management and control interface (OMCI) specification.

## 2.3 System Overview

GPON is a Gigabit passive optical network technology, it is the most widely used optical access technology currently. QTECH OLT does not support BPON technology with ATM packaging.

- ❖ The GPON network uses a single fiber to connect the OLT, splitter and the ONU. The upstream and downstream uses different wavelengths for data bearing. The uplink is 1310nm, the downlink is 1490nm.
- ❖ The GPON system follows the principle of wavelength division multiplexing to transmit data over the ODN network with different uplink / downlink wavelengths. The downlink is transmitted by radio, while the uplink is uploaded by TDMA in form of time slots.
- ❖ All the downlink data is broadcast from the OLT to all ONUs, ONU and then choose to receive their own data (based on ONU ID), the other data is discarded directly.
- ❖ when sending data to OLT, ONU can only use the time slot with OLT's prior permission (assigned by downstream upstream map in physical control Block bandwidth in the downlink header). In this way, it guarantees that each ONU sends data in orders according as requested. The conflict can be detected and avoided by ranging, and the optical signal is coupled at the splitter.

### 2.3.1 GPON Principles

#### Basic Concepts of Gem Frame

In the GPON system, a GPON encapsulation mode (GEM) frame is the smallest service-carrying unit and the most basic encapsulation structure. All service streams are encapsulated into the GEM frame and transmitted over GPON lines. The service streams are identified by GEM ports and every GEM port is identified by a unique Port-ID. The Port-ID is globally allocated by the OLT. That is, the ONUs connected to the OLT cannot use GEM ports that have the same Port-ID. The GEM port is used to identify the virtual service channel that carries the service stream between the OLT and the ONU. It is similar to the VPI/VCI of the ATM virtual connection.

#### GEM Frame structure



Figure 2- 1 GEMGEM Frame structure

- ❖ PLI: the length of the data's net load.
- ❖ Port ID: GEM Port ID.
- ❖ PTI: The net load type identification, mainly to identify the status and type of data currently transmitted, such as whether it is a OAM message, whether the data has been transmitted and other information.
- ❖ HEC: Provides forward error correction coding function to ensure transmission quality.
- ❖ Fragment Payload: Represents a user data frame fragment. The data portion of the Ethernet frame is mapped directly to the payload for transmission.

## 2.4 T-CONT Concept

T-CONT: a service carrier in the upstream direction in the GPON system. All GEM ports are mapped to T-CONTs. Then, service streams are transmitted upstream by means of the OLT's DBA scheduling. T-CONT is the basic control unit of the upstream service stream in the GPON system. Every T-CONT is identified by Alloc-ID. The Alloc-ID is globally allocated by the OLT. That is, every T-CONT can be used by only one ONU connected to the OLT.

There are five types of T-CONT; therefore, T-CONT selection varies during the scheduling of different types of upstream service streams. Every T-CONT bandwidth type has its own quality of service (QoS) feature. QoS is mainly represented by the bandwidth guarantee, which can be classified as fixed, assured, non-assured, best-effort, and hybrid mode (corresponding to type 1-type 5).

### 2.4.1 The Principle of Service Multiplexing

GEM Port and T-cont divided the PON network into virtual connection for Service Multiplexing.

- ❖ The GEM port is the smallest service unit in the GPON system. Every GEM port can carry one or more types of service stream. The GEM port, after carrying service streams, must be mapped to a T-CONT before upstream service scheduling. Every ONU supports multiple T-CONTs and can be configured with different service types.
- ❖ A T-CONT can be bound with one or more GEM ports, depending on the user's configuration. On the OLT, GEM ports are demodulated from the T-CONT and then service streams are demodulated from the GEM port payload for further processing.

### GPON service mapping relationship

- ❖ Downstream: all service streams are encapsulated by the GPON service processing unit into GEM ports and then GEM ports are broadcast to all ONUs connected to the GPON port. Then, every ONU filters data according to GEM port ID, reserving the GEM port corresponding to itself. After that, every ONU decapsulates service streams from the GEM port and sends them to the user-side equipment through the service interface of the ONU.
- ❖ Upstream: On ONUs, all service streams are mapped to different GEM ports and then to different types of T-CONTs for upstream transmission (the T-CONT is the basic carrier in the upstream direction over GPON lines). On the OLT, the T-CONT demodulates GEM ports therein and sends them to the GPON MAC chip. The MAC chip demodulates service streams in the GEM port payload and then sends them to a proper service processing unit for processing.

## 2.5 Key GPON Technologies

### 2.5.1 Ranging

For OLT, the logical distances of different ONU to OLT are not equal; the loop delay between OLT and ONU (RTD, Round Trip Delay) also varies with time and environment. Therefore, there may be a collision conflict in ONU in TDMA mode (that is, only one ONU under a PON port can send data to the OLT at a time) when sending the uplink cell.



To avoid the conflict, ranging is enabled when an ONU is registered for the first time. By ranging, the OLT obtains the RTD of each ONU and then calculates their EqDs to ensure that  $Teqd = RTD + EqD$  for each ONU. Teqd is short for the equalized round trip delay, which is preset in the system and is equal to or larger than the RTD of the logically farthest ONU. Each ONU delays the upstream data transmission, in reference to the downstream phase, based on the value of the assigned EqD. This is to avoid the collisions between the upstream data of different ONUs.

*Note: OLT needs to create ranging window, to pause the other ONU's uplink channel.*

### 2.5.2 Burst Optical/Electrical Technology

In the upstream direction, the GPON system uses the time division multiple access (TDMA) technology. That is, every ONU sends data at its own allocated timeslot and disables its optical transceiver (that is, stop sending optical signals) at timeslots allocated to other ONUs, thereby avoiding affecting other ONUs. The OLT then receives the upstream data of every ONU in a burst manner according to timeslots. Hence, to ensure the normal running of the GPON system, OLT-side optical transceivers must support the burst receiving of upstream data sent by ONUs, and ONU-side optical transceivers are able to send data upstream in a burst manner.

*Note: In the GPON system, all data is broadcast downstream to ONUs. This requires not only OLT-side optical transceivers to send optical signals continuously but ONU-side optical transceivers to receive optical signals continuously.*

- ❖ Regarding the distance from each ONU to OLT is different, the attenuation differs for each ONU. So it may cause the message's power level in different time slots to be different.
- ❖ If the OLT module does not have the rapid processing for optical power mutations, the wrong signal will be recovered (higher than the threshold will be considered valid, below the threshold can not be recovered correctly).

### 2.5.3 DBA

In the GPON system, the OLT controls an ONU's upstream data traffic by sending authorization signals to the ONU. PON requires an effective TDMA mechanism to control the upstream traffic, so that data packets from multiple ONUs do not collide when packets are transmitted upstream. Nevertheless, the collision-based mechanism requires QoS management in an optical distribution network (ODN), a passive network. This is physically impossible, or causes severe efficiency decrease. Due to the above-mentioned reason, a mechanism for management of the upstream GPON traffic has been a primary focus in standardization of GPON traffic management. It drives the development of the ITU-TG.983.4 Recommendation, which defines the dynamic bandwidth allocation (DBA) protocol for management of the upstream PON traffic.



- ❖ The OLT's internal DBA module collects DBA reporting information continuously, conducts related calculations and sends the results to each ONU in form of BWMap.
- ❖ Each ONU sends uplink burst data in its own time slot according to BWMap information, taking up the uplink bandwidth. Thus, every ONU can dynamically adjust its upstream bandwidth according to the actual data traffic to be sent, thereby improving the utilization of upstream bandwidth.

#### 2.5.4 FEC

Digital signal will produce error and jitter in the transmission process in different media, and the final effect of jitter is reflected in the system error, resulting in a decline in the transmission quality. In order to solve this problem, it is necessary to introduce error correction mechanism. The FEC mechanism can identify and correct real-time business by itself once the data reaches the end, as these businesses do not allow delays caused by re-transmission.

Forward error correction (FEC) is mainly used for improving the transmission quality of a line. FEC uses RS (255, 239), performing an FEC encoding of all downstream packets every 255 bytes. This ensures the correctness of data received by the ONUs. By using the FEC algorithm at the transport layer, the GPON system achieves the reduced bit error rate (from  $10^{-3}$  to  $10^{-12}$ ) of line transmission, avoids data retransmission, and improves the optical power budget by 2-3 dB. Upstream FEC and downstream FEC are supported in the GPON system.

#### 2.5.5 AES Encryption

In the GPON system, downstream data is broadcast to all ONUs. As a result, downstream data destined for certain ONUs or all ONUs may be intercepted by illegal users. At the same time, the GPON system is uniquely and highly data-directional. Therefore, almost every ONU cannot intercept the upstream data of other ONUs, thus allowing some private information (such as key) to be safely transmitted in the upstream direction. The GPON system uses the line encryption technology to solve the security issues.

##### Encryption system

The GPON system uses AES128 encryption for line security control, thereby effectively preventing security issues such as data embezzlement. In the AES128 encryption system, the OLT supports key exchange and switchover.

##### Key exchange

1. OLT initiates a key replacement request, ONU the response and sends the generated new key to OLT.
2. After receiving the new key, OLT switch and encrypts the data with a new key.
3. The OLT notifies the ONU by sending a command containing the frame number of the new key.
4. the ONU will switch the check key on proper data frames after receiving the command.

*Notes:*

- ❖ *Because the PLOAM (Physical Layer OAM) message is limited in length, the key is sent in two parts. The two parts of the key are sent three times repeatedly. If the OLT has not received the key for any of the three times, it will re-send the key exchange request until it receives the same key all three times the key is sent.*
- ❖ *The OLT notifies the ONU to use the new key frame number by relevant command for three times. ONU switches the checksum key on the corresponding data frame as soon as ONU receives it.*

## 2.6 ONU Authentication and Management

GPON terminal authentication is a mechanism in which an OLT authenticates an ONU according to the authentication information reported by the ONU and in this way denies access to unauthorized ONUs. In the GPON system, only authenticated ONUs can access the system.

The OLT implements the function that the non-authenticated ONU manufacturer cannot pass the ONU authentication. It needs to be implemented on a special version. The default version does not allow illegal ONU registration.

### 2.6.1 ONU Authentication

The ONU can be authenticated in five modes:

SN, PW, SN+PW, LOID, and LOID+LOID PW.

#### 7 States of the ONU

##### ❖ Initial-state

The ONU powers up in this state. LOS/LOF is asserted. Once downstream traffic is received, LOS and LOF are cleared, the ONU moves to the Standby-state (O2).

##### ❖ Standby-state

Downstream traffic is received by the ONU. The ONU waits for global network parameters. Once the Upstream\_Overhead message is received, the ONU configures these parameters (e.g., delimiter value, power level mode, and pre-assigned equalization delay) and moves to Serial-Number-state (O3).

##### ❖ Serial-Number-state

By sending a Serial\_Number request to all ONUs in Serial-Number state, the OLT discovers new ONUs and their Serial Numbers. Once the ONU is discovered, it waits for the unique ONU-ID assignment from the OLT. The ONU-ID is assigned using the Assign\_ONU-ID message. Once assigned, the ONU moves to Ranging-state (O4).

##### ❖ Ranging-state

The upstream transmission from the different ONUs must be synchronized with the upstream frame. In order to make the ONUs appear to be at an equal distance from the OLT, an Equalization-Delay per ONU is required. This Equalization-Delay is measured during this ranging state. Once the ONU receives the Ranging\_Time message, it moves to Operation-state (O5).

##### ❖ Operation-state

Once in this state the ONU can send upstream data and PLOAM messages as directed by the OLT. Additional connections can be established with the ONU as required while in this state. Once the network is ranged, and all ONUs are working with their correct Equalization-Delay, all upstream frames will be synchronized together between all ONUs. The upstream transmissions will arrive separately, each one in its correct location within the frame. Halting operating ONUs: At various times during normal operations, operating ONUs may be halted by the OLT due to serial number acquisition or ranging processes on other ONUs. This is accomplished by withholding all upstream bandwidth grants for a certain appropriate period of time. The ONUs will process this in the normal way, which will result in the desired upstream quiet zone.

#### ❖ POPUP-state

The ONU enters this state from the Operation state (O5) following the detection of LOS or LOF alarms. When entering the POPUP state (O6), the ONU immediately stops upstream transmission, and turns into O1 state.

#### ❖ Emergency-Stop-state

An ONU that receives a Disable\_Serial\_Number message with the "Disable" option moves to the Emergency-Stop-state (O7) and shuts its laser off. The ONU returns to Standby-state (O2) thereafter.

### 2.6.2 ONU Management

In the GPON system, the ONU is managed by PLOAM (Physical Layer OAM) and OMCI messages. PLOAM messages are primarily used for the management and maintenance information of the GPON physical layer and TC layers, such as DBA information, DBRu, and so on. The OMCI message is mainly used for the management and maintenance of the business level, such as the hardware capability discovery, alarm information maintenance and business capability configuration, etc. The OLT's OMCI message is in full compliance with the g.984.4 protocol.

#### Notes:

- ❖ *The PLOAM protocol is defined in ITU-T G.984.3, it is used for physical layer operation maintenance and management.*
- ❖ *OMCI is MS management protocol. OLT controls multiple ONU connected under PON port through the OMCI channel.*

## 3 SYSTEM FUNCTION MANAGEMENT

### 3.1 Management Mode Configuration

OLT supports the following three types of management modes:

### 3.2 Series Port

Enter the system to manage OLT via series port.

### 3.3 Telnet

After the in-band or out-band network management is configured (see In-band/Out-band Network Management Configuration), the user can manage OLT via Telnet.

### 3.4 NMS

After the in-band or out-band network management is configured, the user can manage OLT via NMS mode.

This manual introduces the configuration method of logging on the device in CLI mode via hyper terminal or Telnet.

#### 3.4.1 Series Port

Note that please do not tick RTS/CTS and XON/XOFF options, as shown in the figure below:

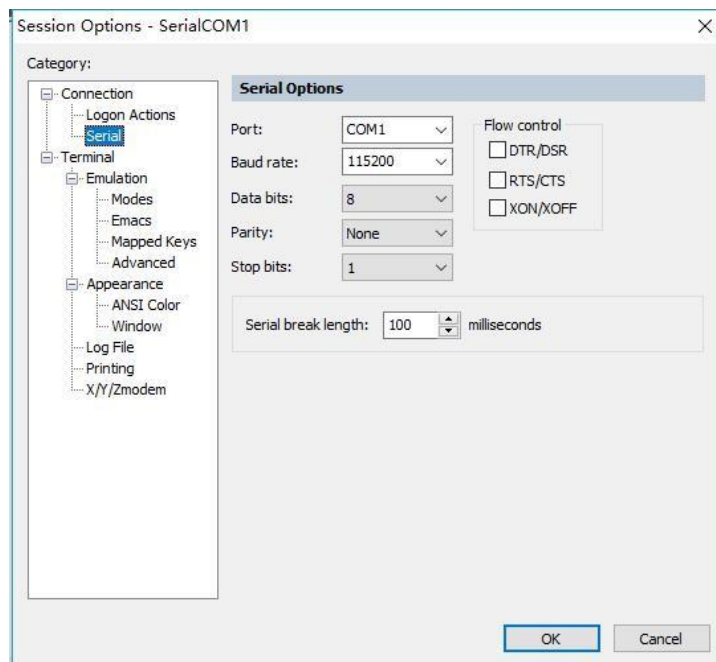


Figure 2- 1 Series Port

## 3.4.2 Telnet

### 3.4.2.1 Out-band Network Management Configuration

The out-band management network accesses the network management system through the MGMT interface of the switching control board. It uses non-traffic channels to transmit management information and to separate management and service channels, which is usually used for local management and maintenance.

There are two management ports –Management port 1 (MGMT1) is located below the front panel. IP defaults to 192.168.1.32, which can be modified by the command. Management port 2 (MGMT2) is located above the front panel. IP defaults to 192.168.100.2. This IP address cannot be changed.

Configure the outband management IP address:

```
OLT(config)# interface fm1-mac2
OLT(config-fm1-mac2)# ip address 192.168.1.32/24
```

Show out band management

```
OLT(config)# show running-config interface fm1-mac2
!
interface fm1-mac2
ip address 192.168.17.175/24
!
end
```

### 3.4.2.2 Configure L3 Interface

In addition, you can configure the Layer 3 interface IP to manage the OLT in inband Telnet mode.

- ❖ Access to IP network is realized by in-band network management through the service channel (upstream port), so as to achieve network management information transmission, which is commonly used in engineering practice.
- ❖ In in-band network management mode, the NMS interaction information is transmitted by the service channel of the device. The in-band network management is with flexible networking and it does not need any extra device, which is cost saving but not easy for maintenance.

Item	Description
------	-------------

Upstream Port	ge1/8
In-band Network Management VLAN	VLAN ID: 1000
In-band Network Management IP Address	10.1.1.1/24

Table 2- 1 Data Configuration

### Configure L3 interface

```
OLT(config)#interface vlanif1000
OLT(config-vlanif1000)#ip address 10.1.1.1/24
```

### Add an interface VLAN to the upstream port

```
OLT(config)#interface ge1/8
OLT(config-ge1/8)#no shutdown
OLT(config-ge1/8)#speed 1000
OLT(config-ge1/8)#switchport mode trunk
OLT(config-ge1/8)#switchport trunk tag 1000
```

### Show the configured L3 interface

```
OLT(config)# show running-config interface vlanif1000
!
interface vlanif1000
no shutdown
ip address 10.1.1.1/24
!
End
```

### Delete L3 interface

```
OLT(config)# no interface vlanif1000
```

 **Note:**

*IP addresses of out-band and in-band network management cannot be in the same network segment.*

*If PC and the in-band network management are not in the same network segment, the default gateway needs to be configured for OLT. For detailed information, see 12.1 OLT Default Routing Configuration.*

### 3.5 NTP System Time Synchronization Configuration

NTP (Network Time Protocol) belongs to the application layer protocol. It is used to synchronize time between the distributed time server and the client and it is based on IP and UDP. NTP protocol is evolved from Time Protocol and ICMP Timestamp Message, which makes special design from the aspects of accuracy and strength.

In order to protect local NTP services, this command can be used to set access control permissions to local NTP services. After the command is successfully configured, for the received NTP synchronous message, the local device will decide whether the message needs to be processed and whether it is allowed to be synchronized with the device according to the configured permissions and the content of the message. OLT works in the NTP client mode and it keeps time synchronization with the NTP server.

In the global configuration mode, enable NTP function:

```
OLT(config)#sntp enable
```

Configure NTP server:

```
OLT(config)#sntp unicast-server 192.168.1.111
```

The source address used when connecting NTP to send time synchronization request:

```
OLT(config)#sntp connect 192.168.1.111
```

Configure NTP synchronization interval time (Unit: Second) :

```
OLT(config)#sntp auto-sync timer 10
```

(Optional) Show NTP running state:



```
OLT# show sntp
Simple ntp client:
Status: Enable
Auto sync timer: 10s
Last sync time: Fri Nov 11 02:33:48 UTC 2016
Current time: Fri Nov 11 02:33:51 UTC 2016
Ntp server list:
Address          Service
192.168.1.111    Support
Total: 1
```

After the system time is configured, the user can view the corresponding time recorded in the command line log and the alarm, so as to locate the fault.

#### Note:

*The system time will not be automatically synchronized when the OLT status is unsupported. Multiple NTP server addresses can be configured to synchronize in a sequence in one cycle. If synchronization with one of the servers is completed, synchronization with the subsequent NTP server will not be initiated.*

### 3.6 System Time Configuration

This command is used to configure the system time. After the command is successfully executed, the system time will become the set time.

Configure the time zone in the global configuration mode:

```
OLT(config)#timezone gmt + 03:00
OLT(config)#exit
```

Configure the system time in the administrator mode:

```
OLT#clock set 2016.05.31-11:02:30
```

#### Note:



*The configuration time is the current time.*

(Optional) Show the system time:

```
OLT(config)# show timezone
System timezone: gmt + 03:00
OLT# show clock
2016-05-31 19:02:40 [gmt +03:00]
```

Show the current runtime of the OLT

```
OLT# show uptime uptime:
2 days, 02:29:54
```

## 3.7 Operations of System Configuration

### 3.7.1 Configuration Saving

This command is used to save the current database files and configuration files of the system. It is used:

1. when the user needs to save the current data or configuration files;
2. After the user modifies the database files or configuration files, he wants to save the modifications

When the save configuration is successful, one can see the following print information on the serial port.

```
OLT# write
Building Configuration...
Integrated configuration saved to /qtech/config/main.conf
[OK]
```

### 3.7.2 Reboot

This command is used to reset the system. If the system fails or the software version needs to be upgraded, this command is used when the system is reset after the upgrade software is imported. After successfully reset the system, the system can resume the operation. It can normally run the newly loaded program.

```
OLT# reboot
```

```
Are you sure reboot [y/n] y
Unsaved configuration will be lost. Save now? [y/n]
```

### 3.7.3 Restore the Default Configuration

This command is used to restore the default configuration of the device.

```
OLT# default configure
OLT# reboot
Are you sure reboot [y/n] y
Unsaved configuration will be lost. Save now? [y/n] n
```

#### Note:

*After restoring the default configuration, restart the device to take effect. When one reboots it, SAVE NOW will save the current configuration and select n.*

Or use the following command to directly restore the default configuration and to reboot it.

```
OLT# reboot config default
```

### 3.7.4 System Diagnosis Information Uploading

OLT supports the uploading function of the system log, saves the LOG information of the system in file mode, compresses and records the file with the name of unos.log, and meanwhile uploads it to the local computer through tftp. When the system fails, the system diagnosis information can be collected and submitted to the technical support staff by using this command.

#### Upload Steps:

1. Open the TFTP server and ensure that the computer is connected to the in-band and out-band management ports of the OLT.
2. Connect the corresponding management IP address on the computer by using the Ping command.
3. In administrator mode, enter the following command to upload the system diagnosis information to the log folder which is created according to the specified path by TFTP of the computer. For IP address, the corresponding address to connect the network card of OLT management port needs to be specified.

```
OLT# zlog upload tftp 192.168.1.111
```

*192.168.1.111 is the IP address of the network adapter used to connect to the OLT management interface on the computer.*

1. After the command is successfully executed, the compressed package file of logs.tar.gz can be seen under the folder of TFTP Server, including diagnosis information such as unog.log and configuration files etc.
2. OLT support self-define compression package file name

```
GPON# zlog upload tftp 192.168.1.111 2018-12-27
```

### 3.7.5 Configuration Saving and Recovery

OLT supports the saving and recovery functions of the system configuration, which saves the system configuration in main.conf folder, and meanwhile it can be saved to the local computer and be recovered by TFTP. Before the device is deployed or the system is upgraded, it is recommended to save the configuration file to the computer for emergency recovery.

### 3.8 Upload Steps

1. Open the TFTP server, manually create the config folder under the path specified by TFTP, and ensure that the local computer can access the OLT device through the in-band and out-band management IP address.
2. When the backup of the configuration command is performed, the user needs to enter the following commands in the administrator mode. The configuration file will be in the config folder under the working folder which is set after it is uploaded to the TFTP software. The default file name is main.conf.

```
OLT# tftp config put 192.168.1.111
```

*192.168.1.111 is the IP address of the network adapter used to connect to the OLT management interface on the computer.*

3. When one need to restore configuration commands, it changes the original configuration file to main.conf, which is stored in the TFTP server settings download folder. The following command will restore the configuration file from the computer to the OLT.

```
OLT# tftp config get 192.168.1.111
```

 **Note:**

*After restoring the default configuration, the device needs to be restarted to take effect. Select *n* in “save now” when restarting.*

### 3.8.1 Show the Current Configuration

OLT supports the user to show the configurations in the running of the current device under any node.

```
OLT# show running-config
```

*The order to show all the configurations of ONU is that of ONU authentication registration.*

One can also use the following command to show the current configuration saved in memory.

```
OLT(config)# show current-config
```

### 3.8.2 Monitoring Records of Command Line

OLT supports that the history command line inputs the records after this login is viewed.

```
OLT(config)# show history
[2018-06-19 06:21:45] : enable
[2018-06-19 06:21:45] : vty-time 3600
[2018-06-19 06:21:45] : show version
[2018-06-19 06:21:45] : con t
[2018-06-19 08:08:55] : show history
```

### 3.8.3 VTY Logout Time Settings

OLT supports to configure the automatic and forced logout time when the serial port and Telnet are idle for a period of time.

```
OLT(config)# vty console idle-timeout 100
OLT(config)# vty console absolute-timeout 2000
OLT(config)# vty telnet idle-timeout 100
OLT(config)# vty telnet absolute-timeout 2000
```

Idle logout means when the input time of the last command exceeds the idle logout time, it will automatically log out and it needs to connect the login device again. Forced logout means when the login time exceeds the forced logout time, it will be forced to log out and it needs to connect the login device again.

#### View Logout Time Settings

```
OLT(config)# vty console idle-timeout 100
vtty console idle-timeout 100
vtty console absolute-timeout 2000
vtty telnet idle-timeout 100
vtty telnet absolute-timeout 2000
```

### 3.8.4 System Host Name Configuration

OLT supports renaming device host name.

```
OLT(config)# hostname GPON
GPON(config)#
```

After renaming, all the CLI's prompt for session connections will be displayed as the host name.

## 3.9 OLT Software Upgrade

### 3.9.1 Software Upgrade

The upgrade of OLT software includes two upgrade methods—FTP and TFTP.

#### Upload Steps:

1. Connect the computer to the in/out-band management port of OLT.
2. The corresponding management IP address can be connected by using ping command on the computer.
3. Open TFTP or FTP server in the local computer. Locate the upgrade software in the file path specified by TFTP or FTP.
4. Input the following command to upload in administrator mode:

```
OLT# upgrade tftp 192.168.1.111 QSW-9010_R5.3.26_V336.tar.gz
```

OR

```
OLT# upgrade ftp 192.168.1.111 QSW-9010_R5.3.26_V336.tar.gz username  
password
```

IP refers to the IP address of the local computer, which requires to successfully ping the in-band and out-band management IP addresses of OLT.

 **Note:**

*It is recommended to use the out-band management port to upgrade the OLT software. When upgrading in the above-mentioned way, please make sure that the windows firewall is closed, or it may cause an upgrade failure.*

### 3.9.2 View Software Version

```
OLT# show load-info  
current load:  
file :app/1/QSW-9010_R5.3.26_V336.tar.gz  
md5 :f50505f7b57509072209622142bfaf9f
```

```
previous load:  
file :app/0/QSW-9010_R5.3.23_V208.tar.gz  
md5 :c505cb53314cde77256be2bdda15627e
```

```
OLT# show version  
Product Name      : OLT  
SVN               : R5.3.23V209  
Compile information : Compiled by ALL Thu Dec 27 09:42:38 CST 2018  
Hardware Version  : 1.2  
Serial Num       : 1111G82BY1612010  
Contact          :  
Loctaion         :  
Copyright        :
```

### 3.9.3 Software Version Rollback

OLT support software roll back to the previous software version after upgrade. By showing the software version, you can see the software version number the OLT is currently running, and the software version number that is stored.

To roll back to the previous OLT software version, please use the following command:

```

OLT# reboot load previous
previous load:
file :app/1/QSW-9010_R5.3.23_V205.tar.gz
md5 :89e6e8717fd573dc334e1d75fd5e7c75

Are you sure reboot with prevoius load[y/n] y
Unsaved configuration will be lost. Save now? [y/n] y
Building Configuration...
Integrated configuration saved, total 279 lines
[OK]
Rebooting system...

```

## 3.10 Operating User Management

Operating users are those who configure and maintain devices through CLI terminals, including serial port terminals and Telnet logins.

The operating users' permissions are divided into three levels by user management, which are view, monitor and system.

### 3.10.1 Description of Operating User Permissions

Table 2- 2 Description of Operating User Permissions

User Level	Description of User Perminssions
Users with view permission	After login the device, the users can enter the operator mode, but they cannot be enabled to enter the administrator mode.
Users with monitor permission	After login the device, the users can enter the administrator mode to perform operations, but they cannot enter the global configuration mode.
Users with system permission	After login the device, the users can enter the global configuration mode to perform operations.

### 3.10.2 Create Operating User

When creating an operating user, you need to configure the attributes of the user, including user accounts, passwords and permissions. The operating user attributes are described in the table below.

Table 2- 3 Description of User Attributes

User Attribute	Description
Account	User name can be made up of 1~31 printable characters (space is not allowed). The user name must be unique and cannot be repeated. The user name is case-sensitive.
Password	The password can be made up of 1~ 31 characters and it is case-sensitive.
Permission	The operating user is divided into 15 authorities, as 1-15.

 **Note:**

- ❖ *Only users with an authorities of system can create other operating users.*
- ❖ *OLT supports 100 operating users.*
- ❖ *The default operating user of OLT is admin, the default password is admin and the default permission is admin*

As shown below, create an operating user with both the user name and password of 1 and the level of monitor.

```
OLT(config)#username 1 password 1 privilege monitor
```

#### (Optional) Show Operating User Configuration

```
OLT# show user

User          Privilege
admin         admin
1             monitor
2             system
3             view
```

### 3.10.3 Modify User Attributes

Modify the user password and permissions, so as to ensure the safety of the device.



In global configuration mode, change the password of user abc to 123, and the level remains as view.

```
OLT(config)#username abc password 123 privilege view
```

(Optional) Show operating user configuration.

```
OLT# show user

User                Privilege
admin               admin
1                   view
2                   system
3                   view
```

#### 3.10.4 Delete User

(Optional) Show operating user configuration.

```
OLT(config)# no username abc

OLT# show user

User                Privilege
admin               admin
2                   system
3                   view
```

### 3.11 CPU and Memory Usage Monitoring

OLT uses dual CPU and dual core processor to show the CPU user status, kernel state occupancy rate and current memory utilization of the current device.

```
OLT# show processor
```

```
-----
CPU   Usage
```

-----

```
User  Kernel      Idle
```

```
3%    2%    94%
```

```
Memory      Usage
```

```
Total (KB)  Free (KB)    Percentage
```

```
456892      175432      38.40%
```

```
%Cpu0 0.7/0.3 (user/kernel)
```

```
%Cpu1 8.0/0.6 (user/kernel)
```

```
Mem 43.2/0.436 (percentage/GiB)
```

## 3.12 Monitoring the System Chip Temperature

### 3.12.1 Real-Time Temperature Query for Device Chips

OLT supports real-time temperature monitoring of CPUs, PON optical modules, switching chips, and PON chips.

```
OLT(config)# show environment temperature
```

```
Cpu Chip Temperature      : 36 C
```

```
Pon Optics Temperature    : 33 C
```

```
Switch Chip Temperature   : 38 C
```

```
Pon Chip Temperature      : 35 C
```

### 3.12.2 High Temperature Restart Protection Strategy for Device

OLT not only supports real-time temperature monitoring of chips, but also allows to set the threshold of ultra high temperature restart.

```
OLT(config)# equipment_reboot temp_threshold 100
```

**Note:**

*When the temperature of any chip being monitored by OLT reaches or exceeds the sub threshold, OLT will restart automatically.*

### 3.13 Broadcast Storm Suppression

In order to prevent broadcast storm of broadcasting, unknown unicasting and multicasting messages, the default value for the suppression of PPS by the message of OLT upstream port is 100 when the inbound messages take effect.

```
OLT(config)# interface ge1/1
OLT(config-ge1/1)# storm-control broadcast pps 100
OLT(config-ge1/1)# storm-control multicast pps 100
OLT(config-ge1/1)# storm-control unicast pps 100
```

**Note:**

- ❖ *Broadcast storm suppression can also be configured on each PON port.*
- ❖ *Each port can be configured with only one unit mode (kbps/pps). When one modifies the unit mode corresponding to any message, all configurations of another unit configured earlier are deleted.*
- ❖ *When configured as kbps, the speed limit is more accurate when the configuration value is 200kbps~100Mbps.*
- ❖ *The current speed limit PPS will have a certain degree of float at 1~4.*

### 3.14 Optical Module Parameter Query

The following optical module parameters of the uplink port can be read: module type, manufacturer, SN number, current transmitting optical power, temperature, voltage and bias current.

```
OLT(config-ge1/1)# show optical module info
optical module type           : FIBRE
optical module vendor         : QTECH
optical module sn             : 1154315267
optical module tx power       : -6.30 dbm
optical module rx power       : -9.10 dbm
optical module temperature    : 38.00 C
```

```
optical module voltage      : 3.24 V
optical module bias current  : 16.25 mA
```

The following optical module parameters of the PON port can be read: transmitting optical power, temperature, bias current and voltage.

```
OLT(config-gpon-olt1/1)# show optical module info
optical module type         : FIBRE
optical module vendor       : QTECH
optical module sn           : B0761180200993
optical module pn           : SOGQ4321-PSGB
optical module tx power     : 5.24 dbm
optical module temperature  : 43.00 C
optical module voltage      : 3.15 V
optical module bias current  : 18.37 mA
```

### 3.15 Uplink Mode Switching

OLT supports three uplink modes: two 10GE uplink interfaces, eight GE uplink interfaces, or two 10GE and four GE uplink interfaces. One can switch between the three modes. After switching modes, one need to restart the device to take effect and the uplink port needs to be reconfigured. The default mode is 8\*GE uplink interface.

OLT switches to 2\* 10G uplink modes:

```
OLT(config)# upstream-mode xe
change upstream mode setting will delete current upstream config & reboot
the system ,Are you sure to set upstream mode[y/n] y
Unsaved configuration will be lost. Save now? [y/n] y
```

#### Note:

*When the uplink mode is 2\* 10G uplink ports, only the first two uplink ports (E1, E2) are available. The rate can be configured as 1000M or 10000M, and the last six uplink ports cannot be used.*

OLT switches to 8\* GE uplink modes:

```
OLT(config)# upstream-mode ge
change upstream mode setting will delete current upstream config & reboot
the system ,Are you sure to set upstream mode[y/n] y
Unsaved configuration will be lost. Save now? [y/n] y
```

#### Note:

- ❖ *When the uplink mode is 8\*GE uplink port, the eight uplink ports (E1~E8) are available. The rate can only be configured as 1000M.*

OLT switches to 8\*XE and 4\*GE uplink port mode:

```
OLT(config)# uplink-mode xge
change uplink mode setting will delete current uplink config & reboot the
system ,Are you sure to set uplink mode[y/n] y
Unsaved configuration will be lost. Save now? [y/n] y
```

#### Note:

- ❖ *When OLT is in 8\*XE and 4\*GE uplink port mode, all the 8 uplink ports (E1~5, E7) of OLT can be used. The uplink port rates of E1, E3, E4 and E5 can only be configured as 1000M, and the uplink ports of E2 and E7 can be configured as 1000M or 10000M.*

## 3.16 Global VLAN Configuration

Create VLAN globally

```
OLT(config)# vlan 2
```

View the usage of current specific or all VLANs

```
OLT(config)# show vlan 2
2          static      vlan2
          TagPorts:   xe1/1
          Untag
```

```
OLT(config)# show vlan
Vid  Status Name
1    static vlan1
     TagPorts:
```

```
Untag : xe1/1 xe1/2 gpon-olt1/1 gpon-olt1/2 gpon-olt1/3 gpon-olt1/4
gpon-olt1/5 gpon-olt1/6 gpon-olt1/7 gpon-olt1/8
2 static vlan2
TagPorts:
Untag :
10 static vlan10
TagPorts: xe1/1
Untag :
20 static vlan20
TagPorts:
Untag :
100 static vlan100
TagPorts:
Untag :
```

### Delete VLAN

```
OLT(config)# no vlan 2
```

#### Note:

*VLANs that are not used in any interface can be deleted. However, when the VLAN is used in the uplink port, ONU or the third-layer interface, the VLAN cannot be deleted.*

*VLAN1 cannot be deleted.*

### 3.17 PON Protection Function

With the wide application of PON network, how to ensure the service reliability of enterprise customers or mobile users in PON network has become a common concern of operators. Two dual PON protection configurations are defined in the G.984.1 standard (version 2008). Type B and Type C protection networking is feasible. Compared with Type C protection, Type B protection has low cost and low technical implementation difficulty. Type B protection provides redundant protection for both OLT PON ports and backbone fibers. When OLT PON ports or backbone fibers fail, they can switch to another optical fiber automatically.

The network diagram of GPON TYPE B protection is shown in the figure below. The corresponding protection range includes the primary and standby PON ports, as well as the primary and secondary optical fibers.

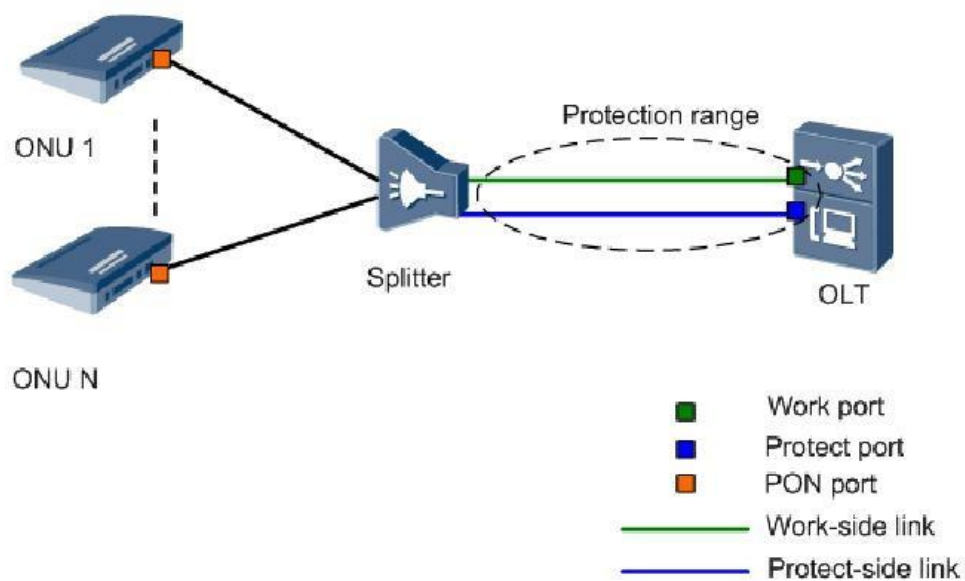


Figure 2-2 GPON Type B Protection

When the following conditions occur, automatic protection switching will be triggered:

- ❖ Backbone optical fiber fracture
- ❖ OLT hardware failure
- ❖ Line quality cracking

Before you select two PON ports to create a protection group, you need to clear all the configurations of the protection port first.

```
OLT(config-gpon)# clear config gpon-olt1/2
OLT(config-gpon)# protectgroup 1 name ProGroup1 workpon gpon-olt1/1
protectpon gpon-olt1/2 typeB
```

View the configured protection group information, including the work port, the protection port and the current Active port.

```
OLT(config)# show protectgroup 1
group name:          s
work pon port:      gpon-olt1/1
protect pon port:   gpon-olt1/2
active pon port:    gpon-olt1/1
```

Manual Switch:

When the current Active port is the Work port, the following command is used to realize the switch:

```
OLT(config-gpon)# protectgroup 1 switchover w2p
```

When the current Active port is the Protect port, the following command is used to realize the switch.

```
OLT(config-gpon)# protectgroup 1 switchover p2w
```

Delete the protection group:

```
OLT(config-gpon)# no protectgroup 1
```



## 4 BASIC SERVICE CONFIGURATION

GPON configuration mainly includes configuration of GPON profiles, GPON ONU, GPON ports and GPON service flow etc.

### 4.1 GPON Profiles

#### 4.1.1 Configure ONU Type Profiles

GPON ONU profile is composed of parameters that need to be configured for GPON access service. The GPON ONU capability profile includes the type and number of ONU physical port, the number of boards, the number of CATV interfaces and the number of uplink and downlink queues.

```
OLT(config)# gpon
OLT(config-gpon)# profile onutype onu-4fe eth 4 pots 0 card 4 video 0 down-
queue 8 up-queue 8
OLT(config-gpon)# profile onutype catv eth 1 pots 0 card 1 video 1 down-
queue 8 up-queue 8
```

Configuration:

Show ONU type configuration:

```
OLT(config)# show profile onutype
*****

Profile Name           :STG-402
Is Default             :Yes
Card Number           :1
Tcont Number          :8
GemPort Number        :32
Up Queue Number       :4
Down Queue Number     :4
Host Number           :2
Uni Eth Number        :4
Uni Pots Number       :2
Video Number          :0
```

\*\*\*\*\*

```
Profile Name           :onu-4fe
Is Default             :No
Card Number           :1
Tcont Number          :8
GemPort Number        :32
Up Queue Number       :8
Down Queue Number     :8
Host Number           :2
Uni Eth Number        :4
Uni Pots Number       :0
Video Number          :0
```

\*\*\*\*\*

```
Profile Name           :catv
Is Default             :No
Card Number           :1
Tcont Number          :8
GemPort Number        :32
Up Queue Number       :8
Down Queue Number     :8
Host Number           :2
Uni Eth Number        :1
Uni Pots Number       :0
Video Number          :1
```

\*\*\*\*\*

Delete onutype:

```
OLT(config-gpon)# no profile onutype onu-4fe
```

 Note:

- ❖ *When an ONU type profile is being used (with an ONU that binds the profile), the profile is not allowed to be deleted. The above configuration includes the maximum 4 Ethernet ports of the ONU and the upstream and downstream queues are all 8.*
- ❖ *By default, the number of card is 1.*
- ❖ *Whether it supports the binding of corresponding ONU type profile can be determined by querying the capability set of the remote ONU. When the number of onutype bound by the remote ONU cannot meet the requirements for the number of the actual ONU, it will cause that the corresponding configuration cannot be issued.*
- ❖ *The profile is the onutype which is used when the PON port develops the function of ONU automatic registration. The number of the upstream and downstream queues is 4.*
- ❖ *In the current R5.3 version, only thename, the number of Ethernet ports, and the number of downstream queues are valid attributes in the configured ONU type profile parameters.*

**4.1.2 Configure DBA Profile**

```
OLT(config)# gpon
OLT(config-gpon)# profile bandwidth dba-type1 fixed 20000
OLT(config-gpon)# profile bandwidth dba-type2 assured 100000
OLT(config-gpon)# profile bandwidth dba-type3 assured 100000 maximum 200000
OLT(config-gpon)# profile bandwidth dba-type4 maximum 200000
OLT(config-gpon)# profile bandwidth dba-type5 fixed 20000 assured 100000
maximum 200000
```

Show DBA Profile Configuration

```
OLT(config)# show profile bandwidth
*****
ProfileName          FixBw          AssuredBw      MaxBw
-----
dba-type1            20000          0               0
dba-type2            0              100000          0
dba-type3            0              100000          200000
```

dba-type4	0	0	200000
dba-type5	20000	100000	200000
default	0	0	100000

\*\*\*\*\*

### Delete DBA Profile:

```
OLT(config-gpon)# no profile bandwidth dba-typex
```

#### Note:

- ❖ *When a bandwidth profile is being used (there is a T-CONT bound to the bandwidth profile), the profile is not allowed to be deleted. Our OLT has a default DBA profile default, which uses a maximum bandwidth of 100M. This profile is used in versions that have customized automatic delivery services.*
- ❖ *The default profile cannot be deleted. When you delete the DBA profile, please pay attention that you cannot delete the profile which has been bound to ONU. You need to unbind it firstly.*
- ❖ *When DBA profile is added, the bandwidth value must be an integer multiple of 250. If the input bandwidth value is not an integer multiple of 250, it will be shaped down to a multiple of 250.*

### 4.1.3 Service Template

The service templates can be batch issued to ONUs, for detailed information please refer to chapter 6.2 Batch Configuration service. The service template can also be used for ONU auto-config, for detailed information please refer to chapter 6.7 to Remote ONU Configuration.

```
OLT(config)# gpon
OLT(config-gpon)# onu-srvprofile profile-id 32 onu-type STG-402
OLT(config-onu-srvprofile-32)# tcont 1 profile default
OLT(config-onu-srvprofile-32)# gempport 1 tcont 1
OLT(config-onu-srvprofile-32)# service-port 1 gempport 1 user-vlan 1000 vlan
1000
OLT(config-onu-srvprofile-32)# remote service 1 gem 1 vlan 1000
OLT(config-onu-srvprofile-32)# remote uni eth_1/1 vlan-mode access pvlan
1000
OLT(config-onu-srvprofile-32)# exit
```

*Note: You need to configure ONU-type before creating a service template, otherwise there will be a echo print of "Onu type profile name not exist".*

#### 4.1.4 ONU Authentication and Registration

Register an ONU with the ONU type template that created.

Step 1 Open the PON port:

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# no shutdown
```

Show PON Port Status:

```
OLT(config)# show interface gpon-olt1/1

gpon-olt1/1          : up
Hardware address    : 08c6-b300-645f
Media type          : MEDIUM_FIBER
loopback            : NONE
Autonegotiation     : enable
Flow control transmit : on  recieve:  on
Speed               : 2500      Duplex-full
Max frame size     : 12284
Ifindex            : 0x9010001
Port link-type     : access
PVID               : 1
RxPackets          : 0
RxBytes            : 0
RxBcast           : 0
RxMcast           : 0
RxPause           : 0
RxInjabber        : 0
RxErrors           : 0
```

```
RxCRCErrors      : 0
RxDrops          : 0
TxPackets        : 0
TxBytes          : 0
TxBcast         : 0
TxMcast         : 0
TxPause         : 0
TxCollision     : 0
TxErrors        : 0
TxDrops         : 0
```

### Step 2. Show the unauthenticated ONU information:

```
OLT(config-gpon-olt1/1)# show onu unconfig
      gpon-olt  onu-index  info
      1/1      1          sn:STGUbc0036c5  pw:  loid: loidpw:
      1/1      2          sn:STGUbc003709  pw:  loid: loidpw:
Total: 2
```

### Step 3 Add corresponding ONU

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# onu 1 type STG-402 sn STGUbc0036c5
OLT(config-gpon-olt1/1)# onu 2 type onu-4fe sn STGUbc003709
```

### Step 4 Add ONU Status:

```
OLT(config-gpon-olt1/1)# show onu status
      gpon-onu  auth-type  auth-info  state
      1/1:1    sn          sn:STGUbc0036c5  operational
      1/1:2    sn          sn:STGUbc003709  operational
Total: 2
```

### Description of ONU Status:

added :                   ONU has been added but it is offline.  
authpass:                ONU has been successfully authenticated.  
operational:            ONU is operational.

#### Note:

*When the PW part of PW authentication and SN+PW authentication are the same, it may not be able to display the SN number. Therefore, please ensure that ONU does not have the same SN and PW when it is out of the factory.*

### 4.1.5 Modify ONU registration information

In the existing network, there is a case where the actual ONU is replaced. OLT supports to modify ONU registration information, which automatically completes the automatic configuration of service migration. There is no need to reconfigure ONU related services.

Step 1, show the ONU status under the current PON port:

```
OLT(config-gpon-olt1/1)# show onu status
gpon-   onu-type   auth-type   auth-info   onu-act-   state
onu                                           version
-----
1/1:1   STG-402     sn          sn:STGUbc0036c5  E3.V1.01.157  operational
Onu Number: 1/1
OLT(config-gpon-olt1/1)# show onu unconfig
gpon-olt  onu-   info
          index
1/1       2     sn:STGUbc003709  pw:      loid:      loidpw:
Total: 1
```

Step 2, modify the ONU registration information of the fixed ID:

```
OLT(config-gpon-olt1/1)# onu modify 1 sn STGUbc003709
```

Step 3, show the ONU status under the current PON port:

```
OLT(config-gpon-olt1/1)# show onu status
gpon-   onu-type   auth-type   auth-info   onu-act-   state
onu                                           version
-----
1/1:1   STG-402   sn          sn:STGUbc003709  E3.V1.01.157  operational
Onu Number: 1/1
OLT(config-gpon-olt1/1)# show onu unconfig
gpon-   onu-index  info
olt
1/1     1          sn:STGUbc0036c5  pw:          loid:        loidpw:
Total: 1
```

#### 4.1.6 Query of ONU Status Information

Query the current status of all ONU.

```
OLT(config-gpon-olt1/1)# show onu status
gpon-   onu-type   auth-type   auth-info   onu-act-   state
onu                                           version
-----
1/1:1   STG-402   sn          sn:STGUbc003709  E3.V1.01.157  operational
Onu Number: 1/1
OLT(config-gpon-olt1/1)# show onu unconfig
gpon-   onu-index  info
olt
1/1     1          sn:STGUbc0036c5  pw:          loid:        loidpw:
Total: 1
```

OLT supports ONU queries based on registration information attributes (such as SN, Password, LOID or name).

```
OLT(config)# show onu filter sn STGU
```



gpon-onu	onu-type	auth-type	auth-info	onu-act-version	state
1/1:1	STG-402	sn	sn:STGUbc003663	G1.V1.68	operational
1/6:1	STG-402	sn	sn:STGUbc003601	G1.V1.68	operational
1/6:2	STG-402	sn	sn:STGUbc0035fe	G1.V1.68	operational
1/7:2	STG-402	sn	sn:STGUbc003655	G1.V1.01.157	operational
1/8:2	STG-402	sn	sn:STGUbc00365e	G8.V3.0.1	operational

OLT supports ONU status information queries based on ONU registration ID.

```
OLT(config)# show onu 1 status
```

gpon-onu	onu-type	auth-type	auth-info	onu-act-version	state
1/1:1	STG-402	sn	sn:STGUbc003663	G1.V1.68	operational
1/6:1	STG-402	sn	sn:STGUbc003601	G1.V1.68	operational

## 5 REMOTE ONU FUNCTION CONFIGURATION

### 5.1 ONU Automatic Discovery Function

The ONU auto-discovery function is disabled at the corresponding PON port so that the PON port does not discover unregistered ONUs. This feature is turned on by default.

Disable

```
OLT(config-gpon-olt1/1)# onu auto-discovery disable
OLT(config-gpon-olt1/1)# show onu unconfig
gpon-olt  onu-index  info
Total: 0
```

Enable

```
OLT(config-gpon-olt1/1)# onu auto-discovery enable
OLT(config-gpon-olt1/1)# show onu unconfig
gpon-olt  onu-index  info
1/1          1      sn:FHTT06e39620 pw: loid:fiberhome loidpw:fiberhome
Total: 1
```

### 5.2 ONU Automatic Registration Function

When the ONU automatic registration function is enabled for the corresponding PON port, ONU can automatically enter operational status without any manual operation if the optical signals are in normal status.

Enable:

```
OLT(config)# interface gpon-olt1/1
OLT(config-gpon-olt1/1)# onu auto-authentication enable
```

Disable:

```
OLT(config-gpon-olt1/1)# onu auto-authentication disable
```

Show:

```
OLT(config)# show running-config interface gpon-olt1/1
!
interface gpon-olt1/1
no shutdown
qos-queue-scheduler model hierarchy
onu 1 type STG-402 sn FHTT06e39620
!
```

#### Note:

- ❖ *The default onotype for ONU automatic registration is profile STG-402, and the ONU gets online through SN mode.*
- ❖ *The ONU which is automatically registered will not be offline when the automatic registration function is disabled.*
- ❖ *By default, the automatic registration function is disabled.*

### 5.3 ONU Activation and Deactivation

This command is used to activate the ONU which is in deactivated status. When deactivate command is used to activate ONU, the ONU cannot work normally. This command is used to activate the ONU and recover its normal operation status.

Activate:

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# active
```

Deactivate:

```
OLT(config-gpon-onu1/1:1)# deactivate
```

#### Note:

*The ONU is activated by default.*

### 5.4 Show ONU Information

OLT can show the ONU information such as the type, vendor, and software version of the ONU.

```
OLT(config-gpon-onu1/1:1)# show onu remote info
interface gpon-onu1/1:1 remote inforamtion:
```

```
OnuType       : SFU
VendorId      : FHTT
Version       : WT-2.134.318A9
SN            : FHTT06E39620
Loid          : fiberhome
LoidPass      : fiberhome
EqptID        : AN5506-01-A
OmccVersion   : ITU-T G.988 Amd.1 (2011) Base
```

## 5.5 The situation show the short term of ONU's up and down line

OLT supports showing the short term of ONU's up and down time.

```
OLT(config)# show onu history
```

```
gpon-onu      authtime1   offtime1     authtime2    offtime2     authtime3
              offtime3
-----
1/1:1 2017-01-16 14:06:39   0000-00-00 00:00:00     0000-00-00   00:00:00
       0000-00-00 00:00:00   0000-00-00 00:00:00     0000-00-00 00:00:00
```

### Note:

*Only the last three ONU offline times are supported.*

## 5.6 ONU UNI Port Status

By this command, the users can control the UNI port management status of remote ONU, and enables or disables the Ethernet port of the user.

Enable:

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 enable
```

Disable:

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 disable
```

### Note:

*By default, all UNI ports of the ONU are enabled.*

Show the status of the UNI port:

```
OLT(config-gpon-onu1/1:1)# show onu remote uni eth_1/1 param
admin status:          enabled
link status:           up
link speed:            1000BaseT full
```

## 5.7 Query ONU Capability Set

This command is used to query the actual capability of ONU. After it obtains the actual capability of ONU, the suitable ONU capability set profile can be created according to the actual capability.

```
OLT(config-gpon-onu1/1:1)# show onu remote capability
TCONT number:          8
GEMPort number:        128
Total priority queue number: 96
Up priority queue number: 64
Down priority queue number: 32
Traffic scheduler number: 8
Total Card number:     1
Total Ethuni number:   4
Card1 Ethuni number:   4
Operation Id:          CTC
CTC Spec Version:      V2.0
OnuType:               SFU
Tx power supply control: 1
```

Table 4- 1 Hardware Capability Parameter Information of ONU

Item	Description
------	-------------

TCONT number	The number of T-CONT supported by the ONU.
GEMPort number	The number of GEM interfaces which can be provided by the ONU.
Total priority queue number	The total number of the upstream and downstream queues supported by the ONU.
Up priority queue number	The number of upstream queues supported by the ONU.
Down priority queue number	The number of downstream queues supported by the ONU.
Traffic-scheduler number	The number of traffic scheduler supported by the ONU.
Total Card number	The number of card supported by the ONU.
Total Ethuni number	The number of UNI ports supported by the ONU.
Card1 Ethuni number	The number of UNI ports contained by card 1 of the ONU.
Operation Id	The ID number for the operators configured by the ONU.
CTC Spec Version	The relevant versions for the operators configured by the ONU.
OnuType	ONU type
Tx power supply control	Tx power supply control stipulated in G988 protocol.

## 5.8 The parameter query of optical module

The ONU optical module parameters that can be read include: the current transmitter and receiver optical power, voltage, bias current, and temperature of ONU module:

```
OLT(config-gpon-onu1/1:1)# show onu remote optical info
onu tx power           : 2.67 dbm
onu rx power           : -17.64 dbm
onu voltage             : 3.24 V
onu bias current       : 10.87 mA
```

```
onu temperature          : 54.00 C
```

The ONU optical power parameters that can be read include: the current OLT transmitter and receiver optical power, the current ONU transmitter and receiver optical power:

```
OLT(config-gpon-onu1/1:1)# show onu power
olt tx power           : 5.68 dbm
olt rx power           : -23.56 dbm
onu tx power           : 2.67 dbm
onu rx power           : -17.62 dbm
```

The PON port can be used to query the the OLT receiver optical power at the PON port:

```
OLT(config-gpon-olt1/1)# show optical module rxpower onuid 1
olt rx power : -23.09 dbm
```

## 5.9 Threshold Configuration of Optical Module and ONU Optical Power

Show the transmitter and receiver optical power thresholds of ONU:

```
OLT(config-gpon-onu1/1:1)# show onu remote optical threshold
optical lower rxpower threshold:      onu_internal
optical upper rxpower threshold:      onu_internal
optical lower txpower threshold:      onu_internal
optical upper txpower threshold:      onu_internal
```

Modify the transmitter and receiver optical power thresholds of ONU

```
OLT(config-gpon-onu1/1:1)# remote onu optical threshold ?
lowerrxpower      lowerrxpower
upperrxpower      upperrxpower
lowertxpower      lowertxpower
uppertxpower      uppertxpower
```

### Note:

- ❖ "onu\_internal" is the threshold reported by the ONU.

- ❖ *When the ONU cannot report the optical power over-low alarm and over-high alarm, the OLT cannot obtain the over-low optical power alarm of the corresponding ONU.*

## 5.10 Restarting and Reseting Remote ONU

Remote ONU restore:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# remote onu restore
```

Remote ONU reboot

```
OLT(config-gpon-onu1/1:1)# remote onu reboot
```

## 5.11 AES Configuration

### 5.11.1 The Interactive Enable and Interactive Interval Configuration of the Key to the Downstream Messages

Enable Key Encryption :

```
OLT(config-gpon-olt1/1)# aes encryption key_exchange enable
```

Disable Key Encryption :

```
OLT(config-gpon-olt1/1)# aes encryption key_exchange disable
```

Configure the Key Update Interval :

```
OLT(config-gpon-olt1/1)# aes encryption key_exchange interval 10000
```

 **Note:**

- ❖ *After enabling the downlink key interaction of the PON port, the default time interval to configure the interaction is 10000ms.*

### 5.11.2 Enable Service Flow Encryption of Upstream Message Through Gem Port

Enable Encryption:



```
OLT(config-gpon-onu1/1:1)# gempport 1 encryption enable
```

Disable Encryption:

```
OLT(config-gpon-onu1/1:1)# gempport 1 encryption disable
```

## 5.12 Configuration and Query of Logical Distance

Configure the logical distance attribute of the PON port:

```
OLT(config-gpon-olt1/1)# onu max_distance
20 onu range 0~20km
40    onu range 20~40km
60    onu range 40~60km
```

Show the physical distance of the ONU:

```
OLT(config)# show distance gpon-olt1/1 onu 1
onu 1 physical distance(m) : 57
```

 **Note:**

- ❖ *Before configuring the logical distance attribute of the PON port, shut down the PON port and open it after configuration.*
- ❖ *The reading physical distance of the ONU is the calculated value, and there may be an error of about 100 meters.*

## 5.13 Upstream and Downstream FEC Configuration

Enable Downstream FEC:

```
OLT(config-gpon-olt1/1)# fec downstream enable
```

Enable Upstream FEC:

```
OLT(config-gpon-onu1/1:1)# fec upstream enable
```

 **Note:**

- ❖ *By default, the upstream and downstream FEC status is “disable”.*
- ❖ *It needs to use PON port SFP module of C++ to enable this function.*

## 5.14 ONU End MAC Address Filtering

OLT supports dynamic MAC address quantitative restriction or static fixed MAC address quantitative restriction of remote service for the remote ONU.

Configure ONU remote service MAC address quantitative restriction mode (static mode):

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 mode static
```

Configure ONU remote service MAC address quantitative restriction mode (dynamic mode)

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 mode dynamic
```

### Note:

- ❖ *When it is static restriction, it is forwarded according to the configured static MAC address.*
- ❖ *When it is dynamic restriction, it is forwarded according to the configured dynamic MAC address.*

MAC dynamic number limit:

When the mode is dynamic, one can configure the number of MAC addresses that the ONU can learn.

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 mac-limit 2
```

MAC static address restriction:

When the mode is static, one can configure to allow only fixed (source/destination) MAC address data to pass, or only to discard the fixed (source/destination) MAC address data flow.

Only data flows with destination MAC address 0000-0001-0001 are allowed to pass, and others are discarded

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 rule 1 forward da  
0000-0001-0001
```

Only the data flows with the source MAC address 0000-0001-0001 is allowed to pass. All other data are discarded.

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 rule 2 forward sa 0000-0001-0001
```

Only the data flows with destination MAC address 0000-0001-0001 is discarded. Others are allowed to pass.

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 rule 1 discard da 0000-0001-0001
```

Only the data data flows with source MAC address 0000-0001-0001 is discarded. Others are allowed to pass.

```
OLT(config-gpon-onu1/1:1)# remote mac_filter service 1 rule 2 discard sa 0000-0001-0001
```

 **Note:**

- ❖ *The MAC address limit configured for a single remote service can only be allowed through the rule or all the rules are dropped.*

## 5.15 Remote ONU Upgrade

Use OLT to remotely upgrade the ONU by

1. Upload ONU upgrade software version to OLT temporary storage
2. Download ONU upgrade software version to ONU
3. Confirm the Software Version of ONU would be used to upgrade
4. Reboot the ONU to complete the remote upgrade.

Upload ONU version to OLT:

```
OLT# tftp onuversion 192.168.1.111 460_img_V9G460-170320.tar
```

 **Note:**

- ❖ *460\_img\_V9G460-170320.tar is the ONU upgrade for software version name.*

Show ONU version files stored at the current OLT. Currently, it can place a maximum of 5 different version files at OLT.

```
GPON# show onu versions
7843840 Jan 2 06:36 460_img_V9G460-170320.tar
7854080 Jan 2 06:37 460_img_V9G460-170608.tar
```

Delete the stored ONU version in the OLT

```
OLT# delete onuversion 460_img_V9G460-170608.tar
```

Update the ONU version. Manual upgrade can only update the ONU whose operating status is operational. During the upgrade process make sure the ONU status keep normal:

```
OLT# cpe update 460_img_V9G460-170320.tar gpon-olt1/1 onu-range 1 3 5-7
```

Support simultaneous upgrade of single or multiple ONUs under the same PON port. Show ONU version

```
OLT# show cpe information gpon-olt1/1 onu-id 1
```

Show the upgrade status. There are three update statuses: downloading, ONU writing disk, and update success.

```
OLT# show cpe update-status gpon-olt1/1 onu-id 1
```

After the ONU software upgrade is downloaded and the ONU upgrade status is updated. One can issue the commit command to confirm that the ONU uses the upgraded software version:

```
OLT# cpe commit gpon-olt1/1 onu-range 1 3 5-7
```

When the ONU upgrade status is commit success, the activate command can be issued and the ONU will automatically restart:

```
OLT# cpe activate gpon-olt1/1 onu-range 1 3 5-7
```

After the upgrade is complete, the ONU re-authentication becomes an operational state. One can use the command to view that the current version of the ONU has been updated.

In the ONU upgrade process, one can use the abort command to terminate the current upgrade ONU operation before the commit operation.

```
OLT# cpe abort gpon-olt1/1 onu-range 1
```

## 5.16 ONU TR069 Management Configuration

Currently, there is an Ethernet over cable (EOC) device in the radio and television network. One need to configure the management IP over the OLT. This jumps (Jump to other pages to verify login) to the EOC device to perform service configuration on the attached CNU device.

1. Configure the IP address of the management VLAN interface.

```
OLT(config)# interface vlanif46
OLT(config-vlanif101)# ip address 192.168.99.37/24
```

2. Configure the basic services of the ONU.

```
OLT(config)# interface gpon-onu 1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan 46 transparent
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 46
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

3. Unlock the TR069 management status of the ONU.

```
OLT(config-gpon-onu1/1:1)# remote onu tr069-mgmt state unlock
```

4. Configure the TR069 management VLAN of ONU.

```
OLT(config-gpon-onu1/1:1)# remote onu tr069-mgmt tag 46 pri 0
```

5. Configure TR069 management IP (including IP, mask, gateway, DNS, and standby DNS configuration) of ONU.

```
OLT(config-gpon-onu1/1:1)# remote onu mgmt-ip 192.168.99.41 255.255.255.0
192.168.99.1 192.168.99.1 192.168.99.1 vlan 46
```

PING the assigned IP Address of ONU from OLT is available.

```
OLT# ping 192.168.99.41
PING 192.168.99.41 (192.168.99.41): 56 data bytes
64 bytes from 192.168.99.41: seq=0 ttl=64 time=0.744 ms
64 bytes from 192.168.99.41: seq=1 ttl=64 time=0.455 ms
64 bytes from 192.168.99.41: seq=2 ttl=64 time=0.394 ms
64 bytes from 192.168.99.41: seq=3 ttl=64 time=0.403 ms
--- 192.168.99.41 ping statistics ---
4 packets transmitted, 4 packets received, 0% packet loss
round-trip min/avg/max = 0.394/0.499/0.744 ms
```

The VLAN 46 can be forwarded to the PC through the uplink port to implement the jump management (Jump to other pages to assist in verifying login.) of the configuration service for the EOC.

## 5.17 ONU ACS Configuration

One can use the following command to configure the ACS server address and ONU registration method on the ACS server.

```
remote onu tr069-mgmt acs STRING validate (basic | md5) username STRING password STRING
remote onu tr069-mgmt acs STRING validate disable
```

E.g.:

```
OLT(config-gpon-onu1/1:1)# remote onu tr069-mgmt acs
http://192.168.99.217:8081/acs validate md5 username useradmin password
12345678
```

## 5.18 Isolation Function of PON port

The ONU isolation function of the PON port can be disabled for the customer's needs so that the services of the same VLAN between the ONUs under the PON port can communicate with each other.

When ONUs in multiple PON ports need to implement service interworking, the corresponding PON port needs to be disabled. The port isolation feature is enabled by default.

```
OLT(config-gpon-olt1/1)# switch-port protected disable
```

## 5.19 ONU CATV Port Management

Our OLT supports to enable and disable the CATV port of ONU, and supports the query of CATV port status.

Firstly, it needs to use ONU type profile with video port configuration to register ONU. For ONU configuration profile, please see 4.1.

```
OLT(config-gpon-olt1/1)# onu 1 type catv sn CMSZ08080808
```

Enable the CATV port of ONU:

```
OLT(config-gpon-onu1/1:1)# remote video video_1/1 state unlock
```

Show the CATV port status of ONU.

```
OLT(config-gpon-onu1/1:1)# show onu remote video video_1/1
video_1/1      :Admin status[Unlock]          Operational status[Operational]
```

## 6 UNICAST SERVICE CONFIGURATION

### 6.1 MAC Address Management

MAC address management is a basic function of Layer 2 network management, which includes setting MAC address aging time, limiting the number of dynamic MAC address learning, and static MAC address.

#### 6.1.1 Aging Time of Dynamic MAC Address

Aging dynamic MAC address can update MAC address table in time, so as to avoid the situation that the user data cannot be forwarded because the system cannot learn the new MAC address.

Configure MAC address aging time (unit: second)

```
OLT(config)# mac-address aging-time 100
```

Show the current MAC address aging time. (unit: second)

```
OLT(config)# show mac-address aging-time
Mac address aging-time : 100
```

After the MAC address aging time is successfully configured, the system periodically views the aging dynamic MAC address. If it is within 1-2 times of the aging time, no packets carrying the source MAC address are sent or received. The corresponding MAC address will be deleted from the MAC address table.

Show MAC address table

```
OLT(config)# show mac-address
Mac          Vid  Interface  Type
-----
08c6-b301-2346  46  gpon-onu1/8:1  dynamic
08c6-b300-43aa  46  gpon-onu1/8:2  dynamic
total: 2
```

#### Note:

*The learning function of the MAC address is only for unicasting MAC addresses.*

*It does not learn multicast and broadcast MAC addresses.*



MAC address table: The MAC address table exists in the system cache, which contains the MAC address of the device connected to the system, the VLAN ID which it belongs to and the interface. While forwarding the data, the system can quickly locate the interface according to the destination MAC address in the data frame and the VLAN ID for the MAC address table, so as to reduce the broadcast.

### 6.1.2 Static MAC Configuration

#### Configuration commands

```
OLT(config)# mac-address static 08c6-b303-0004 vlan 100 interface ge1/1  
MMMM-MMMM-MMMM Specify mac address, e.g. 08c6-b303-0004
```

#### Note:

*The uplink port configured with a static MAC address must belong to this VLAN;  
otherwise, the configured static MAC address is invalid.*

```
OLT(config)# show mac-address  
Mac Vid Interface Type  
-----  
08c6-b303-0004 100 ge1/1 static  
total: 1
```

## 6.2 Batch Configuration Service

### 6.2.1 Batch Configuration Service Profile

```
OLT(config)# gpon  
OLT(config-gpon)# onu-srvprofile profile-id 32 onu-type STG-402  
OLT(config-onu-srvprofile-32)# tcont 1 profile default  
OLT(config-onu-srvprofile-32)# gempport 1 tcont 1  
OLT(config-onu-srvprofile-32)# service-port 1 gempport 1 user-vlan 1000 vlan  
1000  
OLT(config-onu-srvprofile-32)# remote service 1 gem 1 vlan 1000  
OLT(config-onu-srvprofile-32)# remote uni eth_1/1 vlan-mode access pvlan  
1000  
OLT(config-onu-srvprofile-32)# exit
```

 Note:

*Before you configure the batch service profile, you need firstly configure onu-type, or it will appear the echo printing of “Onu type profile name not exist”.*

### 6.2.2 Show Batch Configuration Profile

```
OLT(config)# show profile onu-srvprofile 32
!
onu-srvprofile profile-id 32 onu-type STG-402
tcont 1 profile default
gemport 1 tcont 1
service-port 1 gemport 1 user-vlan 1000 vlan 1000
remote service 1 gem 1 vlan 1000
remote uni eth_1/1 vlan-mode access pvlan 1000
```

### 6.2.3 Configure Batch Issued ONU Services

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# multi-onusrv-cfg onu-srvprofile 32 onu 12 24 32
```

 Note:

- ❖ *When ONU does not exist, it will appear the echo printing of “Onu \* not exist”.*
- ❖ *The batch configuration profile onu-type will judge the eth of onu.*
- ❖ *The profile does not judge SFU&HGU.*
- ❖ *The actual batch configuration will judge onu type and automatically remove the illegal configuration.*
- ❖ *In batch configuration, the ONU range must be consistent with the actual number of ONU under the PON port; otherwise the batch configuration will fail.*

### 6.2.4 Configure Batch Deletion of ONU Services

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# no multi-onusrv 32 onu 12 24 32
```

 Note:

- ❖ *When ONU does not exist, there will be echo prints of "% Onu \* not exist" and "% Invalid ONU ID or range!" and all configurations within the range will not be deleted.*

## 6.3 Configure VLAN

Creating VLAN is the basis for configuring VLAN and services. Before configuring VLAN, please ensure that VLAN has been created according to the actual planning.

### Note:

❖ *The system default VLAN is 1. This VLAN cannot be deleted.*

### 6.3.1 Configure the Upstream Port and Plan VLAN

#### 6.3.1.1 Uplink Mode Configuration

```
OLT(config)# upstream-mode
ge upstream 8 ge port
xe    upstream 2 xe port
```

### Note:

*The OLT supports 2 \* 10G mode or 8 \* GE mode. After switching over the uplink mode, the OLT needs to be restarted. The default is 8 \* GE mode.*

#### 6.3.1.2 Upstream Port VLAN Attributes Configuration

In upstream port configuration mode, it supports the configuration of two port modes—trunk (hybrid) and access.

##### Trunk Mode :

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 100-200
OLT(config-ge1/1)# switchport trunk untag 300
```

##### Access Mode :

```
OLT(config-ge1/1)#switchport mode access
OLT(config-ge1/1)#switchport access 100
```

### Note:

*While configuring the upstream port VLAN, the system will automatically create the corresponding VLAN.*

### 6.3.1.3 Upstream Port Rate Configuration

OLT is designed with dual 10G upstream, which can configure 1G. By default, the upstream port is in shutdown status which needs to be enabled manually and configure the corresponding rate. The detailed configuration is as follows:

```
OLT(config)#interface xe1/1
OLT(config-xe1/1)#no shutdown
OLT(config-xe1/1)#speed 10000
OLT(config-xe1/1)#speed 1000
```

#### Note:

*OLT supports GE/10GE optical and electrical modules and does not support 10/100/1000M self-adaptive optical and electrical modules.*

The OLT can be switched to 8 GE uplink modes. The rate can only be configured to 1G. By default, the uplink port is in the shutdown state. One need to manually enable it. The configuration is as follows:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#no shutdown
OLT(config-ge1/1)#speed 1000
```

### 6.3.1.4 Upstream Port Rate Limit

OLT supports upstream port rate limit function, which is used to set port rate limit flow. This command is used when rate limit needs to be set for the message of the specified port.

```
OLT(config-ge1/1)# rate-limit 1000 2000 egress //Upstream Rate Limit
OLT(config-ge1/1)# rate-limit 1000 2000 ingress //Downlink Rate Limit
```

#### Note:

*The first value is the rate limit value; the unit is kbps. The second value is the maximum peak of Burst, the unit is kbit. When these two values are configured as "0", there is no rate limit. The Burst here is different from the concept of token bucket in RFC2697, 2698 and 4116. When the rate limit value is <10Mbps,*

*burst size needs to be configured as the value of 10~1000. When the rate limit value is >10Mbps, burst size needs to be configured as 2000, otherwise, the rate limit may be not accurate. When the rate limit value is less than 1Mbps, the rate limit is inaccurate.*

### 6.3.1.5 Limits of Address Learning of Uplink MAC

The number of dynamic MAC address learning for a user port or service is manually set. After the learned MAC address reaches the maximum number of configured dynamic MAC , all addresses learned, the user port or service processes flow will learn the new MAC addresses no longer. Limiting the number of dynamic MAC address learning can limit the number of MAC addresses that are entered the network , which reduce the burden on network devices. The dynamic MAC address can be aged, that is, the system does not send or receive packets sent by a certain device within a certain period of time. The device deletes the related MAC address table.

This command is used to configure the largest dynamic MAC address supported on the port. When one need to limit the number of users access to a virtual port of a business, this command is used. The maximum dynamic MAC address entry of the port is successfully configured. When the learned MAC address reaches this value, the port no longer learns the new MAC address.

The OLT supports a limited number of MAC address learning with a maximum of 8K MACs.

```
OLT(config-ge1/1)# mac-address limit 8000
```

(Optional) Show MAC address.

```
OLT(config)# show mac-address
Mac          Vid   Interface  Type
-----
08c6-b39d-2ffb  17   ge1/2      dynamic
08c6-b360-7348  17   ge1/2      dynamic
08c6-b32b-821e  17   ge1/2      dynamic
08c6-b3ad-9678  17   ge1/2      dynamic
08c6-b330-de0d  17   ge1/2      dynamic
08c6-b300-0001  100  gpon-      dynamic
              onu1/5:5
```

```

08c6-b300-0001    100    ge1/1    dynamic
08c6-b310-cfd1    100    gpon-    dynamic
                  onu1/5:5
08c6-b300-3554    200    gpon-    dynamic
                  onu1/5:2

total: 9

```

### 6.3.1.6 Uplink Broadcast Storm Control

The OLT supports the rate limit for broadcast, multicast, and unknown unicast packets, which can limit the rate based on the kbps and pps of the packets and it takes effect on incoming packets:

```

OLT(config-ge1/1)# storm-control broadcast pps 10000
OLT(config-ge1/1)# storm-control multicast pps 10000
OLT(config-ge1/1)# storm-control unicast pps 10000

```

or

```

OLT(config-ge1/1)# storm-control broadcast kbps 10000
OLT(config-ge1/1)# storm-control multicast kbps 10000
OLT(config-ge1/1)# storm-control unicast kbps 10000

```

#### Note:

- ❖ When configured as kbps, the speed limit is more accurate when the configuration value is 200kbps~100Mbps.
- ❖ At present, the speed limit PPS will have a certain degree of float at 1~4.

### 6.3.1.7 Monitor Session Port Mirror

Port mirror copies the message of the specified port to the port connected to the data monitoring device, so that the user can monitor and analyze these copied messages for network monitoring and troubleshooting.

Mirror the inbound message from the source port xe9/2 to the destination port xe9/1:

```

OLT(config)# monitor session 1 ingress destination ge1/1 source ge1/2
OLT(config)# show monitor

```

Session	Source port	Destination port	Type	Vlan
1	ge1/2	ge1/1	ingress	-

### 6.3.1.8 Configuring Layer 3 Subinterfaces

Use the interface vlanif command to create a VLAN interface and enter VLANIF mode from the global configuration mode. This command is required when configuring the virtual three level interface in VLANIF mode.

```
OLT (config)# interface vlanif10
OLT (config-vlanif10)# ip address 10.0.0.1/24
OLT (config-vlanif12)#exit
```

#### Note:

*The IP address configured on the Layer 3 interface should not be on the same network segment as the outband or other Layer 3 interface IP address. Otherwise, other existing IP addresses cannot be used. The number of Layer 3 interfaces that can be configured is 18.*

*The IP address configured in the Layer3 interface should not be in the same network segment as the outband IP address or other Layer 3 interface IP address, otherwise it will result in the unavailable of the other configured IP. The maximum layer 3 interface to be configured is 10.*

*The OLT has two IP addresses by default, the MGMT1 IP is 192.168.1.32/24, MGMT2 IP is 192.168.100.2.*

## 6.4 PON Port VLAN

It does not need to configure PON port VLAN. OLT will automatically put PON port to the corresponding VLAN after VLAN is configured and planned for the upstream port and the remote ONU.

## 6.5 Configure Various Service Type

### 6.5.1 Transparent Transmission Service

OLT supports full transparent transmission and VLAN transparent transmission modes. Full transparent transmission refers to transparent transmission of all the messages. VLAN transparent transmission means transparent transmission of specified VLAN messages.

### 6.5.1.1 Full Transparent Transmission Configuration

Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 2-4094
```

Add T-CONT to bind gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```

Configure full transparent service:

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1
```

Configure transparent transmission mode for the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

### 6.5.1.2 VLAN Transparent Transmission Configuration

Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 100
```

Add T-CONT to bind gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```



### Configure service :

```
OLT(config-gpon-onu1/1:1)# service-port 1 gemport 1 user-vlan 100
transparent
```

### Configure transparent transmission mode for the remote ONU :

#### Note:

*When transparent transmission of VLAN is performed, all VLAN needs to go through the same GEM.*

## 6.5.2 VLAN Conversion Service

Our OLT supports 1:1 and N:1 VLAN translation services, which can modify the CoS value of the uplink-translated VLAN. Only the VLAN conversion is performed on the downlink, and the CoS value is not modified.

### 6.5.2.1 VLAN 1:1 Configuration

#### Configure the uplink port

```
OLT(config)#interface gel/1
OLT(config-gel/1)#switchport mode trunk
OLT(config-gel/1)#switchport trunk tag 300-400
```

#### Add T-CONT binding gemport

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gemport 1 tcont 1
OLT(config-gpon-onu1/1:1)# tcont 2 profile default
OLT(config-gpon-onu1/1:1)# gemport 2 tcont 2
```

#### Configure 1:1 service

```
OLT(config-gpon-onu1/1:1)# service-port 1 gemport 1 user-vlan 100 vlan 300
priority 2
OLT(config-gpon-onu1/1:1)# service-port 2 gemport 2 user-vlan 200 vlan 400
priority 2
```

## Configure the remote ONU

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 100
OLT(config-gpon-onu1/1:1)# remote service 2 gem 2 vlan 200
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode trunk tag 100 200
```

### 6.5.2.2 N:1 configuration

#### Configure the uplink port

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 300
```

#### Add T-CONT binding gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
OLT(config-gpon-onu1/1:1)# tcont 2 profile default
OLT(config-gpon-onu1/1:1)# gempport 2 tcont 2
```

#### Configure N:1 service

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan 100 vlan 300
priority 2
OLT(config-gpon-onu1/1:1)# service-port 2 gempport 2 user-vlan 200 vlan 300
priority 2
```

#### Configure the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 100
OLT(config-gpon-onu1/1:1)# remote service 2 gem 2 vlan 200
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode trunk tag 100 200
```

### 6.5.3 Add SVLAN Service

Our OLT supports to add SVLAN to VLAN messages, untag messages, all tag messages and all messages.

The added SVLAN can modify the priority or copy the cos value of the user VLAN.

#### 6.5.3.1 Add SVLAN for VLAN Message

Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 202
```

Add T-CONT to bind gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```

Configure service:

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan 2002 vlan 2002
svlan 202 priority copy
```

Configure the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

#### 6.5.3.2 Add SVLAN to untag Messages

Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 200
```

Add T-CONT to bind gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```

#### Configure service:

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan untagged vlan-
add 200 priority 2
```

#### Configure the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

### 6.5.3.3 SVLAN Configure the remote ONU

#### Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 100
```

#### Add T-CONT to bind gempport

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```

#### Configure service:

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan tagged vlan-
add 100 priority 2
```

#### Configure the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
```

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

#### 6.5.3.4 Add SVLAN to All Messages

Configure the upstream port:

```
OLT(config)#interface ge1/1
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)#switchport trunk tag 100
```

Add T-CONT to bind gempport:

```
OLT(config)#interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# tcont 1 profile default
OLT(config-gpon-onu1/1:1)# gempport 1 tcont 1
```

Configure service:

```
OLT(config-gpon-onu1/1:1)# service-port 1 gempport 1 user-vlan all vlan-add
100 priority 2
```

Configure the remote ONU:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

#### Note:

- ❖ *When it is configured as the service model of untag-add | tagged-add, the default priority of the added outer VLAN is 0.*
- ❖ *The VLAN configuration by the service-port is not strict filtering. VLAN which has no configuration of service will also be forwarded, and it is controlled by the upstream port and onu\_eth.*
- ❖ *When the downlink message is with a multi-layer tag, only the priority of the inner tag will be copied.*
- ❖ *At present, a single ONU supports a maximum of 32 GEMs and 32 streams.*

## 6.6 Remote ONU configuration

### 6.6.1 Remote service configuration

Remote ONU service is ONU-based configuration and is related to service vlan. OLT supports the transparent transmission of remote ONU service-port and vlan, vlan+pri, vlan+port and vlan+port+priority services.

Port transparent transmission (for all messages):

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1
```

Specify the VLAN service:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 100
```

Specify Vlan+cos (enter different gem according to cos):

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 100 cos 0
OLT(config-gpon-onu1/1:1)# remote service 2 gem 2 vlan 100 cos 1
OLT(config-gpon-onu1/1:1)# remote service 3 gem 3 vlan 100 cos 2
OLT(config-gpon-onu1/1:1)# remote service 4 gem 4 vlan 100 cos 3
OLT(config-gpon-onu1/1:1)# remote service 5 gem 5 vlan 100 cos 4
```

Bind Vlan with the ONU port:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 vlan 100 eth_1/1
```

Bind Service with the port:

```
OLT(config-gpon-onu1/1:1)# remote service 1 gem 1 eth_1/1
```

 **Note:**

*OLT supports the configuration of a maximum of 32 remote service. Remote service is configured as strict filtering. All services are required to be the same, that is, VLAN service cannot be mixed with VLAN+cos service.*

### 6.6.2 Remote UNI Configuration

The configuration of ONU UNI port by the OLT supports five modes--VLAN access / hybrid / transparent / trunk / xlate.

Access Mode:

```
OLT(config-gpon-onu1/1:1)#remote uni eth_1/1 vlan-mode access pvlan 100
```

Hybrid Mode:

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode hybrid pvlan 100 tag 200
```

Transparent Mode:

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode transparent
```

Trunk Mode:

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 vlan-mode trunk tag 100 200
```

Xlate Mode:

```
OLT(config-gpon-onu1/1:1)#remote uni eth_1/1 vlan-mode xlate 100-200
```

## 6.7 Automatic Configuration of ONU Services

Our OLT supports functions such as automatic registration of ONU, identification of ONU type and automatic configuration of ONU services after access to OLT.

Prerequisite: Create ONU service profile.

```
OLT(config)# gpon
OLT(config-gpon)# onu-srvprofile profile-id 1 onu-type STG-402
OLT(config-onu-srvprofile-1)# tcont 1 profile default
OLT(config-onu-srvprofile-1)# gemport 1 tcont 1
OLT(config-onu-srvprofile-1)# service-port 1 gemport 1 user-vlan 101
transparent
OLT(config-onu-srvprofile-1)# remote service 1 gem 1 vlan 101
```

```
OLT(config-onu-srvprofile-1)# remote uni eth_1/1 vlan-mode trunk tag 101

OLT(config-gpon)# onu-srvprofile profile-id 2 onu-type STG-402
OLT(config-ONU-srvprofile-2)# tcont 1 profile default
OLT(config-ONU-srvprofile-2)# gemport 1 tcont 1
OLT(config-ONU-srvprofile-2)# service-port 1 gemport 1 user-vlan 2001
transparent
OLT(config-ONU-srvprofile-2)# remote service 1 gem 1 vlan 2001
OLT(config-ONU-srvprofile-2)# remote uni veip vlan-mode transparent
```

PON port enables automatic registration of ONU function.

```
OLT(config)# interface gpon-olt1/1
OLT(config-gpon-olt1/1)# onu auto-flow enable
```

ONU service profiles for configuring SFU and HGU.

```
OLT(config)# interface gpon-olt1/1
OLT(config-gpon-olt1/1)# onu-auto-flow SFU srv-profile 1
OLT(config-gpon-olt1/1)# onu-auto-flow HGU srv-profile 2
```

It needs to enable the ONU auto-authentication function of the PON port.

```
OLT(config-gpon-olt1/1)# onu auto-authentication enable
```

#### Note:

- ❖ *The automatic configuration of ONU services function is only effective for ONU which is automatically registered, that is, ONU which is manually registered or has already been registered cannot realize automatic configuration of services.*
- ❖ *If there is QoS-related configuration of ONU in the ONU service profile, it needs to configure the PON port to hierarchical mode, otherwise relevant configurations cannot be issued.*
- ❖ *If the ONU type read by OLT is UNKnown or OLT cannot get ONU type, it will be regarded as HGU and will be automatically configured as ONU service profile bound by HGU.*



## 7 MULTICAST SERVICE CONFIGURATION

Multicast refers to the point to multipoint communication form that the source sends information to a certain subset of all network nodes. The core of multicast technology is to put the copy of the message into the nearest place to the recipient, so as to save the network bandwidth.

Multicast permission control is that network devices perform corresponding permissions control by identifying the user's join or request packets, and determine whether the applicants have corresponding permissions to watch the programs, so as to control and forward the multicast service in access devices. OLT supports to provide IPTV services to operators through unicast and multicast. Through the introduction of controlled multicast, the management and control of multicast users can be achieved on network devices, so as to meet the requirements of operators for distributing broadband video services and make multicast services "operational and manageable." OLT supports v1, v2 and v3 versions of igmp messages, and v1 version of mld messages. Among them, IGMP v4 supports some functions of type 1-4 when run version is v3.

OLT supports two working modes—snooping and proxy. In Snooping mode, OLT only listens to the protocol message, extracts the key information and establishes the second layer forwarding table. In Proxy mode, OLT acts as a node and sends query message to the user side for the network side equipment. At the same time, OLT sends the join and leave message to the network side for the user side equipment. Moreover, the user's frequent join and leave messages are shielded, and the original messages are sent to the upstream port. Proxy can effectively suppress the multicasat protocol messages and reduce the impact to the network equipment.

The second layer multicast forwarding table created by OLT includes information of MVLAN, GROUP, IF etc. The downlink multicast flow forwards multicast data flow to the corresponding PON port according to the multicast forwarding table.

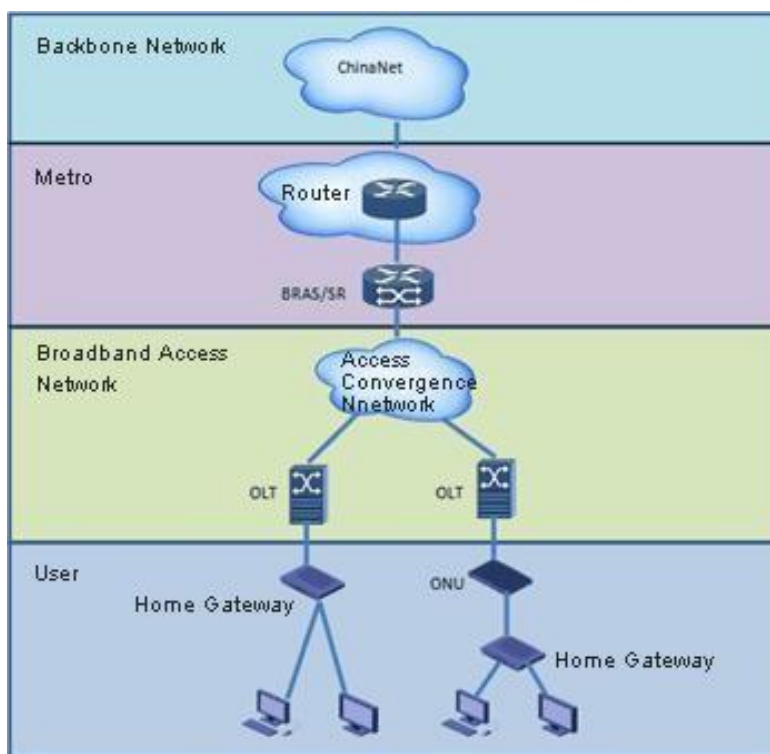


Figure 6- 1 Network Level and Devices

## 7.1 Multicast IGMP Configuration

### 7.1.1 General Multicast Configuration

Table 6- 1 General Multicast Configuration

Item	Description
Multicast Service VLAN ID	510
Service Priority	0
Upstream Port	XE1/2
Service Port	ONU Interface: gpon-onu2/4:3 Service-port ID: 1
T-CONT	Index: 1 Name: T1 T-CONT Profile: default

GEM Port	Index: 1 Name: gemport1 T-CONT Index: 1
Service Channel	Service Type: internet GEM Port Index: 1 Priority: 0 VLAN ID: 510
User Port VLAN	Port: eth_1/1 VLAN Mode: transparent VLAN ID: 510

#### Necessary Configuration :

1. IGMP multicast protocol enable:
2. Create IGMP multicast VLAN
3. Create a multicast group in the multicast VLAN.
4. Configure the source port of the multicast VLAN
5. Configure the receiver port of multicast VLAN.
6. Configure the ONU protocol version.

```
OLT(config)# igmp enable
OLT(config)# igmp mvlan 510
OLT(config)# igmp mvlan 510 group 224.1.1.1
OLT(config)# igmp mvlan 510 source-port xe1/2
OLT(config)# igmp mvlan 510 receive-port gpon-onu1/4:3
OLT(config)# igmp interface gpon-onu1/4:3 version 3
```

#### OLT Optional Configuration :

```
OLT(config)# igmp gen-query-intvl 200 //General Query Interval
OLT(config)# igmp last-memb-query-count 3 //Number of Specified Query Packages
OLT(config)# igmp last-memb-query-intvl 20 //Specified Query Packages Interval
OLT(config)# igmp max-resp-time 300 //Maximum Corresponding Time (The unit is 0.1s.)
OLT(config)# igmp robustness 3 //Robustness Parameter
OLT(config)# igmp snooping-aging-time 200 //snooping Aging Time
OLT(config)# igmp unsolicited-report-interval 2 // Active Reporting Interval
```

#### Note:

*Proxy Member Aging Time = robustness \* gen-query-intvl + max-resp-time.*

#### ONU Configuration :

```
OLT(config-gpon-onu1/4:3)# tcont 1 profile default
OLT(config-gpon-onu1/4:3)# gemport 1 tcont 1
OLT(config-gpon-onu1/4:3)# service-port 1 gemport 1 user-vlan 510 vlan 510
OLT(config-gpon-onu1/4:3)# remote service 1 gem 1 vlan 510
OLT(config-gpon-onu1/4:3)# remote uni eth_1/1 vlan-mode trunk tag 510
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 enable
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 igmp version 3
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 up vlan 510 tag-action transparent
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 down vlan 510 tag-action transparent
```

#### VLAN Configuration :

```
OLT(config)# vlan 510
OLT(config-vlan510)# unknown-multicast drop //By default, it is the example to unknown multicast.
```

### 7.1.2 IGMP Over vlan Multicast

Table 6- 2 IGMP over VLAN Multicast

Item	Description
Multicast Service VLAN ID	510
Service Priority	0
Upstream Port	XE1/2
Service Port	ONU interface: gpon-onu1/4:3 Service-port ID: 1
T-CONT	Index: 1 Name: T1 T-CONT Profile: default

GEM Port	Index: 1 Name: gemport1 T-CONT Index: 1
Service Channel	Service Type: internet GEM Port Index: 1 Priority: 0 VLAN ID: 510
User Port VLAN	Port: eth_1/1 VLAN Mode: translate VLAN ID: 500

### OLT Configuration:

```
OLT(config)# igmp enable
OLT(config)# igmp span-vlan enable // Enable cross-VLAN functionality
OLT(config)# igmp mvlan 510
OLT(config)# igmp mvlan 510 group 224.1.1.1
OLT(config)# igmp mvlan 510 source-port xe1/2
OLT(config)# igmp mvlan 510 receive-port gpon-onu1/4:3
OLT(config)# igmp interface gpon-onu1/4:3 version 3
```

### ONU Configuration:

```
OLT(config-gpon-onu1/4:3)# tcont 1 profile default
OLT(config-gpon-onu1/4:3)# gemport 1 tcont 1
OLT(config-gpon-onu1/4:3)# service-port 1 gemport 1 user-vlan 500 vlan 510
OLT(config-gpon-onu1/4:3)# remote uni eth_1/1 vlan-mode trunk tag 500
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 enable
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 igmp version 3
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 up vlan 500 tag-action transparent
OLT(config-gpon-onu1/4:3)# remote multicast eth_1/1 down vlan 510 tag-action xlate 500
```

### Note:

*Please do not configure the converted MVLAN; otherwise the situation that it cannot join the multicast group may occur.*

### 7.1.3 IGMP Controllable Multicast

Controllable multicast can achieve access control of the channel to the user, including three types of permissions--permit, deny and preview. Under preview permission, it can control the number, duration and interval of the user's preview. When the number of previews reaches the configured maximum number, OLT will force the user to leave the corresponding multicast group and the user is not allowed to be rejoined for a certain period of time.

CAC mode is a controllable multicast, which limits the duration, interval and number of joining a certain multicast group.

```
OLT(config)# igmp work-mode proxy
OLT(config)# igmp cdr enable // Enable controllable multicast
OLT(config)# igmp interface gpon-onu1/4:3 cac eth_1/1 group 224.1.1.1
preview
OLT(config)# igmp interface gpon-onu1/4:3 cac eth_1/1 group 224.1.1.1
preview period 30
OLT(config)# igmp interface gpon-onu1/4:3 cac eth_1/1 group 224.1.1.1
preview maxnbr 3
OLT(config)# igmp interface gpon-onu1/4:3 cac eth_1/1 group 224.1.1.1
preview blackout 30
```

### 7.1.4 Show IGMP configuration

Show the current dynamic multicast for group table:

```
OLT(config)# show igmp dynamic-group
=====
MVLAN SOURCE      GROUP      TYPE      INTERFACE
-----
510  0.0.0.0      224.1.1.1  Dynamic  gpon-onu1/4:3
=====
```

Show the current IGMP protocol enablement status, working mode, and configuration parameters:

```
OLT(config)# show igmp
=====

IGMP Global Configuration

Global                : Enable
WorkMode              : Proxy
Span-Vlan             : Enable
CDR                   : Enable
Robustness            : 10
Snooping Aging Time  : 3600
Proxy Member Aging Time : 310
Query Max Resp Time  : 100
General Query Interval : 30
Startup Query Interval : 31
Startup Query Number  : 2
Last Member Query Interval : 10
Last Member Query Number : 2
Unsolicited          Report Interval : 10
Interval
```

#### Description of Related Parameters:

- ❖ CDR: This parameter is only effective in proxy mode;
- ❖ Robustness: Robustness parameters;
- ❖ Snooping Aging Time: The aging time in snooping mode, the aging time will be reset after the report packet is received;
- ❖ Proxy Member Aging Time: The aging time in proxy mode, the calculation formula is  $[\text{General Query Interval}] * [\text{Robustness}] + [\text{Query Max Resp Time}]$ , and the aging time will be reset after the report packet is received;
- ❖ Query Max Resp Time: Query the maximum response time of the packet. This value is inserted into the query packet and sent to the ONU. If there are multicast group table on the ONU, a report packet must be randomly responded within  $[1, \text{Query Max Resp Time}]$  in units of 0.1 seconds.

- ❖ **General Query Interval:** General query interval. In Proxy mode, the OLT sends query packets to all dynamic members by each [General Query Interval] second to maintain multicast group table.
- ❖ **Startup Query Interval:** Start the query interval. In the Proxy mode, the OLT immediately sends a general query packet to all receive ports after the system is successfully started. The interval is [Startup Query Interval] seconds.
- ❖ **Startup Query Number:** The number of queries started. In the Proxy mode, use it to quickly restore services, after the system is successfully started, the OLT immediately sends a general query packet to all receiving ports, the number of which is [Startup Query Number].
- ❖ **Last Member Query Interval:** The last member query interval. In Proxy mode, after the OLT receives the Leave packet, if the fast-leave function is disabled on the port, the switch sends a specific group query to the specified port. The interval is [Last Member Query Interval] seconds.
- ❖ **Last Member Query Number:** Last member inquiry interval. In Proxy mode, after the OLT receives the Leave packet, if the fast-leave function is disabled on the port, the specific group query is sent to the specified port, and the number is of [Last Member Query Number].
- ❖ **Unsolicited Report Interval:** Active reporting interval. In the Proxy mode, to prevent accidental loss of reported **Report Packets**, the OLT actively reports [Robustness] **Report Packets** when joining the group for the first time. The interval is a random value between [1, Unsolicited Report Interval].

### Show the multicast operating version of the ONU

```
OLT(config)# show igmp interface gpon-onu1/4:2
=====
IGMP Interface Configuration
-----
Fast-Leave           :Enable
IGMP Version        :V3
IGMP Run Version    :V3
Max Group Number    :512
```

When the protocol type received by the port is v3, then the running version of this port will be automatically adjusted to v3, and the default version is v2.

## 7.2 Description of Related Parameters

- ❖ **Fast-Leave:** Enable fast leave, which is mainly reflected in the behavior after OLT receives the user's leave messages.



- When it is configured as enable, OLT will immediately stop to forward the multicast flow to the user.
- When it is configured as disable, if the work-mode is snooping , then after [snooping-aging-time], it will stop to forward the multicast flow.
- If the work-mode is proxy, then OLT will send [Last Member Query Number] special query packets to the user, and then stop to forward the multicast flow.
- ❖ IGMP Version: The maximum IGMP message version number—If the IGMP message version number received by OLT is larger than the specified version number, then OLT will discard the message.
- ❖ IGMP Run Version: The IGMP version number currently run on the port—after OLT receives IGMP message, the version number of the message is recorded in the parameter. In subsequent interactions, OLT will send the corresponding version of IGMP message according to this parameter.
- ❖ Max Group Number: The maximum number of groups which can be joined on the port.

Show current IGMP channel control information for a specific ONU

```
OLT(config)# show igmp interface gpon-onu1/4:3 cac-info
```

```
=====
```

```
IGMP CAC Configuration
```

```
-----
```

```
Group Address           : 224.1.1.1
Authorization           : PREVIEW
Current State           : IDLE
Preview Max-Count       : 3
Preview Period(s)       : 30
Preview Blackout(s)     : 30
```

```
=====
```

### 7.3 Description of Related Parameters

- ❖ Group Address: Multicast group address--the channel address which needs to be controlled.
- ❖ Authorization: Authorization modes—PERMIT, DENY and PREVIEW.
- ❖ Current State: Current control state which is only effective in PREVIEW mode. There are three states—PLAY, STOP, and IDLE
- ❖ Preview Max-Count: The maximum preview number which is effective only in PREVIEW mode.
- ❖ Preview Period(s): Preview period which is effective only in PREVIEW mode.
- ❖ Preview Blackout(s): Preview blackout which is effective only in PREVIEW mode

### 7.3.1 Global IGMP Version Control

OLT supports the control of its IGMP version, which can be configured as V2, V3 or automatic mode. When it is configured as V2 mode, only IGMP V2 protocol is supported, but IGMP V3 protocol is not supported. When it is configured as V3 mode, only IGMP V3 protocol is supported, but IGMP V2 protocol is not supported. When it is configured as automatic mode, both IGMP V2 and V3 versions can be supported.

```
OLT(config)# igmp version auto
OLT(config)# show igmp
=====
IGMP Global Configuration

Global                : Enable
Version               : auto
WorkMode              : Proxy
Span-Vlan             : Disable
CDR                   : Disable
Robustness             : 2
Snooping Aging Time  : 10
Proxy Member Aging Time : 6
Query Max Resp Time  : 20
General Query Interval : 2
Startup Query Interval : 31
Startup Query Number  : 2
Last Member Query Interval : 10
Last Member Query Number : 2
Unsolicited Report Interval : 10
QueryGemMode          : Multicast
Prejoin               : Disable
Prejoin Interval      : 125
=====
```

*Note: When IGMP multicast table items exist, you cannot switch the OLT global IGMP mode.*

## 7.4 Multicast MLD Configuration

MLD is the multicast protocol of IPv6 version. The multicast group address follows the definition in RFC-2460 standard. In the process of configuration, change the key word from igmp to mld. The format of the multicast group is ip v6. The v1 version of mld message is now supported.

### 7.4.1 General Multicast Configuration

Table 6- 3 General Multicast Configuration

Item	Description
Multicast Service VLAN ID	410
Service Priority	0
Upstream Port	XE1/2
Service Port	ONU Interface: gpon-onu1/4:1 Service-port ID: 1
T-CONT	Index: 1 Name: T1 T-CONT Profile: default
GEM Port	Index: 1 Name: gemport1 T-CONT Index:1
Service Channel	Service Type: internet GEM Port Index: 1 Priority: 0 VLAN ID: 410
User Port VLAN	Port: eth_1/1 VLAN Mode: transparent VLAN ID: 410

OLT Configuration:

```
OLT(config)# mld enable
OLT(config)# mld mvlan 410
OLT(config)# mld mvlan 410 group ff1e::101:101
```

```
OLT(config)# mld mvlan 410 source-port xe1/2
OLT(config)# mld mvlan 410 receive-port gpon-onu1/4:1
OLT(config)# mld interface gpon-onu1/4:1 version v1
```

### ONU Configuration:

```
OLT(config-gpon-onu1/4:1)# tcont 1 profile default
OLT(config-gpon-onu1/4:1)# gemport 1 tcont 1
OLT(config-gpon-onu1/4:1)# service-port 1 gemport 1 user-vlan 410 vlan 410
OLT(config-gpon-onu1/4:1)# remote service 1 gem 1 vlan 410
OLT(config-gpon-onu1/4:1)# remote uni eth_1/1 vlan-mode trunk tag 410
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 enable
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 igmp version 4
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 up vlan 410 tag-action transparent
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 down vlan 410 tag-action transparent
```

### Show mld Table:

```
OLT(config)# show mld dynamic-group
=====
MVLAN SOURCE      GROUP              TYPE              INTERFACE
-----
410   0.0.0.0        ff1e::101:101     Dynamic          gpon-onu1/4:1
=====
```

### Show Current Configurations of MLD:

```
OLT(config)# show mld
=====
MLD Global Configuration
-----
Global WorkMode      : Enable
Span-Vlan            : Proxy
                     : Disable
CDR                   : Disable
```

```
Robustness : 2
Snooping Aging Time : 300
Proxy Member Aging Time : 260
Query Max Resp Time : 100
General Query Interval : 125
Startup Query Interval : 31
Startup Query Number : 2
Last Member Query Interval : 10
Last Member Query Number : 2
Unsolicited Report Interval : 10
```

=====

**Show Interface Configurations of MLD:**

```
OLT(config)# show mld interface gpon-onu1/4:1
```

=====

MLD Interface Configuration

-----

```
Fast-Leave : Disable
Version : MLDv1
Max Group Number : 2
```

=====

**7.4.2 MLD Over VLAN Multicast**

Table 6- 4 MLD Over VLAN Multicast

Item	Description
Multicast Service VLAN ID	410
Service Priority	0
Upstream Port	Xe1/2
Service Port	ONU Interface: gpon-onu1/4:1

	Service-port ID: 1
T-CONT	Index: 1 Name: T1 T-CONT Profile: fault
GEM Port	Index: 1 Name: gemport1 T-CONT Index: 1
Service Channel	Service Type: internet GEM Port Index: 1 Priority: 0 VLAN ID: 410
User Port VLAN	Port: eth_1/1 VLAN Mode: translate VLAN ID: 400

### OLT Configuration:

```
OLT(config)# mld enable
OLT(config)# mld span-vlan enable
OLT(config)# mld mvlan 410
OLT(config)# mld mvlan 410 group FF1E::0101:0101
OLT(config)# mld mvlan 410 source-port xe1/2
OLT(config)# mld mvlan 410 receive-port gpon-onu1/4:1
OLT(config)# mld interface gpon-onu1/4:1 version 1
```

### Remote ONU Configuration:

```
OLT(config-gpon-onu1/4:1)# tcont 1 profile default
OLT(config-gpon-onu1/4:1)# gemport 1 tcont 1
OLT(config-gpon-onu1/4:1)# service-port 1 gemport 1 user-vlan 400 vlan 410
OLT(config-gpon-onu1/4:1)# remote uni eth_1/1 vlan-mode trunk tag 400
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 enable
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 up vlan 400 tag-action transparent
OLT(config-gpon-onu1/4:1)# remote multicast eth_1/1 down vlan 410 tag-action xlate 400
```

Please do not configure the converted MVLAN; otherwise the situation that it cannot join the multicast group may occur.

### 7.4.3 MLD Controllable Multicast

CAC mode is controllable multicast, which limits the duration, interval and number of joining a certain multicast group:

```
OLT(config)# mld work-mode proxy
OLT(config)# mld cdr enable
OLT(config)# mld interface gpon-onu1/4:1 cac eth_1/1 group FF1E::0101:0101
preview
OLT(config)# mld interface gpon-onu1/4:1 cac eth_1/1 group FF1E::0101:0101
preview period 30
OLT(config)# mld interface gpon-onu1/4:1 cac eth_1/1 group FF1E::0101:0101
preview maxnbr 3
OLT(config)# mld interface gpon-onu1/4:1 cac eth_1/1 group FF1E::0101:0101
preview blackout 30
```

Show the command:

```
OLT(config)# show mld interface gpon-onu1/4:1 cac-info
=====
MLD CAC Configuration
-----
Group Address          : ffle::101:101
Authorization          : PREVIEW
Current State          : IDLE
Preview Max-Count      : 3
Preview Period(s)     : 30
Preview Blackout(s)   : 10
=====
```

## 7.5 CTC Enable

After this function is enabled, the OLT will issue rules in accordance with the CTC standard. The default is according to the ITU-T (2012) rules;

```
OLT(config)#gpon
OLT(config-gpon)#ctc-enable
```

## 7.6 Multicast Bandwidth Downlink Rate Limit

It must be configured in the hierarchical mode of the PON port to switch the mode, which manually switches off the PON port before switching the mode.

```
OLT(config-gpon-olt1/4)# scb max-bandwidth 20000
```

The configuration takes effect in both simple mode and hierarchical mode.

```
OLT(config-xe1/2)# storm-control multicast kbps 5000
```

When both the SDN port scb multicasts with the flow rate limit and the uplink interface storm-control are configured, the traffic rate is based on a small rate limit.

### *IGMPv3 Snooping Description:*

1. For IGMPv3, only snooping of type1.2.3.4 are supported according to the following rules.  
Type1--is include: If it is with source, it joins. If it is without source, it leaves.  
Type2--is exclude: If it is without source, it joins. If it is with source, it leaves.  
Type3--change to include: If it is with source, it joins. If it is without source, it leaves.  
Type4--change to exclude: If it is without source, it joins. If it is with source, it leaves.
2. Currently, it supports to record a maximum of 16 table items.
3. The upstream port automatically adjusts IGMP Run Version. Therefore, if it needs to receive report of v3, it needs to send query of v3.
4. MLD only supports v1 version.

### *IGMPv3 Proxy Description:*

1. The current function implementation does not send the source IP of the group, there are two cases:
  - 1.1. When the upstream port does not issue v3-query, the default running version is v2. At this time, report of v2 is sent.
  - 1.2. When the upstream port issues v3-query, report of v3 is sent. The type is fixed to type4 (change to exclude).
2. When the newly-added messages are carried with type 5 or type6, the source group information corresponding to OLT is discarded.

### *Attentions of over VLAN configuration:*



1. When over VLAN multicast is configured, please pay attention to the sequence of the configuration—firstly configure the converted MVLAN, or do not configure mvlan related parameters of user-vlan, otherwise, it may cause failure of joining the group.
2. The planned igmp vlan and mld vlan cannot be the same vlan.

## 7.7 Static Multicast Table Configuration

Configure static multicast table

```
OLT(config)# igmp static-member mvlan 100 group 224.1.1.1 port gpon-onu1/1:1
```

Show the static multicast table

```
OLT(config)# show igmp static-group
```

```
=====
MVLAN GROUP      INTERFACE      TYPE
-----
1001  224.1.1.1    gpon-onu1/8:2  STATIC
=====
```

## 7.8 Multicast group of filtering configuration

By default, the multicast group of the added multicast VLAN is filtered to the enabled state. One need to configure a regular multicast group so that users can join the multicast group normally only in a specific multicast group.

The multicast group has the function of filtering multicast VLANs. The configuration of a specific multicast group can be eliminated, and the user needs to be added to the receiving port of the multicast VLAN only.

Disable multicast filtering on multicast VLANs

```
OLT(config)# igmp mvlan 1001 group-filter disable
```

Enable multicast filtering on multicast VLANs

```
OLT(config)# igmp mvlan 1001 group-filter enable
```

 **Note:**

*When this function is disabled, the dynamic multicast entry of this multicast VLAN must be cleared first.*

## 7.9 Multicast Prejoin Function

OLT supports the prejoin function of IGMP and MLD. After enabling the function, if static multicast table items are configured, OLT will automatically send a Report request message to the uplink port. This function is used to diagnose whether the multicast operating status of the equipment in the line is normal.

Enable/Disable IGMP multicast prejoin function

```
OLT(config)# igmp prejoin enable
OLT(config)# igmp prejoin disable
```

Configure IGMP prejoin interval

```
OLT(config)# igmp prejoin interval 60
```

Show IGMP global configuration

```
OLT(config)# show igmp
=====
IGMP Global Configuration
-----
Global                : Enable
Version               : auto
WorkMode              : Proxy
Span-Vlan             : Disable
CDR                   : Disable
Robustness            : 2
Snooping Aging Time  : 10
Proxy Member Aging Time : 6
Query Max Resp Time  : 20
General Query Interval : 2
Startup Query Interval : 31
```

```
Startup Query Number      : 2
Last Member Query Interval : 10
Last Member Query Number  : 2
Unsolicited Report Interval : 10
QueryGemMode              : Multicast
Prejoin                   : Disable
Prejoin Interval          : 60
=====
```

**Enable/Disable MLD multicast prejoin function:**

```
OLT(config)# mld prejoin enable
OLT(config)# mld prejoin disable
```

**Configure MLD prejoin interval**

```
OLT(config)# mld prejoin interval 60
```

**Show MLD global configuration.**

```
OLT(config)# show mld
=====
MLD Global Configuration
-----
Global                : Enable
WorkMode              : Proxy
Span-Vlan             : Disable
CDR                   : Enable
Robustness            : 2
Snooping Aging Time  : 300
Proxy Member Aging Time : 260
Query Max Resp Time  : 100
General Query Interval : 125
Startup Query Interval : 31
Startup Query Number  : 2
Last Member Query Interval : 10
Last Member Query Number : 2
Unsolicited Report Interval : 10
```

```
QueryGemMode           : Multicast
Prejoin                 : Disable
Prejoin Interval       : 125
```

=====



## 8 QOS SERVICE CONFIGURATION

QoS: Quality of Service means in the process of network communication, the user service is allowed to obtain the expected service quality in terms of bandwidth, delay, jitter and packet loss rate etc. The indicators for measuring QoS are as follows:

- ❖ Bandwidth refers to the theoretical transmission capacity of a connection.
- ❖ Delay refers to the time that information is sent from one network node to another network node. Larger time delay will affect the quality of real-time services (such as IP phones).
- ❖ Jitter refers to the change of time delay. Jitter can seriously affect the quality of multimedia services (such as video on demand).
- ❖ Packet loss rate refers to the percentage of messages lost during network transmission.
- ❖ QTECH OLT, QoS realizes that the message enters the queue and is scheduled according to the queue. The scheduling mode supports two scheduling modes:

Simple scheduling is carried out to support uplink and downlink message scheduling according to the port incoming message to queue, the principle of port outgoing scheduling.

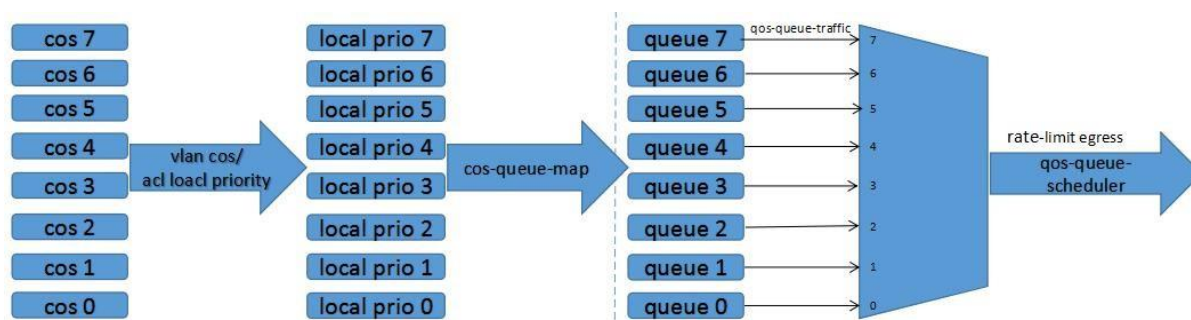


Figure 7- 1 simple scheduling model

For the upstream data stream, the message enters the PON port,

- ❖ According to the CoS value of the outer VLAN after the service forwarding rule is configured (the single-layer VLAN is the CoS value of the VLAN and the double-layer VLAN is the CoS value of the SVLAN), the local priority of the packet is determined. The default value is A 0-0 mapping can use ACL rules to modify the Local Priority of the packet.
- ❖ On the PON entrance, configure the mapping relationship of the egress to queue on the egress according to the internal priority.
- ❖ Configure the queue scheduling policy on the uplink port (including the SP strict priority scheduling policy, the WRR weighted round-robin scheduling policy, and the SP+WRR hybrid scheduling policy).
- ❖ In the uplink interface, the maximum and minimum bandwidth of each queue can be optionally configured, and the speed limit of the uplink interface can be selected.

For downlink data flow, our OLT provides two scheduling modes: a simplistic scheduling mode and a hierarchical scheduling mode.

## 8.1 Simple Scheduling Mode

- ❖ When the PON port is configured as a simplification scheduling mode, the incoming packet on the uplink interface is based on the converted CoS value of the outer VLAN (the single-layer VLAN is the CoS value of the VLAN, and the double-layer VLAN is the CoS value of the SVLAN. Determine the packet's Local Priority (internal use priority, the default is 0-0 mapping, one can use ACL rules to modify the Local Priority of the message).
- ❖ Configure the mapping relationship of the PON egress queue according to the internal priority at the uplink interface entrance. Then, configure the queue scheduling policies at the PON egress (including the SP strict priority scheduling policy, the WRR weighted round-robin scheduling policy, and the SP+WRR hybrid scheduling policy).
- ❖ On the PON port, one can configure the maximum and minimum bandwidth of each queue and the speed limit of the PON port.

## 8.2 Hierarchical Scheduling

Divided into three levels of scheduling

- ❖ The first level is the scheduling between each ONU's queue (this level of scheduling can be changed; the default is SP).
- ❖ The second level is the scheduling between ONUs and ONUs on each PON port (this level of scheduling is fixed as WRR, and the weight can be changed. The default weight of each ONU is 1).
- ❖ The third layer is the scheduling between the ONU and the multicast channel of the PON port (this level can not be changed, is fixed as SP, and the priority of the multicast channel is higher).

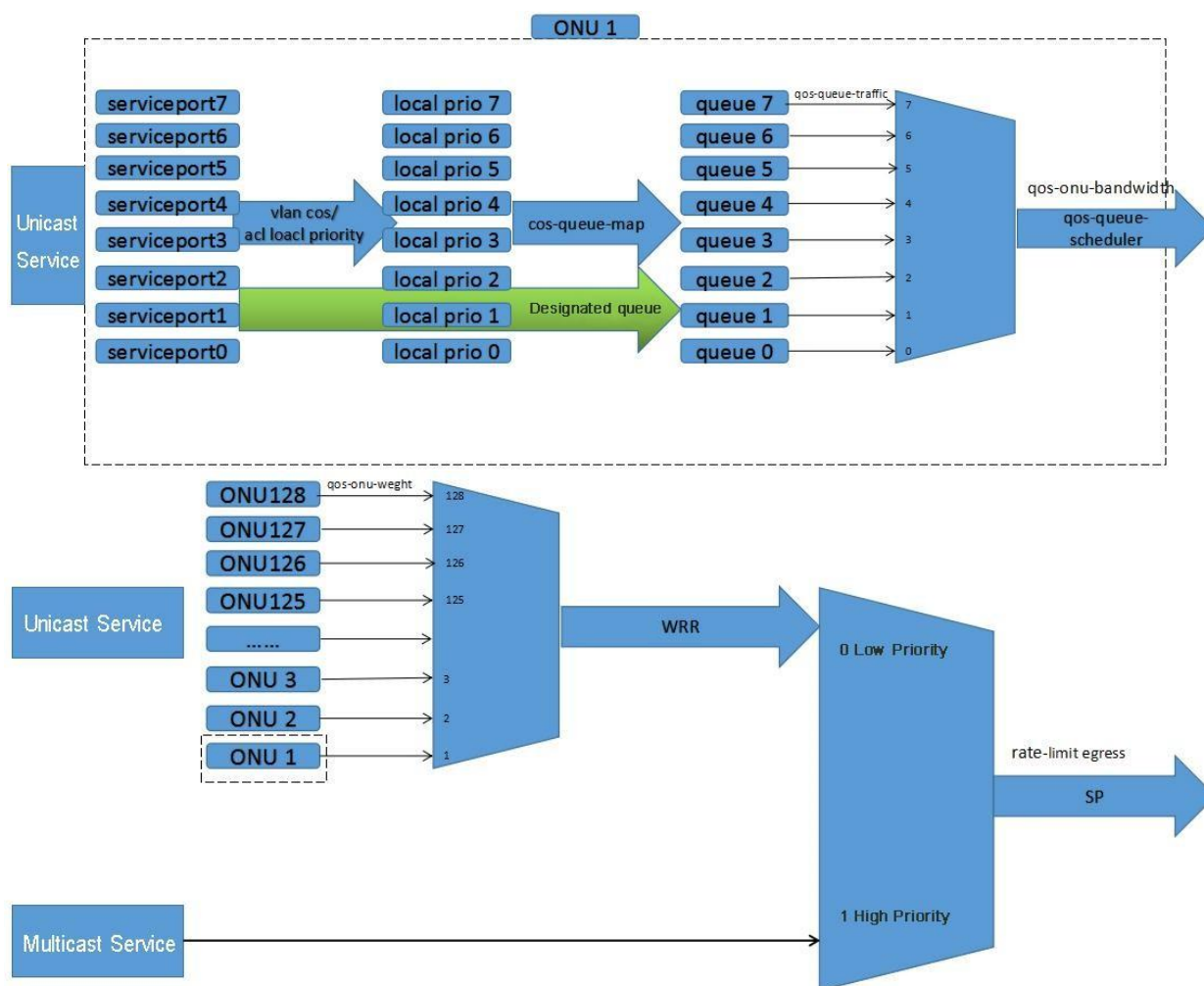


Figure 7- 2Hierarchical scheduling model

When the PON port is configured as a hierarchical scheduling mode:

- ❖ According to the converted 802.1Q CoS value of the outer VLAN (the single-layer VLAN is the CoS value of the VLAN and the double-layer VLAN is the CoS value of the SVLAN), the local priority of the packet is determined. The default value is the mapping relationship of 0- 0, which can use ACL rules to modify the Local Priority of the packet.
- ❖ According to its internal priority into the ONU downstream queue mapping
- ❖ Configure service-port to specify a queue. One can configure the maximum and minimum bandwidth of each ONU queue and the maximum and minimum of ONU bandwidth.
- ❖ Under the PON port, the WRR-weighted round robin of scheduling policy is used between ONUs to configure ONU weights. The SP strict priority scheduling policy is adopted between all unicast and multicast services. To guarantee the multicast service mode, one can configure the multicast bandwidth and the PON output rate limit.



## 8.3 Profiles Configuration

### 8.3.1 CoS-Queue-Map

Use the `CoS-queue-map` command to configure the mapping between internal priorities and queues used for packet scheduling. Use this command when one need to modify the mapping between internal priorities and queues. After the mapping relationship is configured, user packets are forwarded according to the configured mapping relationship.

 **Note:**

- ❖ *The internal priority used for packet scheduling is determined by the VLAN CoS priority of the data packet by default. Modifying the 802.1p priority of packets using the `CL traffic-priority` command does not affect the mapping. One can configure the ACL local-precedence to modify the internal priority used for packet scheduling.*
- ❖ *Use the `cos-queue-map default` command to restore the default mapping between internal priorities used for packet scheduling and queues. The default mapping is queue 0 for all priorities.*
- ❖ *When the service model is configured as `untag-add | tagged-add`, the added outer VLAN has a default priority of 0.*

**Configuration :**

```
OLT(config)# gpon
OLT(config-gpon)# profile cos-queue-map 1 name 1 cos0 0 cos1 0 cos2 0 cos3 0
cos4 0 cos5 0 cos6
0 cos7 0
OLT(config-gpon)# profile cos-queue-map 2 name 2 cos0 0 cos1 1 cos2 2 cos3 3
cos4 4 cos5 5 cos6
6 cos7 7
OLT(config-gpon)# profile cos-queue-map 3 name 3 cos0 7 cos1 6 cos2 5 cos3 4
cos4 3 cos5 2 cos6 1 cos7 0
```

**Show the configured profile:**

```
OLT(config-gpon)# show profile cos-queue-map
profile cos-queue-map 1 name 1 cos0 0 cos1 0 cos2 0 cos3 0 cos4 0 cos5 0
cos6 0 cos7 0
profile cos-queue-map 2 name 2 cos0 0 cos1 1 cos2 2 cos3 3 cos4 4 cos5 5
cos6 6 cos7 7
profile cos-queue-map 3 name 3 cos0 7 cos1 6 cos2 5 cos3 4 cos4 3 cos5 2
cos6 1 cos7 0
```



 **Note:**

*The cos-queue-map can be configured on the PON port and the uplink port, and the service cos-queue-map on the ONU port is not supported.*

### Binding profile

The uplink packet profile is bound to the PON port.

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# cos-queue-map 1
```

The downstream packet profile is bound to the uplink interface.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# cos-queue-map 1
```

 **Note:**

*The PON interface is a hierarchical scheduling mode. This attribute does not take effect.*

There is a default mapping relationship between the internal priority of recovery message scheduling and the queue.

The upstream packet profile is bound to the PON port and restores the default mapping.

```
OLT(config)# interface gpon-OLT 1/1
OLT(config-gpon-olt1/1)# cos-queue-map default
```

The downstream packet profile is bound to the uplink interface and restores the default mapping.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# cos-queue-map default
```

Downlink packets are directly entered into the queue on the ONU.

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# service-port 1 queue 1
```

#### Note:

*When the PON interface is in the simple scheduling mode, the configuration on the ONU does not take effect and cannot be modified. In the hierarchical mode, all the priorities of the ONU are mapped to queue 0 by default.*

View the mapping between the internal priority used by packet scheduling on the port and the queue.

Uplink binding profile.

```
OLT(config)# show cos-queue-map interface xe1/1
cos-queue-map default
```

PON port binding profile.

```
OLT(config)# show cos-queue-map interface gpon-olt1/1
cos-queue-map default
```

The ONU configuration is sent directly into the queue mode.

```
OLT(config)# show running-config interface gpon-onu1/1:1
service-port 1 queue 1
```

### 8.3.2 QoS-Queue-Scheduler

The QoS-queue-scheduler command is used to configure the queue scheduling policy on a port. This command is used when the user needs to select different queue scheduling policies according to the importance of the service to ensure that QoS guarantees can still be provided for important services when the network is congested. After the queue scheduling policy is successfully configured, the system forwards the packets in the queue according to the new scheduling mode. The OLT supports three QoS scheduling policies: a strict priority strict priority scheduling policy, a weighted round robin (WRR) weighted round-robin scheduling policy, and an SP+WRR hybrid scheduling policy.

Use the `qos-queue-scheduler default` command to restore the system default queue scheduling policy. After this command is executed successfully, the system reverts to strict priority queue scheduling.

Configuration:

Configure the SP strict priority for scheduling policy profile.

```
OLT(config)# profile qos-queue-scheduler 1 name 1 policy sp
OLT(config)# profile qos-queue-scheduler 2 name sp2 policy wrr queue0 0
queue1 0 queue2 0 queue3 0 queue4 0 queue5 0 queue6 0 queue7 0
```

Configure the WRR weighted round robin for scheduling policy profile.

```
OLT(config)# profile qos-queue-scheduler 3 name wrr policy wrr queue0 1
queue1 1 queue2 1 queue3 1 queue4 1 queue5 1 queue6 1 queue7 1
```

Configure the SP+WRR hybrid for scheduling policy profile.

```
OLT(config)# profile qos-queue-scheduler 4 name spwrr policy wrr queue0 1
queue1 0 queue2 2 queue3 0 queue4 3 queue5 0 queue6 4 queue7 0
```

 Note:

- ❖ *When the weight of the queue is not 0, the profile is a WRR weighted round robin for scheduling policy profile.*
- ❖ *When the queue has an entry with a weight of 0, the profile is an SP+WRR hybrid scheduling policy profile.*

Show the currently configured QoS-queue-scheduler profile.

```
OLT(config-gpon)# show profile qos-queue-scheduler
profile qos-queue-scheduler 1 name 1 policy sp
profile qos-queue-scheduler 2 name sp2 policy wrr queue0 0 queue1 0 queue2 0
queue3 0 queue4 0 queue5 0 queue6 0 queue7 0
profile qos-queue-scheduler 3 name wrr policy wrr queue0 1 queue1 1 queue2 1
queue3 1 queue4 1 queue5 1 queue6 1 queue7 1
profile qos-queue-scheduler 4 name spwrr policy wrr queue0 1 queue1 0 queue2
2 queue3 0 queue4 3 queue5 0 queue6 4 queue7 0
```

This command is used to apply the existing qos-queue-scheduler profile on the uplink interface or PON interface node.

When the uplink queue needs to be scheduled, the queue scheduling policy should be configured at the egress, that is, the uplink interface.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-scheduler 1
```

When the PON interface is in the simple scheduling mode, before the downlink queue needs to be scheduled, the queue scheduling policy should be configured at the egress, that is, the PON interface.

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# qos-queue-scheduler 1
```

#### Note:

*The PON port is in hierarchical scheduling mode. This attribute does not take effect and cannot be modified.*

When the PON port is in the hierarchical scheduling mode, the scheduling policy of the queue should be configured on the ONU before the ONU downlink queue needs to be scheduled.

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# qos-queue-scheduler 1
```

*The PON interface is in simple scheduling mode. This attribute does not take effect and cannot be modified.*

Restore the system default queue scheduling policy.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-scheduler default
```

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# qos-queue-scheduler default
```

 **Note:**

*The PON port is in hierarchical scheduling mode. This attribute does not take effect and cannot be modified.*

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# qos-queue-scheduler default
```

 **Note:**

*The PON interface is in simple scheduling mode. This attribute does not take effect and cannot be modified.*

View the queue scheduling policy used by the packet scheduling on the port.

This command is used to show the qos-queue-scheduler profile applied on the uplink interface, PON interface, and ONU node application:

```
OLT(config)# show cos-queue-map interface xe1/1
qos-queue-scheduler default
OLT(config)# show cos-queue-map interface gpon-olt 1/1
qos-queue-scheduler default
```

Show the queue scheduling policy of the ONU

```
OLT(config-gpon-onu1/1:1)# show qos-queue-scheduler interface gpon-onu1/1:1
qos-queue-scheduler default
```

### 8.3.3 QoS-Queue-Traffic

QoS-queue-traffic guarantees and limits the queue bandwidth involved. The minimum bandwidth is the guaranteed bandwidth of the queue, and the maximum bandwidth is the maximum bandwidth allowed by the queue.

Use the qos-queue-traffic default command to restore the system default queue bandwidth rate limit policy. After the command is successfully executed, the system reverts to the default

queuing bandwidth rate limiting policy. The limiting policy of default queuing bandwidth is unlimited.

This command can be configured under the GPON node.

```
OLT(config-gpon)#profile qos-queue-traffic 1 name 1 queue0 1-1 queue1 1-1
queue2 1-1 queue3 1-1 queue4 1-1 queue5 1-1 queue6 1-1 queue7 1-1

OLT(config-gpon)#profile qos-queue-traffic 2 name 2 queue0 10-1000000 queue1
10-100000 queue2 10-10000 queue3 10-1000 queue4 10-100 queue5 10-10 queue6
10-11 queue7 10-10

OLT(config-gpon)#profile qos-queue-traffic 3 name 3 queue0 10-1000000 queue1
10-100000 queue2 10-10000 queue3 10-1000 queue4 10-500 queue5 1-250 queue6
10-200 queue7 10-100

OLT(config-gpon)#profile qos-queue-traffic 4 name 4 queue0 10-1000000 queue1
10-100000 queue2 10-10000 queue3 1-1000 queue4 10-500 queue5 10-250 queue6
10-200 queue7 10-100
```

#### Note:

*The maximum bandwidth of configuration value of the queue must not be less than the minimum bandwidth configuration value of the queue.*

This command is used to show the current qos-queue-traffic profile on the gpon, uplink port, PON port, and ONU port node:

```
OLT(config-gpon)# show profile qos-queue-traffic

profile qos-queue-traffic 1 name 1 queue0 1-1 queue1 1-1 queue2 1-1 queue3
1-1 queue4 1-1 queue5 1-1 queue6 1-1 queue7 1-1

profile qos-queue-traffic 2 name 2 queue0 10-1000000 queue1 10-100000 queue2
10-10000 queue3 10-1000 queue4 10-100 queue5 10-10 queue6 0-1 queue7 0-0

profile qos-queue-traffic 3 name 3 queue0 0-1000000 queue1 0-100000 queue2
0-10000 queue3 0-1000 queue4 0-500 queue5 0-250 queue6 0-200 queue7 0-100

profile qos-queue-traffic 4 name 4 queue0 10-1000000 queue1 10-100000 queue2
10-10000 queue3 0-1000 queue4 0-500 queue5 10-250 queue6 10-200 queue7 10-
100
```

The application takes effect in the qos-queue-traffic profile.

This command is used to apply the existing QoS-queue-traffic profile on the uplink interface or PON interface node.

When one need to limit the rate of the upstream queue, the bandwidth of the queue is configured at the egress, that is, the uplink port. Example:

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-traffic 1
```

When the PON interface is in the simple scheduling mode, before the downlink queue needs to be scheduled, the bandwidth of the queue should be configured at the egress, that is, the PON interface. Example:

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# qos-queue-traffic 1
```

 **Note:**

*The PON interface is in hierarchical scheduling mode. This attribute does not take effect and cannot be modified.*

When the PON port is in the hierarchical scheduling mode, the bandwidth of the configurable queue is on the ONU before the ONU downlink queue is scheduled. For example:

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-onu1/1:1)# qos-queue-traffic 1
```

 **Note:**

*The PON interface is in simple scheduling mode. This attribute does not take effect and cannot be modified.*

Restore the system default queue scheduling policy.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-traffic default
```

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# qos-queue-traffic default
```

**Note:**

*The PON interface is in hierarchical scheduling mode. This attribute does not take effect and cannot be modified.*

```
OLT(config)# interface gpon-onu1/1:1  
OLT(config-gpon-onu1/1:1)# qos-queue-traffic default
```

**Note:**

*The PON interface is in simple scheduling mode. This attribute does not take effect and cannot be modified.*

View the queue scheduling policy used by the packet scheduling on the port.

This command is used to show the QoS-queue-traffic profile applied on the uplink port, PON port, and ONU node. Example:

```
OLT(config)# show cos-queue-map interface xe1/1  
qos-queue-traffic default  
OLT(config)# show cos-queue-map interface gpon-olt 1/1  
qos-queue-traffic default
```

Show the ONU queue rate limit:

```
OLT(config-gpon-onu1/1:1)# show qos-queue-traffic interface gpon-onu1/1:1  
qos-queue-traffic default
```

### 8.3.4 QoS-ONU-Bandwidth

This configuration can only be configured and validated on the ONU when the PON interface is in the hierarchical scheduling mode.

```
OLT(config-gpon-onu1/1:1)# qos-onu-bandwidth min 100 max 1000
```



**Note:**

*The ONU maximum bandwidth configuration value must not be smaller than the minimum bandwidth configuration value. If the maximum or minimum value is configured as 0, the ONU maximum and minimum of bandwidths are not limited. The default ONU is no speed limit in the downlink.*

Show the ONU downlink bandwidth configuration.

```
OLT(config)# show qos-onu-bandwidth interface gpon-onu1/1:1  
qos-queue-bandwidth min 100 max 1000
```

### 8.3.5 QoS-ONU-Weight

This configuration can only be configured and validated on the ONU when the PON interface is in the hierarchical scheduling mode.

```
OLT(config-gpon-onu1/1:1)# qos-onu-weight 1
```

Show ONU weights:

```
OLT(config)# show qos-onu-weight interface gpon-onu1/1:1  
qos-onu-weight 1
```

**Note:**

*When the downstream traffic is congested, according to the weight value, WRR weighted round robin scheduling is performed on each ONU unicast service under the PON port. The default ONU weight is 1.*

## 8.4 Upstream QoS Configuration

### 8.4.1 PON Port Configuration

Before the uplink queue needs to be scheduled, the operation of the data packet into the queue should be configured at the entrance, that is, the PON port. Example:

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# cos-queue-map 1
```

### 8.4.2 Configuration of the upper link end

When the uplink queue needs to be scheduled, the queue scheduling policy should be configured at the egress, that is, the uplink interface. Example:

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-scheduler 1
```

### 8.4.3 Optional configuration

When one need to limit the rate of the upstream queue, the bandwidth of the queue is configured at the egress, that is, the uplink port. Example:

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# qos-queue-traffic 1
```

When one need to limit the rate of QoS flow for upstream data, one can configure the rate at which the uplink is to be exported.

```
OLT(config-xe1/1)# rate-limit 1000 2000 egress // Upstream speed limit
```

## 8.5 Downlink Simple QoS Scheduling Configuration

When the QoS mode is simple, the following profiles are bound to the uplink port and pon port. According to the inbound queue, the principle of scheduling and rate limiting occurs. The uplink only has the default simplistic QoS scheduling mode, which cannot be modified. The default direction for the downlink is simplistic QoS scheduling mode, which can be modified.

Set the scheduling mode of PON1 port to simplify the scheduling configuration.

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# shutdown
OLT(config-gpon-olt1/1)# qos-queue-scheduler model simple
OLT(config-gpon-olt1/1)# no shutdown
```

### 8.5.1 PON Port Configuration

When the PON interface is in the simple scheduling mode, the queue scheduling policy should be configured at the egress. Example:

```
OLT(config)# interface gpon-onu1/1:1
OLT(config-gpon-olt1/1)# qos-queue-scheduler 1
```

### 8.5.2 Uplink Configuration

When the behavior of the PON interface is simplified and the scheduling mode needs to be performed before scheduling the downlink queue. The operation of the data packet into the queue should be configured at the entrance, that is, the uplink interface. Example:

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# cos-queue-map 1
```

### 8.5.3 Optional Configuration

When one need to limit the speed of the downstream queue, the bandwidth of the queue is configured at the egress, that is, the PON port. Example:

```
OLT(config)# interface gpon-olt1/1
OLT(config-gpon-olt1/1)# qos-queue-traffic 1
```

When one need to limit the QoS flow rate for downstream data, one can configure the PON port to export the rate limit.

```
OLT(config-gpon-olt1/1)# rate-limit 1000 2000 egress // Downlink speed limit
```

## 8.6 Downstream Hierarchical QoS Scheduling Configuration

The three-layer QoS scheduling supported by the OLT is for ONU downlink services. The OLT that supports only eight queues for upstream services, also supports the scheduling of unicast services within a single ONU. Each ONU is provided with a maximum of 8 queues to differentiate services and perform scheduling (Note: The number of supported queues is related to the profile used by the ONUs. For details, see Configuring a GPON ONU Type Profile). Different scheduling policies can be used for each ONU. OLT supports WRR weighted polling scheduling among ONU under a single PON port. For all unicast and multicast services under a single PON port. OLT follows the principle of strict multicast service priority scheduling to ensure multicast service.

### 8.6.1 PON Port Configuration

Configure the PON port scheduling mode as a hierarchical scheduling mode. The command format is as follows:

Example: Set the scheduling mode of PON1 port to hierarchical scheduling configuration.

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# qos-queue-scheduler model hierarchy
```

#### Note:

*After changing the scheduling mode of the PON port to the hierarchical scheduling mode, the speed limit configured on the PON port and the cos-queue-map of the uplink port will not take effect. It needs to be reconfigured. The configurations of qos-queue-scheduler and qos-queue-traffic cannot be configured in hierarchical mode.*

### 8.6.2 ONU Configuration

Configure the ONU downlink bandwidth.

```
OLT(config-gpon-onu1/1:1)# qos-onu-bandwidth min 100 max 1000
```

#### Note:

*The ONU maximum bandwidth configuration value must not be smaller than its minimum bandwidth configuration value. If the maximum or minimum value is*

*configured as 0, the ONU maximum and minimum bandwidths are not limited.*

*The default ONU is downward and there is no limit.*

Show the ONU downlink bandwidth configuration.

```
OLT(config)# show qos-onu-bandwidth interface gpon-onu1/1:1
qos-queue-bandwidth min 100 max 1000
```

Configure ONU weight value.

```
OLT(config-gpon-onu1/1:1)# qos-onu-weight 1
```

Show the ONU weight value

```
OLT(config)# show qos-onu-weight interface gpon-onu1/1:1
qos-onu-weight 1
```

 **Note:**

*When the downstream traffic is congested, according to the weight value, WRR weighted round robin scheduling is performed on each ONU unicast service under the PON port. The default ONU weight is 1.*

Configure the ONU service into the queue mode.

The OLT supports the service to specify the queue mode.

Service specifies the queue mode:

```
OLT(config-gpon-onu1/1:1)# service-port 1 queue 0
```

Show the ONU service into the queue

```
OLT(config)# show running-config interface gpon-onu1/1:1
```

 **Note:**

*By default, the ONU uses the default mapping, that is, all GEMs are mapped to queue 0.*

*Note: The number of configured queues cannot be greater than the number of downstream queues registered by the ONU.*

#### Configure queue scheduling policy on the ONU

```
OLT(config-gpon-onu1/1:1)# qos-queue-scheduler 1  
OLT(config-gpon-onu1/1:1)# qos-queue-scheduler default
```

#### Show the queue scheduling policy of the ONU

```
OLT(config-gpon-onu1/1:1)# show qos-queue-scheduler interface gpon-onu1/1:1  
qos-queue-scheduler default
```

#### Note:

*By default, the ONU uses the system's default queue scheduling policy. The system's default queue scheduling policy is strict priority queue scheduling.*

#### Configure the rate limit of the ONU queue

```
OLT(config-gpon-onu1/1:1)# qos-queue-traffic 1  
OLT(config-gpon-onu1/1:1)# qos-queue-traffic default
```

#### Show ONU queue speed limit

```
OLT(config-gpon-onu1/1:1)# show qos-queue-traffic interface gpon-onu1/1:1  
qos-queue-traffic default
```

#### Note:

*By default, the ONU uses the system's default queuing bandwidth on the rate limiting policy. The default queuing bandwidth limiting policy is unlimited.*

### 8.6.3 Optional Configuration

When one need to limit the QoS flow rate for downstream unicast and multicast data flows, one can configure the rate limit of the PON port.

```
OLT(config-gpon-olt1/1)# rate-limit 1000 2000 egress // downstream of speed limit
```

When you need to limit the rate of downstream multicast traffic, one can configure the maximum multicast bandwidth for PON exports.

```
OLT(config-gpon-olt1/1)# scb max-bandwidth 20000
```

## 9 ACL SERVICE CONFIGURATION

ACL (Access Control List) strategy is to filter a specific packet through a set of configured matching rules and to identify the objects that need to be filtered. After the specific objects are identified, the corresponding packet is allowed or prohibited to pass according to a predetermined strategy.

The system supports ACL of IPv4 and IPv6, that is, ACLv4 and ACLv6. There are 5 types of ACL—standard ALC, extended ACL, hybrid ACL, link layer ACL and customized ACL.

### 9.1 Principle of ACL Implementation

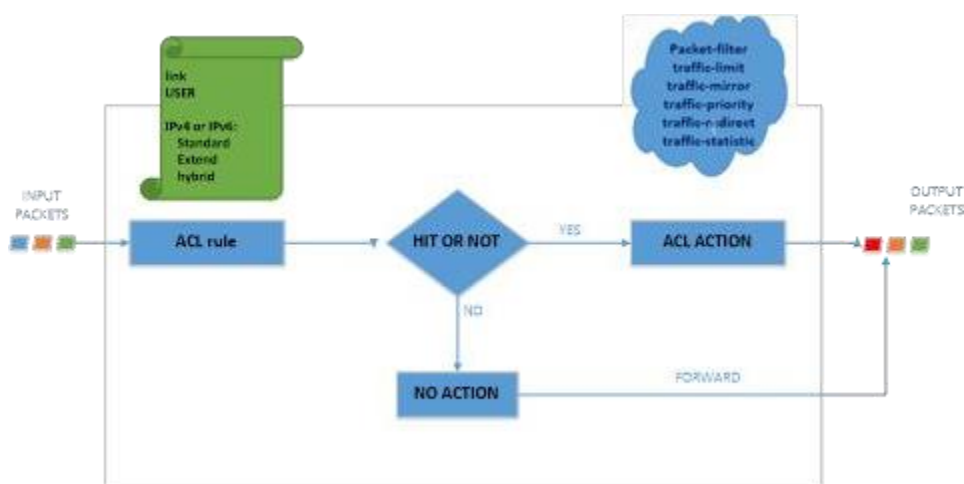


Figure 8- 1 ACL Implementation Principle

### 9.2 ACL Categories

Table 8- 1 ACL Categories

Item	Range of Value	Features
Acl standard ipv4	<2000-2999>	The rules can only be made according to the source IP and mask fields of the IPv4 message, and the data packets are analyzed and processed accordingly.



Acl extend ipv4	<3000-3999>	The rules are made for the protocol type code (ip tcp udp gre ipinip icmp etc.), source IP and mask, source port number, destination IP and mask, destination port number, dscp<0-63> or precedence<0-7> and cos<0-15> fields, and the data packets are analyzed and processed accordingly.
Acl hybrid ipv4	<5000-5999>	The mode of Hybrid ipv4 is the hybrid mode of link and extend ipv4.
Acl link	<4000-4999>	The rules are made according to the ethernet type code (ip ipv6 arp rarp pppoe-conurol pppoe-data
		etc.) the VLAN ID, cos<0-7>, source MAC and destination MAC, and the data packets are analyzed and processed accordingly.
Acl user	<6000-6999>	The corresponding data packets are analyzed and processed according to the string content.
Acl standard ipv6	<7000-7999>	The rules are made only according to the source IP and the mask fields of ipv6 message. The data packets are analyzed and processed accordingly.
Acl extend ipv6	<8000-8999>	The rules are made for the protocol type code (ip tcp udp gre ipinip), the source IP and prefix, the destination port number, the destination IP and prefix, the destination port number, the flow-label <0-1048575> and traffic-class<0-255> fields. The data packets are analyzed and processed accordingly (Due to the chip, ICMPv5 is not supported and Traffic-class only supports 0-63).
Acl hybrid ipv6	<9000-9999>	Hybrid ipv6 mode is a hybrid mode of link and extend ipv6.

### 9.3 ACL Rule Configuration

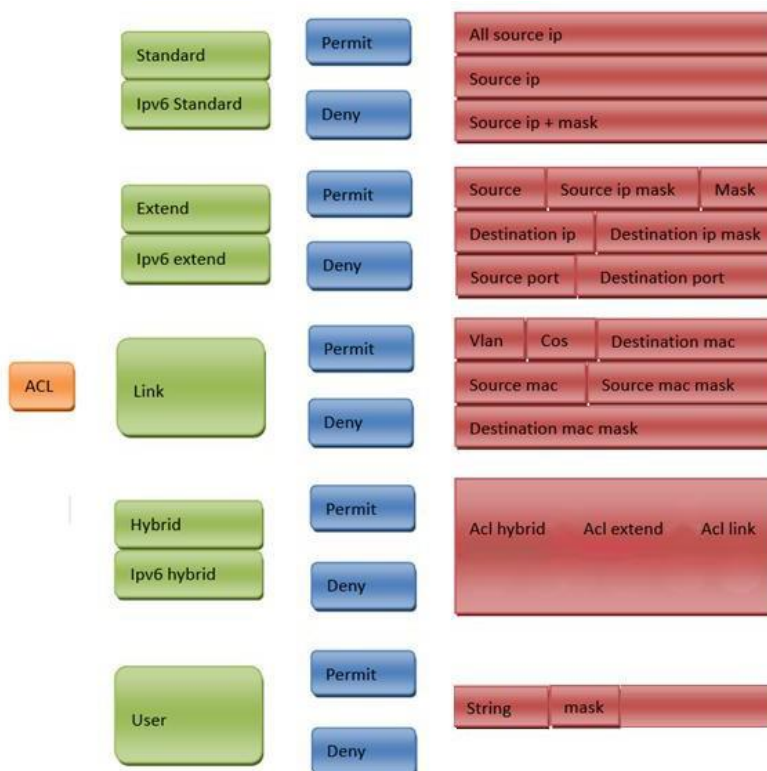


Figure 8- 2 ACL Rule Configuration

**Note:**

*Command Format*

*acl { standard-acl-number | extend-acl-number | link--acl-number | hybrid-acl-number }*

*no acl { all | standard-acl-number | extend-acl-number | link--acl-number |*

*hybrid-acl-number }* Each ACL can create a maximum of 128 rules.

```
OLT(config)# acl hybrid 5555 name iiiiiviiii
OLT(config-acl-hybrid-rule)# rule 55 permit protocol tcp source 192.168.1.11
ignore destination any ignore dscp ef type arp vlan 4000 cos any src-mac any
ignore dst-mac any ignore
```

- ❖ *ACL name can configure unlimited length, but only the first 30 bits are intercepted.*
- ❖ *Do not configure the rule with mutex classes like tcp\arp, or it cannot hit the rule and Action cannot take effect.*

### Typical Configuration:

#### Standard Configuration

```
OLT(config)# acl standard 2222
OLT(config-acl-std-rule)# rule 22 deny source 192.168.2.22 255.255.255.255
```

#### Extend Configuration:

```
OLT(config)# acl extend 3333
OLT(config-acl-ext-rule)#rule 33 deny protocol tcp source 192.168.1.11
ignore source-port equal 33 destination 192.168.2.22 ignore destination-port
equal 33 dscp any
```

#### Link Configuration:

```
OLT(config)# acl link 4444
OLT(config-acl-link-rule)# rule 44 permit type arp vlan 100 cos 6 src-mac
any dst-mac any
```

For multicast MAC addresses (beginning with ipv4:01005e& ipv6:3333), the global multicast enabling needs to be shutdown.

#### Hybrid Configuration

```
OLT(config)# acl hybrid 5555
OLT(config-acl-hybrid-rule)# rule 55 permit protocol tcp source any ignore
source-port eq 20 destination any ignore destination-port lt 23 dscp any
type ip vlan 100 cos 6 src-mac any ignore dst-mac any ignore
```

#### User Configuration

User acl using cautions: Offset from the header of the message and hit 000001000E00 string. It is only effective on source:

```
OLT (config)# acl user 6666
OLT(config-acl-user-rule)#rule 10 permit string 000001000E00
```

#### IPv6 standard Configuration

```
OLT(config)# acl ipv6 standard 7777
OLT(config-acl-ipv6-std-rule)# rule 1 permit source fe80::200:1ff:fe00:e00
```

### IPv6 extend Configuration

```
OLT(config)# acl ipv6 extend 8888
OLT(config-acl-ipv6-ext-rule)# rule 1 permit protocol ip source any ignore
destination any ignore flow-label any traffic-class any
```

### IPv6 hybrid Configuration

```
OLT(config)# acl ipv6 hybrid 9999
OLT(config-acl-ipv6-hyb-rule)# rule 1 permit protocol ip source any ignore
destination any ignore flow-label any traffic-class any type ip vlan any cos
any src-mac any ignore dst-mac any ignore
```

#### Parameter Description:

- ❖ **permit:** the keyword for the eligible packets to pass. This parameter is used when ACL rules are required to be configured for eligible packets to pass.
- ❖ **deny:** the keyword to discard eligible packets. This parameter is used for configuring ACL rules to deny eligible packets to pass.
- ❖ **source:** it is used to specify the source IP address information of the packets. It is an optional parameter. If it is not configured, it means that any source IP address of the message is matched.
- ❖ **sour-addr:** source IP address of the packets in ACL rules. If it is not specified, it means that any source IP address of the message is matched. The point is in decimal representation.
- ❖ **sour-wildcard:** the source IP address wildcard, point decimal representation, which is the counter mask of the source IP address. It is used to match a subnet.

#### Guidelines:

- ❖ When the specified access control list number does not exist, you need to create a new access control list and enter the corresponding ACL configuration mode. When the number has already existed, then you can go directly into the corresponding ACL configuration mode.
- ❖ The matching rules supported by the system includes basic ACL (standard), advanced ACL(extend), link layer ACL (link) and user-defined ACL (hybrid). Moreover, it supports the filtering, flow mirroring, traffic restrictions, priority tag, redirection and traffic statistics functions of the packets and message flow that matches ACL rules.

- ❖ While deleting the access control list, the access control list that has been issued to the port is not allowed to be deleted. If it needs to be deleted, the `acl action` command corresponding to `no` should be used to cancel the issuing of access control list.
- ❖ Currently, “all” in “no acl rule all” acts as “index”. Only the access control list configured with `acl rule all` can be issued.
- ❖ When a message flow matches with more than two rules, if these rules are user-defined or non user-defined rules, the system’s matching order is as follows:

Under the same ACL action circumstance:

The same level (standard\extend\link\hybrid\ipv6 standard\ipv6 extend\ipv6 hybrid\user:

Activate simultaneously (all). The rule-id is larger, the priority is higher.

Activate not at the same time. The rule-id is larger, the priority is higher.

Different level:

ACL ID is larger, the priority is higher.

In the case of different ACL action and there are action conflicts: Packet-filter (deny configuration)>traffic redirect>traffic priority

When there is no conflict of action, configurations for different levels can take effect at the same time.

## 9.4 ACL Action Configuration

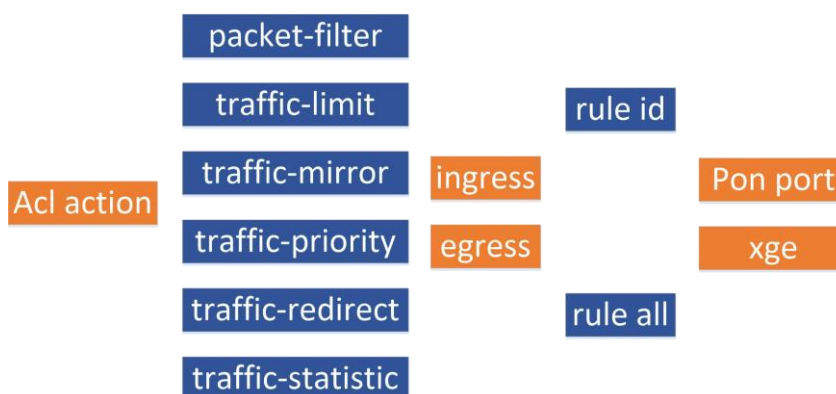


Figure 8- 3 ACL Action Configuration

### 9.4.1 Packet-Filter

packet-filter command is used to configure ACL filtering rules for the specified port and then make it effective. When it needs to make ACL rules filtering of the traffic through a certain port, this command can be used. After the filtering rules are successfully configured, the system will filter the input or output messages according to the rule.

```
OLT(config)# packet-filter ingress acl 2222 rule 1 port gpon-olt1/11
```

no packet-filter command is used to cancel the ACL filtering rules for the specified port. When it needs to delete the ACL filtering rules of a specified port, this command can be used.

```
OLT(config)# no packet-filter ingress acl 2222 rule 1 port gpon-olt1/11
```

### 9.4.2 Traffic-Limit

traffic-limit command is used to make traffic limit to the messages which matches ACL filtering rules and is received by a specified port. When it needs to limit the traffic of a port which matches ACL rules, this command is used. After the traffic limit is successfully configured, if the traffic received by the port exceeds the limitation, please directly discard the messages which exceed the limitation or reset DSCP priority for the messages which exceed the limitation.

```
OLT(config)# traffic-limit ingress acl 2222 rule 1 rate 640000 drop port gpon-olt1/11
```

no traffic-limit command is used to cancel the limitation to the traffic received by the specified port. After it is successfully configured, the system will no longer make rate limit to the traffic received by the port.

```
OLT(config)# no traffic-limit ingress acl 2222 rule 1 port gpon-olt1/11
```

### 9.4.3 Traffic-Mirror

traffic-mirror command is used to mirror the messages of the specified port filtered by ACL rules. When it needs to monitor the transmitting or receiving messages of a certain port, this command can be used to mirror the messages of the port to the specified port for monitoring. Pay attention that the traffic can only be successfully forwarded when the corresponding vlan is configured for the destination port.

```
OLT(config)# traffic-mirror ingress acl 2222 rule 1 port gpon-olt1/11 to-port gpon-olt1/2
```

no traffic-mirror command is used to cancel the mirroring of messages of the specified port filtered by ACL rules. After it is successfully configured, the system will no longer mirror the traffic of the port.

```
OLT(config)# no traffic-mirror ingress acl 2222 rule 1 port gpon-olt1/11
```

#### 9.4.4 Traffic-Priority

traffic-priority command is used to identify the configuration priority of the messages of the specified port filtered by ACL rules. When it needs to configure a priority tag for the traffic of the specified port, this command is used. After it is successfully configured, the port will forward the messages which match ACL rules according to the priority, so as to achieve different QoS guarantee.

Among them, modifying cos, dscp and ip-precedence only modify the message content, which will not affect the enqueueing of the message. However, modifying local-precedence will affect the enqueueing of the message. traffic-priority can modify the enqueueing rules when entry configuration is made for the message.

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 cos 1 port gpon-olt1/11
```

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 cos 1 local-precedence 4 port gpon-olt1/11
```

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 dscp 1 port gpon-olt1/11
```

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 dscp 1 local-precedence 3 port gpon-olt1/11
```

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 dscp 1 cos 2 port gpon-olt1/11
```

```
OLT(config)# traffic-priority ingress acl 2222 rule 1 dscp 1 cos 2 local-precedence 4 port gpon-olt1/11
```

no traffic-priority command is used to cancel the priority markup for the message configuration of a specified port. After the configuration is successful, the system no longer prioritizes the specified message.

```
OLT(config)# no traffic-priority ingress acl 2222 rule 1 port gpon-olt1/11
```

#### 9.4.5 Traffic-Redirect

traffic-redirect command is used to redirect the messages of the specified port which match ACL rules to other port and then forward them. When it needs to redirect specific traffic to other port for forwarding, this command is used. After it is successfully configured, the source



port will no longer forward the redirected messages, but forward the messages from the redirected destination port. Pay attention that the traffic can only be successfully forwarded when the corresponding vlan is configured for the destination port.

```
OLT(config)# traffic-redirect ingress acl 2222 rule 1 port gpon-olt1/11 to-  
port gpon-olt1/2
```

no traffic-redirect command is used to cancel the redirection of messages of the specified port which match ACL rules to other port for forwarding. After the redirection configuration is cancelled, the messages will be directly forwarded from the specified port.

```
OLT(config)# no traffic-redirect ingress acl 2222 rule 1 port gpon-olt1/11
```

#### 9.4.6 Traffic-Statistic

traffic-statistic command is used to make statistics on traffic of the specified port which match ACL rules. When it needs to make statistics on the specific messages of a certain port, this command is used. After it is successfully configured, the system will make statistics on the specific messages, and the show acl +acl id command can be used to query the statistic result.

```
OLT(config)# traffic-statistic ingress acl 2222 rule 1 port gpon-olt1/11  
OLT(config)# show acl 2222  
acl 2222 name acl2222  
rule 1 permit source 192.168.3.33  
traffic-statistic port gpon-olt1/11 ingress (960512 packets)
```

The following command is used to clear the previous statistics:

```
OLT(config)# traffic-statistic ingress acl 2222 rule 1 port gpon-olt1/11  
clear
```

no traffic-statistic command is used to cancel statistics on the traffic that matches the ACL rules under a specific port. After the configuration is successful, the system will no longer make statistics on the traffic.

```
OLT(config)# no traffic-statistic ingress acl 2222 rule 1 pore 1 port gpon-  
olt1/11
```



## 10 STP SERVICE CONFIGURATION

OLT supports three types of STP (Spanning Tree Protocol) modes:

- ❖ STP (Spanning Tree Protocol)
- ❖ RSTP (Rapid Spanning Tree Protocol)
- ❖ MSTP (Multiple Spanning Tree Protocol)

### 10.1 STP, RSTP

STP Mode:

STP is compliant with IEEE802.1d standards.

RSTP Mode:

RSTP is compliant with IEEE802.1w and provides faster convergence rate than STP. That is, when the network topology changes, the port state can migrate quickly (Discard to Forward) under the point-to-point connection of the original redundant switch ports.

In STP and RSTP modes, there is only one state for each port without the concept of VLAN. That is, the forwarding state of the port in different VLAN is consistent.

OLT supports MSTP protocol, and is simultaneously compatible with STP protocol and RSTP protocol. The default protocol type of OLT is STP. No matter which protocol type is configured, it can be fully compatible and interconnected with the other two types. This document takes the RSTP as an example to introduce the configuration of STP.

Steps:

In global configuration mode, enable STP protocol.

```
OLT(config)#spanning-tree
```

Configure Spnning Tree Protocol Type

```
OLT(config)#spanning-tree mode rstp
```

Configure the Priority of the Bridge

```
OLT(config)# spanning-tree instance 0 priority 4096
```

Configure the mapping of the specified VLAN to the specified instance:

```
OLT(config)# spanning-tree instance 0 vid 100
```

### Note:

*By default, all VLAN are mapped to CIST (Common And Internal Spanning Tree), that is, instance 0. A VALN cannot be mapped to different instances, that is, if you remap a VLAN to a different instance, the original mapping relationship is automatically cancelled.*

### Configure Hello Time for a Specific Bridge

```
OLT(config)# spanning-tree hello-time 2
```

### Configure the Max Age Time for a Specific Bridge

```
OLT(config)# spanning-tree max-age 20
```

### Configure the Maximum Number of Hops for the MST Domain

```
OLT(config)# spanning-tree max-hop 20
```

### Configure the Forward Delay Time for a Specific Bridge

```
OLT(config)# spanning-tree forward-delay 15
```

### Show STP

```
OLT(config)# show spanning-tree
Spanning-tree is enable:
Format Selector:          0
Configuration Name:      60E6BC0092B0
Revision Level:          0
Configuration Digest:    2C060C84FA9BD1DA58E17DA1CD383586
CIST info:
bridge id                 8.000.60:E6:BC:00:92:B0
designated root            8.000.60:E6:BC:00:92:B0
```

```
regional root          8.000.60:E6:BC:00:92:B0
root port              none 0
path cost              0      internal path cost      0
max age                20     bridge max age          20
forward delay         15     bridge forward delay    15
tx hold count         6      max hops                20
hello time            2      ageing time             300
force protocol version      rstp
time since topology change  2
topology change count      0
topology change           no
topology change port       None
last topology change port  None
```

### Enable STP function for the upstream port

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# spanning-tree
OLT(config)# interface xe1/2
OLT(config-xe1/2)# spanning-tree
```

## 10.2 MSTP

MSTP (Multiple Spanning Tree Protocol) is used to build a simple and complete topology in bridged LAN. MSTP can be compatible with early STP (Spanning Tree Protocol) and RSTP (Rapid Spanning Tree Protocol).

Both STP and RSTP can only establish a separate spanning tree topology in the network, and all VLAN packets are forwarded along a unique spanning tree. STP converges too slowly, and RSTP ensures fast and stable network topology by handshake mechanism.

MSTP inherits RSTP's fast handshake mechanism. At the same time, on the basis of guaranteeing the fast establishment of network topology, MSTP allows different VLANs to be divided into different spanning trees, thus establishing multiple tree topologies in the network. In the MSTP network, frames belonging to different VLANs can be forwarded on different paths to achieve load balancing of VLAN data.

Unlike partitioning STP (per-VLAN Spanning Tree, PVST) according to VLAN, MSTP also allows multiple VLANs to be partitioned into the same spanning tree topology, which effectively reduces the number of spanning trees needed to support a large number of VLANs.

Set global spanning tree protocol type

```
OLT (config)# spanning-tree mode mstp
```

### Set a domain name

```
OLT (config)# spanning-tree mstp name OLTG1
```

### Create an instance

```
OLT (config)# spanning-tree instance 1 vid 1-10
```

### Configure instance priority

```
OLT (config)# spanning-tree instance 1 priority 0
```

### Set the uplink port as the guard root port

```
OLT (config-ge1/1)# spanning-tree guard root
```

### Set the path cost of the port in the specified spanning tree instance.

```
OLT (config-xe1/1)# spanning-tree mstp 0 cost 20000
```

### Set the priority of a specific port.

```
OLT (config-xe1/1)# spanning-tree mstp 0 port-priority 16
```

### Set whether the port is an edge port.

```
OLT (config-xe1/1)# spanning-tree mstp edge auto
```

### Set whether to be compatible with STP version.

```
OLT (config-xe1/1)# spanning-tree mstp migration-check
```

Set whether the link connected with the port is a point-to-point link.

```
OLT (config-xe1/1)# spanning-tree mstp point-to-point auto
```

Show the status and protection type of OLT in the instances.

```
OLT (config)# show spanning-tree instance 0
```

```
OLT (config)# show spanning-tree instance 1
```

```
OLT (config)# show spanning-tree interface brief
```

## 11 DHCP SERVICE CONFIGURATION

### 11.1 DHCP-Snooping Features

DHCP snooping technology is a DHCP security feature. The DHCP snooping binding table is set up and maintained to filter untrusted DHCP information. This information refers to DHCP information from untrusted areas. The DHCP snooping binding table contains information such as the user MAC address, IP address, lease period, and VLAN-ID interface in the untrusted zone.

Enable OLT global DHCP-Snooping monitoring

```
OLT(config)# ip dhcp-snooping
```

Configure the DHCP snooping function on the PON port

```
OLT(config-gpon-olt1/1)# ip dhcp-snooping
```

Configure the uplink port as a trusted port

```
OLT(config-ge1/1)# ip dhcp trust
```

Show global DHCP-Snooping status

```
OLT(config)# show ip dhcp-snooping
DHCP V4 snooping : enable
Option82         : disable
```

Show all port DHCP status

```
OLT(config)# show ip dhcp port
```

interface	dhcp	trust	snooping	option82
gpon-olt1/1	support	un-trust	enable	disable
gpon-olt1/2	support	un-trust	disable	disable

gpon-olt1/3	support	un-trust	disable	disable
gpon-olt1/4	support	un-trust	disable	disable
gpon-olt1/5	support	un-trust	disable	disable
gpon-olt1/6	support	un-trust	disable	disable
gpon-olt1/7	support	un-trust	disable	disable
gpon-olt1/8	support	un-trust	disable	disable
gpon-olt1/9	support	un-trust	disable	disable
gpon-olt1/10	support	un-trust	disable	disable
gpon-olt1/11	support	un-trust	disable	disable
gpon-olt1/12	support	un-trust	disable	disable
gpon-olt1/13	support	un-trust	disable	disable
gpon-olt1/14	support	un-trust	disable	disable
gpon-olt1/15	support	un-trust	disable	disable
gpon-olt1/16	support	un-trust	disable	disable
ge1/1	support	trust	disable	disable
ge1/2	support	un-trust	disable	disable
ge1/3	support	un-trust	disable	disable
ge1/4	support	un-trust	disable	disable
ge1/5	support	un-trust	disable	disable
ge1/6	support	un-trust	disable	disable
ge1/7	support	un-trust	disable	disable
ge1/8	support	un-trust	disable	disable

### Show the ONU's DHCP status

```
OLT(config)# show ip dhcp onu
interface  dhcp  trust snooping  option82
```

gpon-onu1/1:1	support	un-trust	enable	disable
gpon-onu1/1:2	support	un-trust	enable	disable

## Show DHCP snooping binding table

```
GPON# show ip dhcp-snooping binding
Total info table: 2
DHCP client information:
=====
MAC                VLAN  Lease Type  Interface          layer2 Info IPv4/IPv6
08c6-b360-36b9     4000  86400 snoop gpon-onu1/4:21   [4000]  192.168.55.23
08c6-b3fa-0581     4000  86400 snoop gpon-onu1/8:21   [4000]  192.168.55.30
```

### 11.2 DHCPv4-Option82

After the Dynamic Host Configuration Protocol (DHCP) Option 82 function is enabled, the working process of the DHCPv4 L2 Relay is as follows:

- ❖ The DHCPv4 client sends a request packet in broadcast form during initialization.
- ❖ The DHCPv4 relay device checks whether Option 82 is available in the packet and performs corresponding processing. If Option 82 exists in the packet, the device processes the packet according to the configured policy (discards it, replaces Option 82 in the original Option 82 of the packet with the original Option 82 of the packet or replaces it with Option 82 in the packet). item), then forward the request packet to the DHCPv4 server. If there is no Option 82 option in the request message, the DHCPv4 relay will add the Option 82 to the message and forward it to the DHCPv4 server. In this case, the request packet contains the ONU information connected to the DHCPv4 client, the VLAN to which it belongs, and the MAC address of the DHCPv4 relay device itself.
- ❖ After receiving the DHCPv4 request packet forwarded by the DHCPv4 relay device, the DHCPv4 server records the information carried in the Option 82 in the packet. Then, the DHCPv4 relay device is sent with the DHCPv4 configuration information and Option 82 information.
- ❖ After receiving the packet returned by the DHCPv4 server, the DHCPv4 relay device strips the Option 82 information from the packet and forwards the packet with the DHCPv4 configuration information to the DHCPv4 client.

Enable OLT global DHCPv4-Information.

```
OLT(config)# ip dhcp information
```

The PON port is configured with the DHCPv4-Information function.

```
OLT(config)# interface gpon-olt 1/1
OLT(config-gpon-olt1/1)# ip dhcp information
```



Show the current global DHCP-Snooping enable status.

```
OLT(config)# show ip dhcp-snooping
DHCP V4 snooping : enable
Option82         : enable
Access-Node-ID   : PON
Remote id        : 0002-0304-0506
```

Customize the configuration of the Option 82 field of the ONU.

```
OLT(config-gpon-onu1/1:1)# ip dhcp information circuit-id string gpon-
onu1/1:1
OLT(config-gpon-onu1/1:1)# ip dhcp information remote-id string gpon-
onu1/1:1
```

### 11.3 DHCP-Relay Features

When the service VLAN of OLT and the VLAN of the upper device address pool are different, dhcp-relay function is required to jump the service VLAN to the interface address of the VLAN in the DHCP address pool.

This command is used to set up the filling mode of the three-layer DHCP Relay for the source IP of the message. When the user's broadcast message is unicasted to the DHCP Server, the IP source address and the gateway IP address in the unicast DHCP message can be set up. Enable/Disable Global dhcp relay

```
OLT(config)# ip dhcp-relay
```

Configure the Service VLAN and the Assigned Interface Address

```
OLT(config)# interface vlanif102
OLT(config-vlanif102)# ip address 12.0.0.1/24
OLT(config-vlanif102)#exit
OLT(config)# vlan 202
OLT(config-vlan202)# exit
OLT(config)# interface vlanif202
OLT(config-vlanif202)# ip address 22.0.0.2/16
OLT(config-vlanif202)#exit
```

## Configure the three-layer function of DHCP-Relay

```
OLT (config-vlanif102)# ip dhcp relay-agent
OLT (config-vlanif102)# ip dhcp relay-server-address 22.0.0.1
OLT (config-vlanif102)# ip dhcp relay-server-address 22.0.1.1
OLT (config-vlanif102)# ip dhcp relay-server-address 22.0.3.1
OLT (config-vlanif102)# ip dhcp relay-server-address 22.0.4.1
```

## Show Current Configuration

```
OLT (config)# show running-config interface vlanif102
!
interface vlanif102
ip address 12.0.0.1/24
ip dhcp relay-agent
ip dhcp relay-server-address 22.0.0.1
ip dhcp relay-server-address 22.0.1.1
ip dhcp relay-server-address 22.0.3.1
ip dhcp relay-server-address 22.0.4.1
```

### 11.4 IP Source Guard Function

Through binding function of IP Source Guard, the packets forwarded by the port can be filtered and controlled, so as to prevent illegal packets from passing through the port, and further to restrict the illegal use of network resources (such as illegal host imitates legitimate user's IP to access network), and to improve the security of the port.

There are two types of binding modes—static binding and dynamic binding.

1. **Static Binding:** IP Source Guard is manually configured and is simultaneously bound to the port. This binding mode is applicable to situation that there are a small number of hosts in the LAN or binding operation is needed for a specific device in the LAN.
2. **Dynamic Binding:** The port control function is realized by automatically acquiring the binding table items of DHCP Snooping or DHCP Relay. This binding mode is suitable for the situation that there are many hosts in LAN and DHCP is used to configure dynamic hosts. It can effectively prevent problems such as IP address conflicts and embezzlement etc. The principle is that when DHCP assigns a table item to a user, the dynamic binding function accordingly adds a bound table item to allow the user to access the network. If a user sets the IP address privately, the DHCP assignment table item will not be triggered, as a result,

the dynamic binding function will not add the corresponding access allowance rules and the user cannot access the network.

The current version of our OLT supports dynamic binding mode only.

**Prerequisites:** DHCP-Snooping function needs to be enabled in the global and VLAN interfaces, and the uplink port needs to be configured as the trusted port, otherwise the IP Source Guard related functions cannot be configured.

```
OLT (config)# ip dhcp-snooping
OLT (config)# vlan 10
OLT (config-vlan10)# ip dhcp-snooping
OLT (config)# interface ge1/1
OLT (config-ge1/1)# ip dhcp trust
```

**Enable IP Source Guard function of VLAN interface. Currently only dynamic mode is supported.**

```
OLT (config)# vlan 10
OLT (config-vlan10)# ip verify source ip-address dynamic
```

#### Show DHCP configuration of VLAN

```
OLT (config)# show ip dhcp vlan 10
```

vlan	dhcp-snoop	option82	ip verify
10	enable	disable	enable

**After you get the IP address, show and monitor the binding table.**

```
OLT(config)# show ip dhcp-snooping binding Total info entries: 5
DHCP client information:
```

```
=====
```

MAC	VLAN	Lease	Type	Interface	layer2	Info	IPv4/IPv6
08c6-b300-0001	10	3600	snoop	gpon-onu1/1:1[1]	[10]		72.0.2.3
08c6-b300-0002	10	3600	snoop	gpon-onu1/1:2[1]	[10]		72.0.2.4
08c6-b300-0003	10	3600	snoop	gpon-onu1/1:3[1]	[10]		72.0.2.5

08c6-b300-0004	10	3600	snoop	gpon- onu1/1:4[1]	[10]	72.0.2.6
08c6-b300-0005	10	3600	snoop	gpon- onu1/1:5[1]	[10]	72.0.2.7

### Show IP source binding table.

```
OLT(config)# show ip source binding Total info entries: 5
```

```
Source IP client information:
```

```
=====
```

MAC	VLAN	Type	Interface	IPv4
08c6-b300-0001	10	dynamic	gpon-onu1/1:1[1]	72.0.2.3
08c6-b300-0002	10	dynamic	gpon-onu1/1:2[1]	72.0.2.4
08c6-b300-0003	10	dynamic	gpon-onu1/1:3[1]	72.0.2.5
08c6-b300-0004	10	dynamic	gpon-onu1/1:4[1]	72.0.2.6
08c6-b300-0005	10	dynamic	gpon-onu1/1:5[1]	72.0.2.7

Only the client listed in the IP source binding table can visit the network.

### Disable the Source Guard function of the VLAN port.

```
OLT (config)# vlan 10
```

```
OLT (config-vlan10)# no ip verify source ip-address dynamic
```

### Note:

*After disabling the IP Source Guard function of the VLAN port, all the IP source binding table items of the VLAN need to be cleared. When the DHCP-Snooping function of the VLAN port is disabled, the IP Source Guard function of the VLAN will be simultaneously disabled. When the global DHCP-Snooping function is disabled, the IP Source Guard function of all VLANs will be simultaneously disabled.*

## 12 ROUTER

A route is a process used to describe a grouping emitted by a host in a network that is transferred through one or more routers to a host located on another network. As one of the basic elements in the whole telecommunication network, the access device must support the functions of remote operation, management and maintenance of the equipment. With the miniaturization and far- end of the equipment, access devices are also required to have some BRAS functions, such as network address allocation, user management, etc., All the above mentioned features require the device to be able to support routing functions.

At present, QTECH OLT supports static routing configuration and forwarding.

### 12.1 Static Routing

Static routing is a special routing that requires administrators to configure manually. The network can work normally by setting static routing when the structure is simple. It can improve the network performance and ensure bandwidth for important applications by setting and using static routing carefully. However, when the network fails or the topology changes, the static routing will not change automatically, and the administrator must intervene.

A static routing includes the following elements: 1. destination IP address and mask, 2. exit interface and the next IP address.

Default static routing:

```
OLT(config)# ip route 0.0.0.0/0 192.168.17.1
```

*Note: 192.168.17.1 is the default gateway IP address.*

*Create a Layer 3 interface:*

```
OLT(config)# interface vlanif100  
OLT(config-vlanif100)# ip address 72.0.0.2/24
```

Static routing:

```
OLT(config)# ip route 20.0.0.0/24 72.0.0.1
```

Show OLT's static routing configuration:

```
OLT(config)# do show ip route
```

```
Codes: K - kernel route, C - connected, S - static, R - RIP, O - OSPF, I - IS-IS, B - BGP, A - Babel, > - selected route, * - FIB route
```

```
C>* 10.0.0.0/24 is directly connected, vlanif10
```

```
S>* 20.0.0.0/24 [1/0] via 72.0.0.1, vlanif100
```

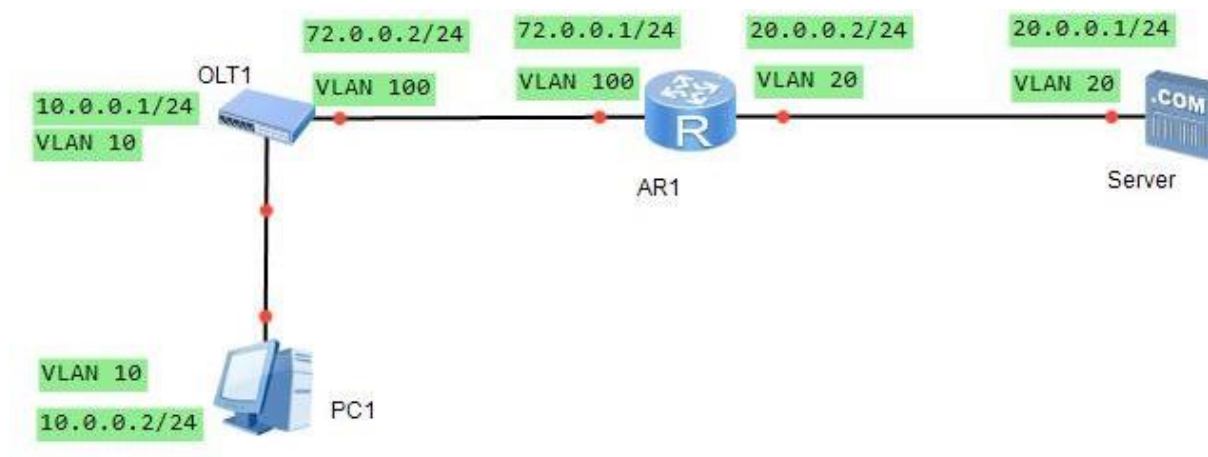
```
C>* 72.0.0.0/24 is directly connected, vlanif100
```

```
S>* 192.168.0.0/16 [1/0] via 192.168.17.1, fm1-mac2
```

```
C>* 192.168.17.0/24 is directly connected, fm1-mac2
```

*Note: "s>" is a static route, and "c>" is a direct-connected route.*

Example:



The OLT configuration of the above topology is shown as follows:

```
OLT(config)# interface vlanif10
OLT(config-vlanif10)# ip address 10.0.0.1/24
OLT(config-vlanif10)# ex
OLT(config)# interface vlanif100
OLT(config-vlanif100)# ip address 72.0.0.2/24
OLT(config-vlanif100)# ex
OLT(config)# ip route 20.0.0.0/24 72.0.0.1
```

It is required to configure the return routing in the upper router "ip route 10.0.0.0/24 72.0.0.2".

## 12.2 ARP

The ARP (Address Resolution Protocol) protocol enables the conversion of IP addresses and MAC addresses and is a protocol used to resolution IP addresses to MAC addresses.

ARP mapping table is a cache in which MAC addresses are mapped to IP addresses. QTECH OLT supports for static ARP configuration and dynamic ARP configuration. Typically, the device runs dynamic ARP. The static table need to be configured manually if the user needs to intervene and adjust the ARP mapping table,

Static ARP table entries are always valid while the OLT is in working state. The aging time of a dynamic ARP table is configurable, the default time is 14,400 seconds.

### Config static ARP table

```
OLT(config)# arp static 10.0.0.2 08c6-b332-af7b
```

### Show ARP table

```
OLT(config)# show arp
```

Ip	Mac	Type	Timeout(s)
-----			
10.0.0.2	08c6-b332-af7b	static	-

```
Total: 1, static: 1, dynamic 0
```

### Create a Layer 3 interface

```
OLT(config)# interface vlanif100  
OLT(config-vlanif100)# ip address 72.0.0.1/24
```

### Configure maximum ARP learning number of Layer 3 interface

```
OLT(config-vlanif100)# arp max-num 255
```

### Configure ARP table aging time of Layer 3 interface

```
OLT(config-vlanif100)# arp timeout 3600
```

### Show ARP table

```
OLT(config)# show arp
```

Ip	Mac	Type	Timeout(s)
----	-----	------	------------

10.0.0.2	08c6-b332-af7b	static	-
72.0.0.2	08c6-b3b0-a78d	dynamic	3598

Total: 2, static: 1, dynamic 1



## 13 PPPOE+ SERVICE CONFIGURATION

PPPoE+ is also known as PPPoE relay agent. In the BBF WT-101\_Issue-2, 3.9.2 defines the PPPoE proxy to implement the line access line identification. The PPPoE relay agent supports the PPPoE access method and is a function of an access node to implement insertion of an access line identifier. The idea of the PPPoE+ technology is to access a relay device (such as a DSLAM or PON) and receive a PADI or PADR packet from the user in order to insert the access line identification. In the packet, it adds PPPoE+ TAG that represents the physical port and logical port (such as VLAN) of the user. After the upstream BRAS device recognizes the PPPoE+ TAG, the user's physical location information is extracted. Radius NAS-Port-ID attribute is used to issue Radius server, so as to realize user identification and user management.

The OLT device carries the user access line identifier (Agent Circuit ID, Agent Remote ID) to the BRAS through the extended tag 0x0105 (Vendor-Specific). The extension tag is the PPPoE+TAG. By default, PPPoE+ is de-enabled.

### 13.1 Global PPPoE Configuration

Enable PPPoE+ globally:

```
OLT(config)# pppoe intermediate-agent
```

Configure Vendor ID:

```
OLT(config)# pppoe intermediate-agent vendor-id 3561
```

The default value is 3561 which is defined in DSL RFC.

Configure the global access line identifier:

```
OLT(config)# pppoe intermediate-agent access-node-identifier OLT
```

Configure chassis number and rack number

```
OLT(config)# pppoe port-tag rack 1 frame 1
```

Configure PPPoE+tag add Circuit ID profile:

```
OLT(config)# pppoe port-tag profile 1
OLT(config-1)# port-tag add delimiter space index 1
OLT(config-1)# port-tag add variable access-node-id index 2
OLT(config-1)# port-tag add variable rack index 3
OLT(config-1)# port-tag add variable frame index 4
OLT(config-1)# port-tag add string GPON index 5
```

The above commands can be used to configure Circuit ID TAG profile. It allows to configure 20 parameters, including separator (space, comma, left slash, colon and point), access node ID, rack number, chassis number, slot number, port number, ONU ID, user VLAN and service side VLAN.

 **Note:**

*Both UVLAN and SVLAN are VLAN converted by service. When the data flow is converted into a single-layer VLAN, the UVLAN is 0 and there is only SVLAN. If it is double-layer VLAN, then UVLAN is the inner layer VLAN and SVLAN is the outer layer VLAN.*

*e.g.: After conversion, the data flow is a single-layer VLAN. VLAN=10, then UVLAN=0, SVLAN=10.*

*After conversion, the data flow is a double-layer VLAN. Inner layer VLAN=20, outer layer VLAN=30, then UVLAN=20, SVLAN=30.*

Show global PPPoE+ status:

```
OLT(config)# show pppoe intermediate-agent
pppoe intermediate-agent is enabled
vendor-id           : 3651
vendor-tag policy   : replace
access-node-identifier : OLT
interface           config
-----
ge1/1               distrust
ge1/2               distrust
ge1/3               distrust
ge1/4               distrust
ge1/5               distrust
```

```
ge1/6          distrust
ge1/7          distrust
ge1/8          distrust
interface      config
-----
```

```
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
gpon-olt1/1    disable
-----
```

### Configure global PPPoE+ TAG information-Circuit ID profile

```
OLT(config)# pppoe intermediate-agent global port-tag profile 1
```

### Add the uplink port as PPPoE+trust port:

```
OLT(config-ge1/1)# pppoe intermediate-agent trust
```

### Show the PPPoE+ status of the uplink port:

```
OLT(config)# show pppoe intermediate-agent interface ge1/1
interface ge1/1
pppoe intermediate-agent trust
```

### Global configuration performs operations on messages that have PPPoE+TAG.

```
OLT(config)# pppoe intermediate-agent information policy replace
```

The operations include configurations to discard, keep or replace. The default operation is to replace.

## 13.2 PPPoE Configuration of Specific VLAN

Create VLAN and enable PPPoE+ function of VLAN:

```
OLT(config)# vlan 10
OLT(config-vlan10)# pppoe intermediate-agent enable
```

Configure PPPoE+ TAG information of VLAN-Circuit ID (use the profile or keep consistent with that of the global):

```
OLT(config)# vlan 10
OLT(config-vlan10)# pppoe intermediate-agent circuit-id type profile 1
OLT(config-vlan10)# pppoe intermediate-agent circuit-id type sysname
```

Configure PPPoE+ TAG information of VLAN-Remote ID (Fill in the string directly or be consistent with the global):

```
OLT(config)# vlan 10
OLT(config-vlan10)# pppoe intermediate-agent remote-id type user gpon-
onu1/1:1
OLT(config-vlan10)# pppoe intermediate-agent remote-id type sysname
```

Show the global and port PPPoE message statistics:

```
OLT(config)# show pppoe intermediate-agent statistics
pppoe intermediate-agent statistics
```

	reviewed	replace	keep	drop	delete
PADI	0	0	0	0	0
PADO	0	0	0	0	0
PADR	0	0	0	0	0
PADS	0	0	0	0	0
PADT	0	0	0	0	0

```
OLT(config)# show pppoe intermediate-agent statistics interface gel1/1
interface gel1/1
```

	reviewed	replace	keep	drop	delete
--	----------	---------	------	------	--------

PADI	0	0	0	0	0
PADO	0	0	0	0	0
PADR	0	0	0	0	0
PADS	0	0	0	0	0
PADT	0	0	0	0	0

### Show PPPoE+ configuration information of VLAN:

```
OLT(config)# show pppoe intermediate-agent vlan 10 Vlan 10
pppoe intermediate-agent enable
pppoe intermediate-agent circuit-id default profile 1
pppoe intermediate-agent remote-id type sysname QSW901008
```

## 14 SNMP CONFIGURATION

Simple Network Management Protocol (SNMP) consists of a set of network management standards, including an application layer protocol, a database schema, and a set of resource objects. The protocol can support a network management system to monitor whether any device connected to the network has caused any management concern. The agreement is part of the internet protocol suite defined by the Internet Engineering Task Force (IETF).

### 14.1 SNMP Basic Configuration

Configure SNMP enterprise ID:

```
OLT(config)# _debug
GPON(config-debug)# enterprise-id 27514
SNMP enterprise id set to 27514 success, please reboot to use the new
enterprise id
```

#### Note:

*Only when the enterprise ID is the same as that in the customized network management, the NMS network element can be used. Therefore, it is not recommended to change the enterprise ID.*

Enable SNMP:

```
OLT(config)# snmp-server enable
```

By default, SNMP service is enabled.

Configure SNMP system name:

```
OLT(config)# snmp-server sysname OLT
```

Configure SNMP address:

```
OLT(config)# snmp-server syslocation location
```

Configure SNMP contact information:

```
OLT(config)# snmp-server syscontact contact
```

#### Enable SNMP Trap function:

```
OLT(config)# snmp-server trap enable
```

#### Show SNMP-related configuration:

```
OLT(config)# show snmp-server
service          enable
version          v1,v2c,v3
sysname          OLT
syslocation      Moscow Russia
syscontact       support@qtech.ru
objectid         1.3.6.1.4.1.27514
trap             enable
```

#### Configure SNMP server read-only community name:

```
OLT(config)# snmp-server community ro public
```

#### Configure SNMP server read-and-write community name:

```
OLT(config)# snmp-server community rw private
```

#### Show SNMP server community configuration:

```
OLT(config)# show snmp-server community
type          community name
-----
rw            private
ro            public
```

#### Configure Engine ID of SNMP:

```
OLT(config)# snmp-server engine-id local 0x123456
```

Local engine-id will effective after the system reboot.

The newly-configured SNMP engine ID will take effect after the device is restarted. By default, port No.162 is used to configure SNMP protocol.

Show SNMP engine ID configuration:

```
OLT(config)# show snmp-server engine-id local
SNMP local engine-id
type          : user defined      [0x123456]
hex string   : 0x80001f88043078313233343536
```

By default, the configuration of local engine ID is as follows:

```
OLT(config)# show snmp-server engine-id local
SNMP local engine-id
type          : auto generated
hex string   : 0x80001f88803e51c4f45870c150
```

## 14.2 SNMP User Configuration

1. For configuring views, the permissions of configurable views are all views that contain or do not contain the node.

```
OLT(config)# snmp-server view 1 included 1.3.6.1.4.1.27514
OLT(config)# snmp-server view 1 excluded 1.3.6.1.4.1.27514.1.1
OLT(config)# snmp-server view 2 included 1.3.6.1.4.1.27514
OLT(config)# snmp-server view 3 included 1.3.6.1.4.1.27514.1
```

Show all the configured views. The ISO view contains all nodes, the None view is blank and does not contain all nodes. Multiple node ID can be configured in the same view.

```
OLT(config)# show snmp-server view
viewname with [*] is system reserved view.
index      viewName      subtree-id  type      OID

1          iso          [*]        [ 1]     included  .1
```



2	none	[*]	[ 1]	excluded	.1
3	1		[ 1]	included	1.3.6.1.4.1.27514
			[ 2]	excluded	1.3.6.1.4.1.27514.1.1
4	2		[ 1]	included	1.3.6.1.4.1.27514
5	3		[ 1]	included	1.3.6.1.4.1.27514.1

- While configuring SNMP user group, the security levels (including three security levels—noauth: no authentication and no encryption, auth: only authentication but no encryption, authpriv—both authentication and encryption), the permission to read the view, the permission to write the view and the permission to notify the view of group members can be configured. The security level, the permission to read the view, the permission to write the view and the permission to notify the view of the group members can be directly changed.

```
OLT(config)# snmp-server group 1 usm noauth read 1 write 1 notify 1
OLT(config)# snmp-server group 2 usm auth read 1 write 2 notify 3
OLT(config)# snmp-server group 3 usm authpriv read 2 write 2 notify 2
```

#### Show SNMP user group configuration:

```
OLT(config)# show snmp-server group
```

GroupName	SecurityMode	SecurityLevel	ReadView	WriteView	NofityView
1	usm	noauth	1	1	1
2	usm	auth	1	2	3
3	usm	authpriv	2	2	2

#### Configure remote Engine ID

```
OLT(config)# snmp-server engine-id remote 192.168.66.1 0x654321
OLT(config)# snmp-server engine-id remote 192.168.66.2 udp-port 100 0x654321
OLT(config)# snmp-server engine-id remote 192.168.66.115 0x123F00
OLT(config)# snmp-server engine-id remote 192.168.66.3 udp-port 162 0x654321
OLT(config)# snmp-server engine-id remote 192.168.66.115 udp-port 100
0x654321
```

## Show remote Engine ID

```
OLT(config)# show snmp-server engine-id remote
Host IP           UDP-Port   Engine ID
-----
192.168.66.1      162       0x654321
192.168.66.115   100       0x654321
192.168.66.2     100       0x654321
192.168.66.115   162       0x123F00
192.168.66.3     162       0x654321
```

## Configure SNMP user

```
OLT(config)# snmp-server user Peter group 2 MD5 12345678
OLT(config)# snmp-server user Peter1 group 2 SHA 12345678
OLT(config)# snmp-server user Alice remote 192.168.66.115 group 1
OLT(config)# snmp-server user Stevey remote 192.168.66.115 udp-port 100
group 3 MD5 951623847 DES 0147852963
OLT(config)# snmp-server user Stevey1 remote 192.168.66.115 udp-port 100
group 3 MD5 951623847 AES 0147852963
```

While configuring the user, it needs to add the user to the user group and configure the information of the corresponding security level, such as whether it is authenticated, whether the authentication method is MD5 or SHA and its password, whether the encryption method is DES or AES and its password.

## Show SNMP user

```
OLT(config)# show snmp-server user
UserName   Engine ID  Group Security Level  Authtype      Privacy
-----
Peter      local      2          auth             MD5           disable
Peter1     local      2          auth             SHA           disable
Alice      0x654321   1          noauth          disable      disable
Stevey     0x654321   3          authpriv        MD5          DES
Stevey1    0x654321   3          authpriv        MD5          AES
```

### 14.3 SNMP Trap Configuration

SNMP Trap configuration includes host address and port configuration for OLT to automatically report Trap information.

#### Enable SNMP Trap function

```
OLT(config)# snmp-server trap enable
```

#### SNMP v1 Trap host configuration

```
OLT(config)# snmp-server trap-host 192.168.66.115 version v1  
OLT(config)# snmp-server trap-host 192.168.66.115 162 version v1
```

#### SNMP v2c Trap host configuration

```
OLT(config)# snmp-server trap-host 192.168.66.116 version v2c  
OLT(config)# snmp-server trap-host 192.168.66.116 162 version v2c
```

#### SNMP v3 Trap host configuration

```
OLT(config)# snmp-server trap-host 192.168.66.115 162 version v3 authpriv  
Stevey
```

#### Show all Trap-related configurations

```
OLT(config)# show snmp-server trap  
SNMP V1 trap infomation:  
HOST          Port      SecLevel   SecName    EngineId  
-----  
0.0.0.0       162      noauth     none       none  
192.168.66.1 162      noauth     none       none  
15  
192.168.66.2 122      noauth     none       none  
SNMP V2c trap infomation:  
HOST          Port      SecLevel   SecName    EngineId  
-----  
0.0.0.0       162      noauth     none       none
```

```
192.168.66.1 162          noauth      none        none
16
```

SNMP V3 trap information:

HOST	Port	SecLevel	SecName	EngineId
------	------	----------	---------	----------

192.168.66.115	162	authpriv	Stevey	0x123F00
----------------	-----	----------	--------	----------

## 15 LAG SERVICE CONFIGURATION

OLT adopts dual upstream protection mechanism to ensure the stability of the services. When service interruption occurs due to interruption of the physical connection between the OLT and the upper device, the device will automatically switch to the standby line to ensure the quick recovery of the services.

OLT realizes the load sharing and protection of the upstream port bearing services flow by configuring dynamic/static link aggregation of the upstream port.

Prerequisite:

Link aggregation has been configured on the opposite end device, and the work rate and the VLAN attributes are consistent with the device of this end.

Related Information:

OLT supports two link aggregation modes.

### 15.1 Static Aggregation Mode

It means that multiple physical ports are added directly to the Trunk group to form a logical port. This approach is easy to implement, but it is not conducive to observing the state of the link aggregation port.

### 15.2 Dynamic Aggregation Mode

It means that multiple physical ports are dynamically aggregated to the Trunk group to form a logical port, so as to realize the load sharing of the output/input flow in each member port. LACP automatically generates aggregation to obtain the maximum bandwidth.

The link aggregation function of OLT is in compliant with the following principles.

The member ports must work in full duplex mode, and the work rate must be consistent with the VLAN attributes.

### 15.3 Dynamic Aggregation Configuration

In upstream port configuration mode, enable lACP and the mode.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# lACP // Enable LACP
OLT(config-xe1/1)# lACP active // Configure the LACP mode (or passive)
OLT(config)# interface xe1/2
OLT(config-xe1/2)# lACP // Enable LACP
OLT(config-xe1/2)# lACP active // Configure the LACP mode (or passive)
```

 Note:

*OLT supports 2 types of port aggregation modes.*

- ❖ *Active: LACP active negotiation mode (default mode)*
- ❖ *Passive: LACP passive negotiation mode*
- ❖ *It is suggested to configure the aggregation mode of one end of the port as active, and configure the other end as passive, or configure both ends as active.*

Configure the Priority of LACP System:

```
OLT(config)# lacp system-priority 33333
```

Configure the dynamic aggregation group vlan and the rate.

```
OLT(config)# interface xe1/1
OLT(config-xe1/1)# no shutdown
OLT(config-xe1/1)# speed 1000
OLT(config-xe1/1)#duplex full
OLT(config-xe1/1)# switchport mode trunk
OLT(config-xe1/1)# switchport trunk tag 200
```

```
OLT(config)# interface xe1/2
OLT(config-xe1/2)# no shutdown
OLT(config-xe1/2)# speed 1000
OLT(config-xe1/2)#duplex full
OLT(config-xe1/2)# switchport mode trunk
OLT(config-xe1/2)# switchport trunk tag 200
```

Show aggregation group state:

```
OLT(config)# show trunk verbose
```

```
Flags: A -- LACP_Activity, B -- LACP_timeout, C -- Aggregation, D -- Synchronization, E -- Collecting, F -- Distributing, G -- Defaulted, H -- Expired
```

```
System ID: 08c6-b300-34f5
```

```
System priority: 32768
```

```
Trunk 17: 2 ports, Dynamic, PSC:src-mac
```

Port	Status	Priority	Oper-key	Flag	Link-Status
-----					

xe1/2	S	32768	3	ABCDEF	UP
xe1/1	S	32768	3	ABCDEF	UP

Remote:

Actor	PartnerPriority	Oper-key	System-Id
xe1/2	32768	305	08c6-b3e9-1160
xe1/1	32768	305	08c6-b3e9-1160

## 15.4 Static Aggregation Configuration

The default configuration is trunk 1

```
OLT(config)# interface trunk 1
```

In the upstream port configuration mode, add the port to the aggregation.

```
OLT(config)# interface ge1/1
OLT(config-ge1/1)# trunk 1
```

```
OLT(config)# interface ge1/2
OLT(config-ge1/2)# trunk 1
```

Configure the aggregation group VLAN and rate.

```
OLT(config)# interface ge1/1
OLT(config-ge1/1)# no shutdown
OLT(config-ge1/1)# speed 1000
OLT(config-ge1/1)#switchport mode trunk
OLT(config-ge1/1)# switchport trunk tag 200
```

```
OLT(config)# interface ge1/2
OLT(config-ge1/2)# no shutdown
OLT(config-ge1/2)# speed 1000
OLT(config-ge1/2)#switchport mode trunk
OLT(config-ge1/2)# switchport trunk tag 200
```

### Show the aggregation group.

```
OLT(config)# show trunk
System ID: 08c6-b300-645e
```

Group	Type	Ports
1	Manual	ge1/1 ge1/2

### Show the state of the aggregation state.

```
OLT(config)# show trunk verbose
Flags: A -- LACP_Activity, B -- LACP_timeout, C -- Aggregation, D --
Synchronization, E -- Collecting, F -- Distributing, G -- Defaulted, H --
Expired
```

```
System ID: 08c6-b300-645e
System priority: 0
```

```
Trunk 1: 2 ports, Manual, PSC:src-mac
```

```
Local:
```

Port	Status	Priority	Oper-key	Flag	Link-Status
ge1/1	-	32768	0	-	UP
ge1/2	-	32768	0	-	UP

## 15.5 Load Balancing

OLT supports three types of load balancing modes for the traffic (source MAC based, destination MAC based and source+destination MAC based). The default value is simultaneously source and destination MAC based.

OLT Configuration (Take source MAC as an example)

```
OLT(config)# interface trunk 1
OLT(config-trunk1)# load-balance src-mac
```



## 16 ALARM MANAGEMENT

OLT alarms include: power supply is not in place. The power supply input voltage is too low, and fan is not in place. The fiber is disconnected from the uplink port, and fiber is disconnected from the PON port. The power is turned off at the ONU, and fiber is disconnected from the ONU. The network is dropped from the ONU\_UNI port, and optical power is high at the ONU. The ONU receives the warning message that the optical power is too high.

Table 14- 1 Alarm Information

Alarm interface	Alarm report content	Alarm related information
PON port alarm	PON_LOS	Loss PON signal
Upstream port alarm	OLT_Ethernet_LOS	Loss uplink signal
ONU alarm	ONU_OFF	ONU offline
	OLT_PON_Unconfig_ONU	ONU is not registered
	ONU_Dying_Gasp	ONU power down
	MAC-MOVE	MAC address spoofing
ONU ani alarm	ONU_PON_Rx_Power_Low	The ONU received optical power exceeds the lower threshold
	ONU_PON_Rx_Power_High	The ONU received optical power exceeds the upper threshold
	ONU_PON_Signal_Fail	Loss ONU signal
	ONU_PON_Signal_Degrade	signal attenuation
	ONU_PON_Tx_Power_Low	The ONU transmit optical power exceeds the lower threshold
	ONU_PON_Tx_Power_High	The ONU transmit optical power exceeds the upper threshold
	ONU_PON_LaserBiasCurrent	ONU current voltage and current parameters exceed the

		threshold
	ONU_LOOP_Detect	ONU loop detection
ONU uni alarm	ONU_UNI_LAN_LOS	Loss of UNI port cable signal
Equipment alarm	EQPT_Missing	The deficiency of fan, power supply, or board
	EQPT_Mismatch	Board type mismatch
	EQPT_Power_Supply_Issue	Abnormal power supply
	EQPT_Temp_Major	Board temperature exceeds the lower threshold
	EQPT_Temp_Critical	Board temperature exceeds the upper threshold
	EQPT_Comm_Fail	Card communication failure
	EQPT_FAN_Major	The current fan speed is less than 10% of the configured speed
	EQPT_FAN_Critical	FANs stop
	Pluggable_Missing	Optical module is not in place
	Pluggable_Fail	Optical module failure
	Pluggable_Power_Too_High_Rx	The optical module received power is too high
	Pluggable_Power_Too_Low_Rx	The receiver optical power of optical module is too low
	Pluggable_Power_Too_High_Tx	The transmitter optical power of the optical module is too high
	Pluggable_Power_Too_Low_Tx	The transmitter power of the optical module is too low

SFP alarm	Pluggable_BiasCurrent_Too_High	Optical module bias current is too high
	Pluggable_BiasCurrent_Too_Low	Optical module bias current is too low
	Pluggable_Temp_Too_High	The temperature of the optical module is too high
	Pluggable_Temp_Too_Low	The temperature of the optical module is too low
	Pluggable_Vcc_Too_High	Optical module voltage is too high
	Pluggable_Vcc_Too_Low	Optical module voltage is too low
	Pluggable_Rx_Power_High_Warning	Optical module receiving power is high
	Pluggable_Rx_Power_Low_Warning	Optical module receives low power
	Pluggable_Tx_Power_High_Warning	Optical module transmit power is high
	Pluggable_Tx_Power_Low_Warning	Optical module transmit power is low
	Pluggable_BiasCurrent_High_Warning	Optical module bias current is high
	Pluggable_BiasCurrent_Low_Warning	Optical module bias current is low
	Pluggable_Temp_High_Warning	The temperature of the optical module is high
	Pluggable_Temp_Low_Warning	The temperature of the optical module is low
Pluggable_Vcc_High_Warning	The optical module voltage is high	

Pluggable\_Vcc\_Low\_Warning

Low optical module voltage

## 16.1 RSSI Alarm

RSSI (Received Signal Strength Indication) indicates that the OLT can configure alarm thresholds for optical module parameters, including warning and alarm thresholds for optical power, received optical power, bias current, voltage, and temperature. The default profile ID is 0. The profile cannot be deleted. The profile can be customized. The same profile can configure all attributes at the same time.

Show the threshold alarm profile of default optical module:

```
OLT(config)# show optical-module threshold-profile 0
-----
-----
Optical-module threshold-profile 0
Description           : alarm-low warning-low warning-high alarm-high
Txpwr-threshold(dbm) : -14.00   -12.00     8.00     9.00
Rxpwr-threshold(dbm) : -34.00   -30.00     2.00     3.00
Bias-threshold(mA)   : 2.00     7.00    110.00  131.00
Vcc-threshold(V)     : 2.97     3.14     3.47     3.63
Temp-threshold(C)    : -45.00  -15.00    80.00   90.00
```

Step 1: Alarm thresholds for each parameter of the optical distribution module:

```
OLT(config)# optical-module threshold-profile 1 txpwr-threshold -20 -15 -10 -5
OLT(config)# optical-module threshold-profile 1 rxpwr-threshold -40 -35 -25 -20
OLT(config)# optical-module threshold-profile 1 bias-threshold 0 1 2 3
OLT(config)# optical-module threshold-profile 1 vcc-threshold 0 1 2 3
OLT(config)# optical-module threshold-profile 1 temp-threshold -50 -40 -20 -10

OLT(config)# show optical-module threshold-profile all
-----
-----
Optical-module threshold-profile 0
Description           : alarm-low warning-low warning-high alarm-high
```

Txpwr-threshold (dbm)	:	-14.00	-12.00	8.00	9.00
Rxpwr-threshold (dbm)	:	-34.00	-30.00	2.00	3.00
Bias-threshold (mA)	:	2.00	7.00	110.00	131.00
Vcc-threshold (V)	:	2.97	3.14	3.47	3.63
Temp-threshold (C)	:	-45.00	-15.00	80.00	90.00

-----

-----

Optical-module threshold-profile 1

Description	:	alarm-low	warning-low	warning-high	alarm-high
Txpwr-threshold (dbm)	:	-20.00	-15.00	-10.00	-5.00
Rxpwr-threshold (dbm)	:	-40.00	-35.00	-25.00	-20.00
Bias-threshold (mA)	:	0.00	1.00	2.00	3.00
Vcc-threshold (V)	:	0.00	1.00	2.00	3.00
Temp-threshold (C)	:	-50.00	-40.00	-20.00	-10.00

### Step 2: Show the alarm profile of all current optical module:

```
OLT(config-ge1/1)# optical-module-threshold-profile 1
OLT(config-gpon-olt1/1)# optical-module-threshold-profile 1
```

### Step 3: Apply the profile to the uplink port or PON port:

```
OLT(config-ge1/1)# optical-module-threshold-profile default
OLT(config-gpon-olt1/1)# optical-module-threshold-profile default
```

Restore the alarm parameter threshold of the uplink or PON optical module:

## 16.2 ONU MAC Address Spoofing Alarm

MAC address spoofing means that: In a VLAN, there are two outgoing interfaces for a MAC address, and the learned outgoing interface overrides the original outgoing interface. For the Layer 2 loop that may exist in the actual use environment, the OLT supports the MAC address drift detection function on the user side. By default, this function is de-enabled.

Enable ONU MAC address spoofing detection:

```
OLT(config-gpon-onu1/1:1)# service-port 1 mac-move enable
```

Disable MAC address spoofing detection on the ONU:

```
OLT(config-gpon-onu1/1:1)# no service-port 1 mac-move
```

 **Note:**

*If MAC address spoofing occurs, a related MAC-MOVE alarm will be generated.*

### 16.3 ONU Loop Detection Alarm

The OLT supports the loop detection function of the ONU port. This function must be enabled on the ETH interface of the ONU.

Enable loop detection on the ONU ETH port:

```
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/1 enable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/2 enable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/3 enable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/4 enable
```

Disable the loop detection function on the ONU ETH port:

```
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/1 disable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/2 disable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/3 disable
OLT(config-gpon-onu1/1:1)# remote loop_detect uni eth_1/4 disable
```

 **Note:**

*The ONU needs to report its UNI information and support loop detection.*

## 16.4 Show Alarm

Use the following command to show the current alarm information of the NE:

```
OLT(config)# show current-alarm
```

```
-----  
gpon-onu1/2:1      ONU_PON_HIGH_TRANS_OPTPOWER      2018-01-13 16:48:14  
gpon-onu1/2:4      ONU_PON_SD                          2018-01-15 11:08:39  
ne-power2          EQPTMISSNG                          2016-07-20 11:38:20
```

## 17 PORT STATISTICS & PM MANAGEMENT

OLT currently supports the port statistics on the upstream port and the PON port, as well as the performance statistics on ONU and gem. Among them, it does not need to enable the port statistics (see port statistics on the upstream port and port statistics on the PON port). And it can clear the statistics through clear counters + the corresponding port. The performance statistics does not support manual clearance. When it is connected to the NMS, it will automatically report to the network management every 15 minutes.

The diagram of the statistics on each port and the PM management is as follows:

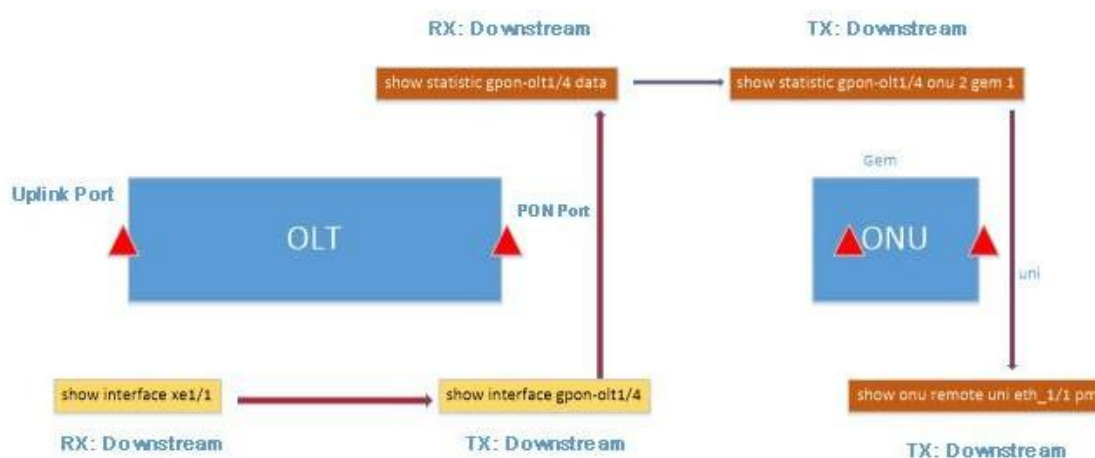


Figure 15- 1 Statistics on Each Port & PM Management Diagram

### 17.1 Statistics on Port Messages

#### 17.1.1 Information statistics of the uplink port

This command is used to view the statistic information of the Ethernet port. If it needs to use the statistic information of the Ethernet port to judge whether the device is in normal operation, this command can be used.

Show port statistics:

```
OLT(config)# show interface ge1/1
ge1/1          : up
Hardware address : 08c6-b300-6461
Media type     : MEDIUM_FIBER
Loopback       : NONE
Autonegotiation : enable
Flow control   : on  receive:  on
transmit Speed : 1000      Duplex-full
```



```
Max frame size      : 12284
Ifindex             : 0x2010003
Port link-type      : access
PVID                : 46
RxPackets           : 9225
RxBytes             : 1311376
RxBcast             : 397
RxMcast             : 946
RxPause             : 0
RxInjabber          : 0
RxEerrors           : 0
RxCRCerrors         : 0
RxDrops             : 115
TxPackets           : 14750
TxBytes             : 4600514
TxBcast             : 5
TxMcast             : 3150
TxPause             : 0
TxCollision         : 0
TxErrors            : 0
TxDrops             : 1
```

Clear the message statistics of the upstream port:

```
OLT (config)# clear counters
```

Clear the message statistics of single uplink port

```
OLT (config)# clear counters ge1/1
```

Table 15- 1 Parameter Description of Message Statistics for the Upstream Port

Item	Description	Item	Description
ge1/1	The port that is currently displayed.	PVID	The configured pvid which is 1 by default.
Hardware address	MAC address of the port	Tag vid	The configured tag list.
Media type	The current optical module type	Untag vid	The stripped vid from the output of Hybrid type
loopback	Whether it is loopback	RxPackets	The number of the messages received by the port.
Autonegotiation	Self-adaptive which is not supported currently.	RxBytes	The number of bytes received by the port.
Flow control transmit	Flow control switch	RxBcast	The number of broadcast messages received by the port.
Speed	The configured rate, full duplex	RxMcast	The number of multicast messages received by the port
Max frame size	The maximum transmitting frame size	RxPause	The number of the paused frames received by the port.
Ifindex	Port Index Number	RxInjabber	The number of big frames received by the port.
Port link-type	Port Type	RxErrors	The number of error frames received by the port.
RxCRCErrors	The CRC checkout error frame received by the port.	TxMcast	The number of multicast messages transmitted by the port.

RxDrops	the number of discarded messages received by the port	TxPause	The number of paused frames transmitted by the port.
TxPackets	The number of the messages transmitted by the port.	TxCollision	The number of conflicting frames transmitted by the port.
TxBytes	The number of bytes transmitted by the port.	TxErrors	The number of error frames transmitted by the port.
TxBcast	The number of broadcast messages transmitted by the port	TxDrops	The number of discarded messages transmitted by the port.

### 17.1.2 Message Statistics of the PON Port

This command is used to query the statistics of the PON port. This command is required when judging the operation of the device according to the statistical information of PON port.

```
OLT(config)# show interface gpon-olt1/1

gpon-olt1/1          : up
Hardware address    : 08c6-b300-6466
Media type          : MEDIUM_FIBER
loopback            : NONE
Autonegotiation     : enable
Flow control transmit : on  receive:  on
Speed               : 2500      Duplex-full
Max frame size      : 12284
Ifindex             : 0x9010008
Port link-type      : access
PVID                : 1
RxPackets           : 15
RxBytes             : 1164
```

```

RxBcast           : 0
RxMcast           : 0
RxPause           : 0
RxInjabber        : 0
RxErrors          : 0
RxCRCErrors       : 0
RxDrops           : 0
TxPackets         : 39
TxBytes           : 5223
TxBcast           : 0
TxMcast           : 21
TxPause           : 0
TxCollision       : 0
TxErrors          : 0
TxDrops           : 0

```

Clear the message statistics of the upstream port:

```
OLT(config)# clear counters gpon-olt1/1
```

Table 15- 2 P Statistical Parameters of PON Packets

Parameter	Parameter Description	Parameter	Parameter Description
gpon-olt1/1	Currently displayed port	PVID	Pvid configured, defaults to 1
Hardware address	Port MAC address	RxPackets	Number of packets received on the port
Media type	Current optical module type	RxBytes	The number of bytes received by the port
loopback	Whether loopback	RxBcast	Number of broadcast packets received by the port

Autonegotiation	Adaptive, not currently supported	RxMcast	Number of multicast packets received on the port
Flow control transmit	Flow control switch	RxPause	The number of pause frames received by the port
Speed	Configure the rate, full duplex	RxInjabber	The number of jumbo frames received by the port
Max frame size	Maximum transmission of frame size	RxErrors	The number of error frames received by the port
Ifindex	Port index number	RxCRCErrors	Received CRC check error frame on the port
Port link-type	Port type	RxDrops	Number of discarded packets received on the port
TxPackets	Number of packets sent by the port	TxPause	The number of pause frames sent by the port
TxBytes	The number of bytes sent by the port	TxCollision	The number of collision frames sent by the port
TxBcast	Number of broadcast packets sent by the port	TxErrors	The number of error frames sent by the port
TxMcast	Number of multicast packets sent by the port	TxDrops	Number of discarded packets sent by the port

 **Note:**

*The port count does not need to be enabled. If the value of the item is 0, it indicates that no frame of this type is received or there is no traffic currently on the port.*

## 17.2 PM Statistics

The following commands are used to query the PON port, ONU, and GEM performance statistics.

### 17.2.1 PM Statistics of PON Port

Enable performance statistics for data packets and protocol packets separately:

```
OLT(config)# interface gpon-olt1/1
OLT(config-gpon-olt1/1)# pm protocol enable
OLT(config-gpon-olt1/1)# pm data enable
```

Show data packet performance statistics:

```
OLT(config)# show statistic gpon-olt1/1 data
the olt data statistic:
Rxframes64                :0
Rxframes65_127            :0
Rxframe128_255            :0
Rxframe256_511            :0
Rxframe512_1023           :0
Rxframe1024_1518          :0
Rxframe1519_2047          :0
Rxframe2048_4095          :0
Rxframe4096_9216          :0
Rxframe9217_16638         :0
Rxframes                   :0
RxBytes                    :0
RxGoodframes              :0
RxUcastframes             :0
RxMcastframes             :0
RxBcastframes             :0
RxFcsError                 :0
```

RxCtrlframes	:0
RxPauseFrames	:0
RxPfcframes	:0
RxUnsupportOpcode	:0
RxUnsupportDa	:0
RxAlignError	:0
RxLenOutofrange	:0
RxCodeErrors	:0
RxOversizeFrame	:0
RxJabberFrame	:0
RxMtuCheckerror	:0
RxPromiscuousFrame	:0
Rxtruncatedframes	:0
RxUndersizeframes	:0
RxFragmentframes	:0
RxRuntframes	:0
TxFrame64	:0
TxFrame65_127	:0
TxFrame128_255	:0
TxFrame256_511	:0
TxFrame512_1023	:0
TxFrame1024_1518	:0
TxFrame1519_2047	:0
TxFrame2048_4095	:0
TxFrame4096_9216	:0
TxFrame9217_16638	:0
TxFrames	:0
TxBytes	:0
TxGoodFrames	:0
TxUcastFrames	:0

```

TxMcastFrames           : 0
TxBcastFrames           : 0
TxPauseFrames           : 0
TxPfcFrames             : 0
TxJabberFrames          : 0
TxFcsErrors             : 0
TxCtrlFrames            : 0
TxOversizeFrames        : 0
TxFragmentedFrames      : 0
TxErrorFrames           : 0
TxRuntFrames            : 0
TxUnderrunFrames        : 0
    
```

Table 15- 3 Statistical Parameters of PON Port Data Packets

Parameter	Parameter Description	Parameter	Parameter Description
Rxframes64	Number of received 64-byte packets	RxUndersizeframes	Receive ultra-small frames
Rxframes65_127	Number of received 65-127 byte packets	RxFragmentframes	Number of received fragment packets
Rxframe128_255	Number of received 128-255 byte packets	RxRuntframes	Number of received Runt frames
Rxframe256_511	Number of received 256-511 byte packets	TxFrame64	Number of 64-byte packets sent
Rxframe512_1023	Number of received 512-1023 byte packets	TxFrame65_127	Number of 65-127 byte packets sent
Rxframe1024_1518	Number of received 1024-1518 byte packets	TxFrame128_255	Number of sent 128-255 bytes
Rxframe1519_2047	Number of received 1519-2047 byte packets	TxFrame256_511	Number of sent 256-511 byte packets



7			
Rxframe2048_4095	Number of received 2048-4095 bytes	TxFramе512_1023	Number of 512-1023 byte packets sent
Rxframe4096_9216	Number of received 4096-9216 byte packets	TxFramе1024_1518	Number of 1024-1518 byte packets sent
Rxframe9217_16638	Number of received 9217-16638 byte packets	TxFramе1519_2047	Number of 1519-2047 bytes sent
Rxframes	Total number of received packets	TxFramе2048_4095	Number of sent 2048-4095 bytes
RxBytes	Number of received bytes	TxFramе4096_9216	Number of packets sent 4096-9216 bytes
RxGoodframes	Number of receive good packets	TxFramе9217_16638	Number of 9217-16638 byte packets sent
RxUcastframes	Number of received unicast packets	TxFrames	Number of received packets
RxMcastframes	Number of received multicast packets	TxBytes	The number of bytes received
RxBcastframes	Number of received broadcast packets	TxGoodFrames	Number of received packages
RxFcsError	Number of FCS errors received	TxUcastFrames	Number of received unicast packets
RxCtrlframes	Number of received CTRL packets	TxMcastFrames	Number of received multicast packets
RxPauseFrames	Receive PAUSE frames	TxBcastFrames	Number of received broadcast packets
RxPfcframes	Receive PFC frames	TxPauseFrames	Receive PAUSE frames
RxUnsupportOpcode	Number of received OpCode packets not received	TxPfcFrames	Number of received PFC frames

RxUnsupportDa	Number of received DA packets not received	TxJabberFrames	Number of Jabber frames received
RxAlignError	The number of bytes received for its error message	TxFcsErrors	Number of received FCS errors
RxLenOutofrange	Number of received length limit messages	TxCtrlFrames	Number of received CTRL packets
RxCodeErrors	Number of received error codes	TxOversizeFrames	Number of received long messages
RxOversizeFrame	Number of received long messages	TxFragmentedFrames	Number of received fragmented packets
RxJabberFrame	Receive Jabber frames	TxErrorFrames	Number of error packets sent
RxMtuCheckerror	Receive MTU check failed frames	TxRuntFrames	Receive Runt frames
RxPromiscuousFrame	Received chaotic packets	TxUnderrunFrames	Receive ultra-small frames
Rxtruncatedframes	Receive shortened packets		

Show protocol packet performance statistics:

```
OLT(config)# show statistic gpon-olt1/1 protocol
the olt statistic:
```

```
FecCodeWordsUncorrect:    0
Bip8Bytes:                0
Bip8Errors:               0
RxGemDropped:             0
RxGemIdle:                0
RxGemCorrtected:         0
```

```

RxGemIllegal:          0
RxAllocationsValid:   0
RxAllocationsInvalid: 0
RxAllocationsDisabled: 0
RxPloams:             0
RxPloamsNonIdle:      0
RxPloamsError:        0
RxPloamsDropped:      0
RxCpu:                0
RxOmci:               0
RxDroppedTooShort:    0
RxDroppedTooLong:     0
RxCrcErrors:          0
RxKeyErrors:          0
RxFragmentsErrors:    0
RxPacketsDropped:     0
TxGem:                0
TxPloams:             0
TxCpu:                0
TxOmci:               1434
TxDroppedIllegalLength: 0
TxDroppedTpidMiss:    0
TxDroppedVidMiss:     0

```

Table 15- 4 Statistical Parameters of PON Port Protocol Packets

Parameter	Parameter Description	Parameter	Parameter Description
FecCodeWordsUncorrect	the number of FEC error code	RxOmci	the number of receive of OMCI messages

Bip8Bytes	the number of Bip8 bytes	RxDroppedTooShort	the number of discarded ultra-short messages received
Bip8Errors	Number of Bip8 error bytes	RxDroppedTooLong	Number of received and dropped long messages
RxGemDropped	Number of frames received by GEM frames	RxCrcErrors	Number of received CRC check error packets
RxGemIdle	Number of non-meaningful frames that receive GEM frames	RxKeyErrors	Number of received key check error packets
RxGemCorrected	The number of normal frames received GEM frames	RxFragmentsErrors	Number of received fragmented error packets
RxGemIllegal	Number of illegal frames received in GEM frames	RxPacketsDropped	Total number of discarded packets received
RxAllocationsValid	Number of valid frames allocated for receiving memory	TxGem	Number of GEM frames sent
RxAllocationsInvalid	Number of invalid frames received for memory allocation	TxPloams	Number of PLOAM frames sent
RxAllocationsDisabled	Receive memory allocation to enable frame number	TxCpu	The number of packets sent to the CPU
RxPloams	Number of PLOAM frames received	TxOmci	Number of OMCI packets sent
RxPloamsNonIdle	Number of PLOAM non-idle frames received	TxDroppedIllegalLength	Number of discarded illegal length packets

RxPloamsError	Number of PLOAM error frames received	TxDroppedTpidMiss	Number of dropped TPID missing packets
RxPloamsDropped	The number of discarded frames received PLOAM frames	TxDroppedVidMiss	Number of sent and dropped VID missing packets
RxCpu	Number of packets received from the CPU		

### 17.2.2 ONU PM Statistics

Enable ONU performance statistics:

```
OLT(config-gpon-onu1/1:1)# pm enable
```

Show ONU performance statistics:

```
OLT(config)# show statistic gpon-olt1/1 onu 1
FecCodeWords:          0
FecBytesCorrected:     0
FecCodeWordsCorrected: 0
FecCodeWordsUncorrected: 0
Bip8Bytes:             920780288
Bip8Errors:            0
RxPloamsCrcError:      0
RxPloamsNonIdle:       2
PositiveDrift:          0
NegativeDrift:          11606
RxOmciPacketsCrcError: 0
BerReported:           0
UnreceivedBurst:       0
opmLcdgErrors:         0
```

opmRdiErrors: 0

Table 15- 5 Description of ONU performance statistics

Parameter	Parameter Description	Parameter	Parameter Description
FecCodeWords	Number of FEC code word	PositiveDrift	Positive offset statistics
FecBytesCorrected	FEC codeword correct number of bytes	NegativeDrift	Negative offset statistics
FecCodeWordsCorrected	Number of FEC correct code word	RxOmciPacketsCrcError	The number of CRC check errors received by the OMCI packet
FecCodeWordsUncorrected	Number of FEC error code word	BerReported	Ber record
Bip8Bytes	Bip8 bytes	UnreceivedBurst	Unaccepted burst
Bip8Errors	Number of Bip8 error bytes	opmLcdgErrors	LCDG error statistics
RxPloamsCrcError	Number of received PLOAM CRC check errors	opmRdiErrors	RDI error statistics
RxPloamsNonIdle	Number of non-idle numbers receiving PLOAM		

### 17.2.3 GEM PM Statistics

Enable ONU GEM performance statistics:

```
OLT(config-gpon-onu1/1:1)# gemport 1 pm enable
```

Show the GEM performance statistics of ONU:

```
OLT(config)# show statistic gpon-olt1/1 onu 1 gem 1
gem statistic:
```

```
RxPackets: 1
```

```
RxBytes:          64
TxPackets:        8
TxBytes:          2382
```

Table 15- 6 Description of ONU GEM performance statistics

Parameter	Parameter Description	Parameter	Parameter Description
RxPackets	Received packets	TxPackets	Received packets
RxBytes	Received bytes	TxBytes	Received bytes

#### 17.2.4 UNI PM Statistics

Enable the performance statistics of the ONU UNI:

```
OLT(config-gpon-onu1/1:1)# remote uni eth_1/1 pm enable
```

Show the performance statistics of ONU UNI:

```
OLT(config-gpon-onu1/1:1)# show onu remote uni eth_1/1 pm
GPON-ONU1/1:1 eth_1/1 Statistics
RxByte:          0
RxPkt:           0
BcPkt:           0
McPkt:           0
FcsErr:          0
AlignmentErr:    0
PppoeDrop:       0
RxBufOverflow:   0
TxBufOverflow:   0
TxCollision:     0
PktLessThan64:  0
Pkt64:           0
Pkt65To127:     0
Pkt128To255:    0
Pkt256To511:    0
```

```

Pkt512To1023:    0
Pkt1024To1518:  0
PktLargerThan1518:0

```

Table 15- 7 Description of ONU UNI performance statistics

Parameter	Parameter Description	Parameter	Parameter Description
RxByte	Number of Received bytes	PktLessThan64	Number of Less than 64 byte packets
RxPkt	Number of Received packets	Pkt64	Number of 64-byte packets Received
BcPkt	Number of broadcast packets	Pkt65To127	Number of 65-127 byte packets
McPkt	Number of multicast packets	Pkt128To255	Number of 128-255 byte packets
FcsErr	FCS check error number	Pkt256To511	Number of 256-511 byte packets
AlignmentErr	Number of calibration errors	Pkt512To1023	Number of 512-1023 byte packets
PppoeDrop	Number of discarded PPPOE packets	Pkt1024To1518	Number of 1024-1518 byte packets
RxBufOverflow	Receive buffer overflow times	PktLargerThan1518	The number of packets larger than 1518 bytes
TxBufOverflow	The number of send buffer overflows	FrmTooLong	The number of ultra-long frames
TxCollision	Number of conflicting packets sent		

 **Note:**

*The PM statistics is based on 15 minutes of performance statistics collection.*

*The first 15 minutes after the performance statistics are turned on is the first interval. The NE can only see the previous performance statistics.*