



Optical Line Terminals

LTP-8X, LTP-4X

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1 Terms and definitions

CBR – Constant bitrate

DBA – Dynamic bandwidth allocation

ERPS – Ethernet Ring Protection Switching

FTP – File Transfer Protocol

FW – Firmware

GPON – Gigabit PON

HSI – High Speed Internet

IGMP – Internet Group Management Protocol

IP – Internet protocol

MLD – Multicast Listener Discovery

OLT – Optical Line Terminal

ONT – Optical Network Terminal

ONU – Optical Network Unit

PCB – Printed Circuit Board

SLA – Service Level Agreement

SNTP – Simple Network time protocol

SNMP – Simple Network Management Protocol


SFP – Small Form-factor Pluggable


TFTP – Trivial File Transfer Protocol

URI – Uniform Resource Identifier

VEIP – Virtual Ethernet Interface Point

Notes and warnings

 Notes contain important information, tips or recommendations on device operation and setup.

 Warnings are used to inform the user about situations that may cause harm to a software and hardware complex, lead to malfunction or data loss.

 Additional information, clarifications.

2 General information

2.1 Introduction

A GPON is a network of passive optical networks (PON) type. It is one of the most effective state-of-the-art solutions for the 'last mile' issue that significantly reduces the required amount of cable and provides data transfer with downstream rate up to 2.5 Gbps and upstream rate up to 1.25 Gbps. Being used in access networks, GPON-based solutions allow end users to have access to new services based on IP protocol in addition to more common ones.

The key GPON advantage is the use of one optical line terminal (OLT) for multiple optical network terminals (ONT). OLT converts Gigabit Ethernet and GPON interfaces and is used to connect a PON network with data communication networks of a higher level.

The range of OLT GPON equipment produced by Eltex comprises of LTP-4X/LTP-8X terminals with internal Ethernet switch with RSSI function and 4/8 GPON ports respectively.

This user manual describes purpose, main technical specifications, installation order, rules of configuration, monitoring, and software update for the devices.

2.2 Purpose

The LTP-8X/4X optical line terminal is designed to establish connection with upstream equipment and provide broadband access across passive optical networks. Ethernet connection is established through Gigabit uplink and 10GBASE-X interfaces, GPON interfaces are used to connect to optical networks. Each PON interface allows connection of up to 128 subscriber optical terminals through one fibre and supports dynamic bandwidth allocation (DBA).

The following services are provided to end users:

- voice communications;
- HDTV;
- VoIP;
- high-speed access to the Internet;
- IPTV;
- video-on-demand (VoD);
- video conferencing;
- online educational and entertainment programs.

The device supports the following functions:

- dynamic bandwidth allocation (DBA);
- support for quality assurance mechanisms (QoS), Strict priority + WRR, GPON ports prioritisation for different types of traffic according to 802.1p;
- security functions;
- ONT remote control, automatic detection of new ONTs;
- FEC errors correction;
- power measurement support for signals received from each ONT (RSSI)1;
- VLAN organisation (VLAN ID range: 0–4094);
- MAC address filtering, 16000 entries in the MAC table;
- support for IGMP snooping v1/2/3, IGMP proxy;
- support for DHCP snooping, DHCP relay agent;
- support for PPPoE IA;
- support for Jumbo Frames up to 2000 bytes (supported on NTU-1 and SFP-NTU-100).

2.3 Delivery package

The standard delivery package includes:

1. LTP-4X/8X optical line terminal;
2. Mounting set for 19" rack;
3. RS-232 DB9(F) – DB9(F) console cable for LTP rev.B; RJ-45 – DB9(F) console cable for LTP rev.C and rev.D;
4. CD with User Manual and Quick Configuration Manual (optionally);
5. Power cable (if equipped with 220 V power module);
6. Passport.

2.4 Technical specifications

Table 1 – Main specifications of the line terminal

Interfaces		
Number of Ethernet interfaces	LTP-8X	10
	LTP-4X	6
Connector	RJ-45	SFP
Data rate	10/100/1000 Mbps duplex/half-duplex	1000/10000 Mbps duplex
Standards	10/100BASE-TX, 1000BASE-T	1000BASE-X, 10GBASE-X
Standards	IEEE 802.1D, IEEE 802.1p, IEEE 802.1Q	
Number of PON interfaces	LTP-8X	8
	LTP-4X	4
Connector type	SC/UPC (socket) in accordance with ITU-T G.984.2, FSAN Class B+, FSAN Class C++, SFF-8472	
Transmission medium	Fibre optical cable SMF – 9/125, G.652	
Standards	Digital RSSI (Received Signal Strength Indication)	
Splitting ratio	1:4, 1:8, 1:16, 1:32, 1:64, 1:128	
	Class B+	Class C++
Range of coverage	20 km	40 km
Transmitter	1490 nm DFB Laser	1490 nm DFB Laser
Data rate	2488 Mbps	2488 Mbps
Average output power	+1,5..+5 dBm	+7..+10 dBm
Spectral linewidth with -20dB	1.0 nm	1.0 nm
Receiver	1310 nm APD/TIA	1310 nm APD/TIA
Data rate	1244 Mbps	1244 Mbps
Receiver sensitivity	-28 dBm	-32 dBm
Receiver optical overload	-8 dBm	-12 dBm

Processor		
Clock frequency	800 MHz	
Core quantity	1	
RAM	LTP-4X/8X rev.B	512 MB
	LTP-4X/8X rev.C	512 MB
	LTP-4X/8X rev.D	512 MB
Non-volatile memory	LTP-4X/8X rev.B	512 MB
	LTP-4X/8X rev.C	512 MB
	LTP-4X/8X rev.D	512 MB
Switch		
Bandwidth	128 Gbps	
MAC table	16K entries	
VLAN support	up to 4K in accordance with 802.1Q	
Quality of Service (QoS)	8 prioritized egress queues per port	
Control		
Local control	CLI – Command Line Interface	
Remote control	CLI (SSH2, Telnet), SNMP	
Monitoring	CLI, SNMP	
Access restriction	by password, IP address, MAC address, privilege level	
General parameters		
Power supply	AC: 150–250 V, 50 Hz DC: 36–72 V	
	Power supply options for LTP-4X/8X rev.C, LTP-4X/8X rev.D: <ul style="list-style-type: none"> • single AC or DC power supply; • two hot-swappable AC or DC power supplies. 	
Maximum power consumption	LTP-8X rev.B	no more than 50 W
	LTP-8X rev.C/rev.D	no more than 55 W
	LTP-4X rev.B	no more than 40 W
	LTP-4X rev.C/rev.D	no more than 50 W
Operating temperature range	from -5 to +40 °C	
Relative humidity	up to 80 %	
Dimensions (W × H × D)	19", 1U	
	Dimensions with installed power module:	
	LTP-4X/8X rev.B	430 × 44 × 259 mm
	LTP-4X/8X rev.C	430 × 44 × 317 mm
	LTP-4X/8X rev.D	430 × 44 × 317 mm

Weight	Complete set	
	LTP-4X/8X rev.B	no more than 3.5 kg
	LTP-4X/8X rev.C	no more than 5 kg
	LTP-4X/8X rev.D	no more than 5 kg
	Modules	
	Power module	0.5 kg

2.5 Compatible SFP transceivers

Correct and error-free operation of GPON interface requires exact parameters to be chosen and set for each transceiver type. This can be done only under laboratory conditions by the terminal vendor. The following table lists SFP transceivers for which seamless terminal operation is guaranteed.

DDMI (Digital Diagnostic Monitoring Interface) provides information on transceiver parameters, such as temperature, supply voltage, etc. DDMI also measures the level of ONT signal (RSSI). All compatible transceivers support this function.

Table 2 – List of compatible SFP transceivers

Vendor	SFP transceiver model	Class	DDMI
NEOPHOTONICS	PTB38J0-6538E-SC	B+	+
NEOPHOTONICS	38J0-6537E-STH1+	C++	+
NEOPHOTONICS	38J0-6537E-STH2+	C++	+
NEOPHOTONICS	38J0-6537E-STH3+	C++	+
Ligent Photonics	LTE3680M-BC	B+	+
Ligent Photonics	LTE3680M-BH	B+	+
Ligent Photonics	LTE3680P-BC	C+	+
Ligent Photonics	LTE3680P-BC+1	C+	+
Ligent Photonics	LTE3680P-BH	C+	+
Ligent Photonics	LTE3680P-BC2	C++	+
Fanghang	DLOLT43BCDS20	B+	+
Fanghang	DLOLT43CCDS20	C+	+
Fanghang	FH-DLT43CCDS20	C+	+
Hisense	LTE3680M-BC+	B+	+
Hisense	LTE3680P-BC+1	C+	+
Hisense	LTE3680P-BC+2	C++	+

2.6 Design

2.6.1 Front panel

The devices have a metal housing available for 19" form-factor rack mount; housing size is 1U. The front panel layout is shown in the figures below. Tables 3 and 4 list connectors, LEDs and controls located on the front panel of the terminal.

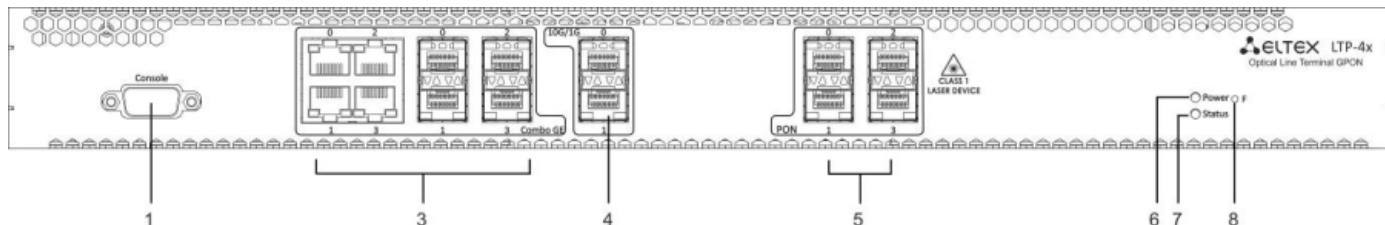


Figure 1 – LTP-4X rev.B front panel layout

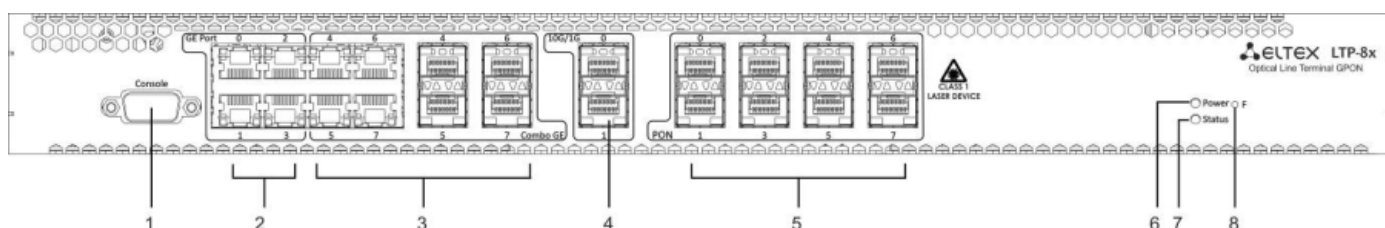


Figure 2 – LTP-8X rev.B front panel layout

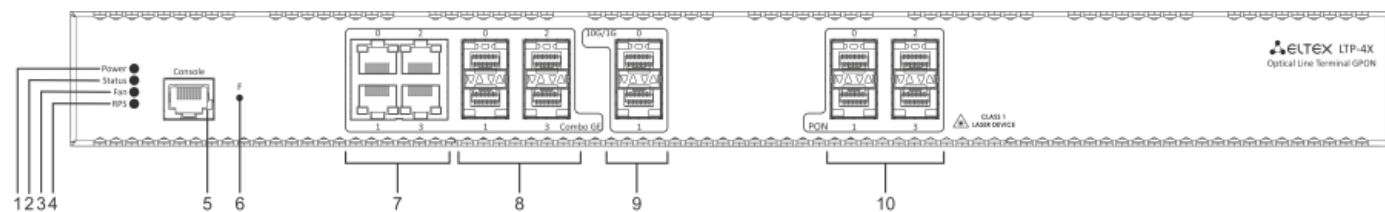


Figure 3 – LTP-4X rev.C/rev.D front panel layout

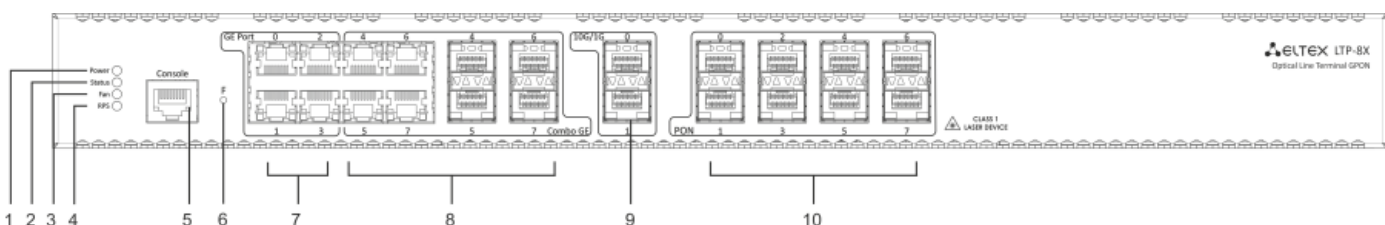



Figure 4 – LTP-8X rev.C/rev.D front panel layout

Table 3 – Description of the connectors, LEDs, and controls located on the front panel of LTP-4X/8X rev.B

#	Front panel element	Description	
1	Console	RS-232 console port for local control of the device	
2	GE Port 0..3	4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-8X)	
3	Combo GE	0..3	4 chassis for SFP modules of 1000BASE-X uplink interface for connection to IP networks (for LTP-4X)
			4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-4X)
		4..7	4 chassis for SFP modules of 1000BASE-X uplink interface for connection to IP networks (for LTP-8X)
			4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-8X)
4	10G/1G 0..1	2 chassis for SFP modules of 10GBase/1000BASE-X uplink interface for connection to IP networks	
5	PON	4 chassis for SFP modules of xPON 2.5 G (for LTP-4X)	
		8 chassis for SFP modules of xPON 2.5 G (for LTP-8X)	
6	Power	Device power indicator	
7	Status	Device operation indicator	
8	F	<p>Functional key that reboots the device and resets it to factory default configuration:</p> <ul style="list-style-type: none"> • pressing the key for less than 10 seconds reboots the device; • pressing the key for more than 10 seconds resets the device to factory default configuration. <p>Configuring the response to a button click performs in the terminal CLI, for detailed description see Section System environment configuration.</p>	

Table 4 – Description of the connectors, LEDs, and controls located on the front panel of LTP-4X/8X rev.C, LTP-4X/8X rev.D

#	Front panel element	Description	
1	Power	Device power indicator	
2	Status	Device operation indicator	
3	Fan	Fan operation LED	
4	RPS	Redundant power supply LED	
5	Console	Console port for local management of the device Console cable pin assignment is shown in APPENDIX A. RS-232 NULL-MODEM CABLE PIN DESIGNATION	
6	F	Functional key that reboots the device and resets it to factory default configuration: <ul style="list-style-type: none"> • pressing the key for less than 10 seconds reboots the device; • pressing the key for more than 10 seconds resets the device to factory default configuration. 	
7	GE Port 0..3	4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-8X)	
8	Combo GE	0..3	4 chassis for SFP modules of 1000BASE-X uplink interface for connection to IP networks (for LTP-4X)
			4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-4X)
		4..7	4 chassis for SFP modules of 1000BASE-X uplink interface for connection to IP networks (for LTP-8X)
			4 RJ-45 connectors of 10/100/1000BASE-T Gigabit uplink interfaces for connection to IP networks (for LTP-8X)
9	10G/1G 0..1	2 chassis for SFP modules of 10GBase/1000BASE-X uplink interface for connection to IP networks	
10	PON		4 chassis for SFP modules of xPON 2.5 G (for LTP-4X)
			8 chassis for SFP modules of xPON 2.5 G (for LTP-8X)

 4 electrical Ethernet and 4 optical interfaces are combined (Combo GE 4..7). The combo ports may have only one active interface at the same time.

2.6.2 Rear panel

The rear panel layout of the device is depicted in Fig. 5, 6, 7.

Table below lists rear panel connectors.

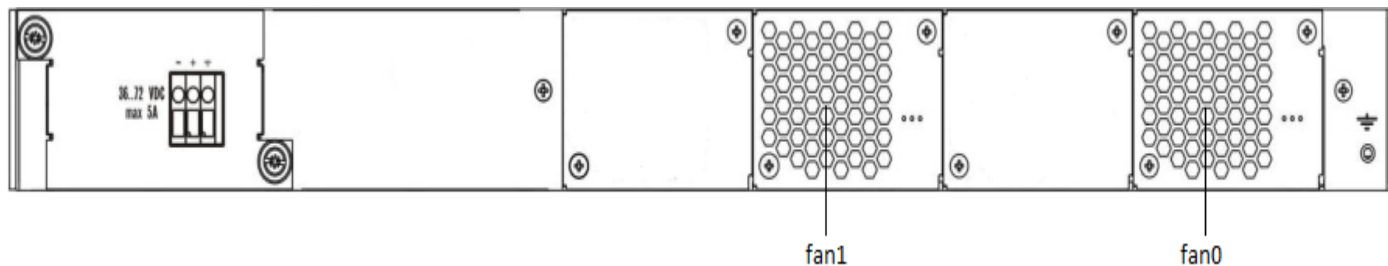


Figure 5 – LTP-4X/8X (DC) rear panel layout

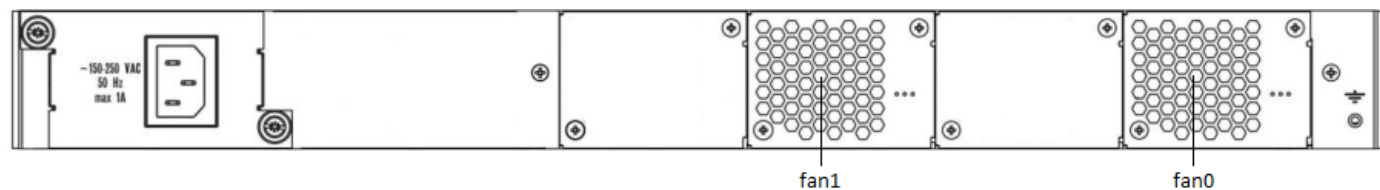


Figure 6 – LTP-4X/8X (AC) rear panel layout

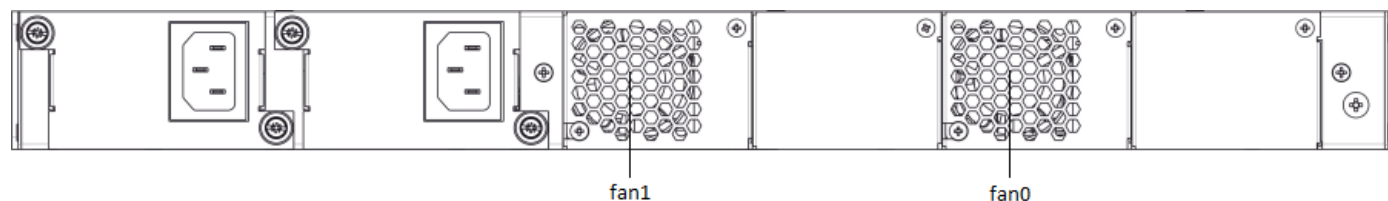


Figure 7 – Rear panel layout of LTP-4X/8X rev.C, LTP-4X/8X rev.D with two power modules

Table 5 – Rear panel connectors description

Rear panel element	Description
36 .. 72 VDC, max 5A	Connector for DC power supply
160–250 VAC, 50 Hz, max 1A	Connector for AC power supply
Fan0, Fan1	Ventilation units
Earth bonding point	Earth bonding point

2.6.3 Light indication

The indicators located on the front panel show the status of the terminal. Indicator states are listed in Tables 6 and 7.

Table 6 – LTP-4X/8X rev.B status light indication

LED name	Indicator state	Device state
Power	Off	Power is off
	Solid green	Power is on, normal device operation
Status	Flashes green	Normal operation
	Flashes red	Critical failure

Table 7 – LTP-4X/8X rev.C/rev.D status light indication

LED name	Indicator state	Device state
Power	Solid green	Power is on, normal device operation
	Off	Power is off
	Red	The primary source of the main power supply is unavailable (in case the device is connected to a redundant power supply) or the main power supply failed
Status	Flashes green	Normal operation
	Flashes red	Critical failure
Fan	Solid green	All fans are operational
	Solid red	One or more fans are failed
RPS	Solid green	Redundant power supply is connected and operates correctly
	Disabled	Redundant power supply is not connected
	Red	The primary source of the redundant power supply is unavailable or the redundant power supply failed

2.6.4 Temperature sensors

2 temperature sensors are used to measure temperature inside the terminal case.

Figure below shows the sensor location on PCB.

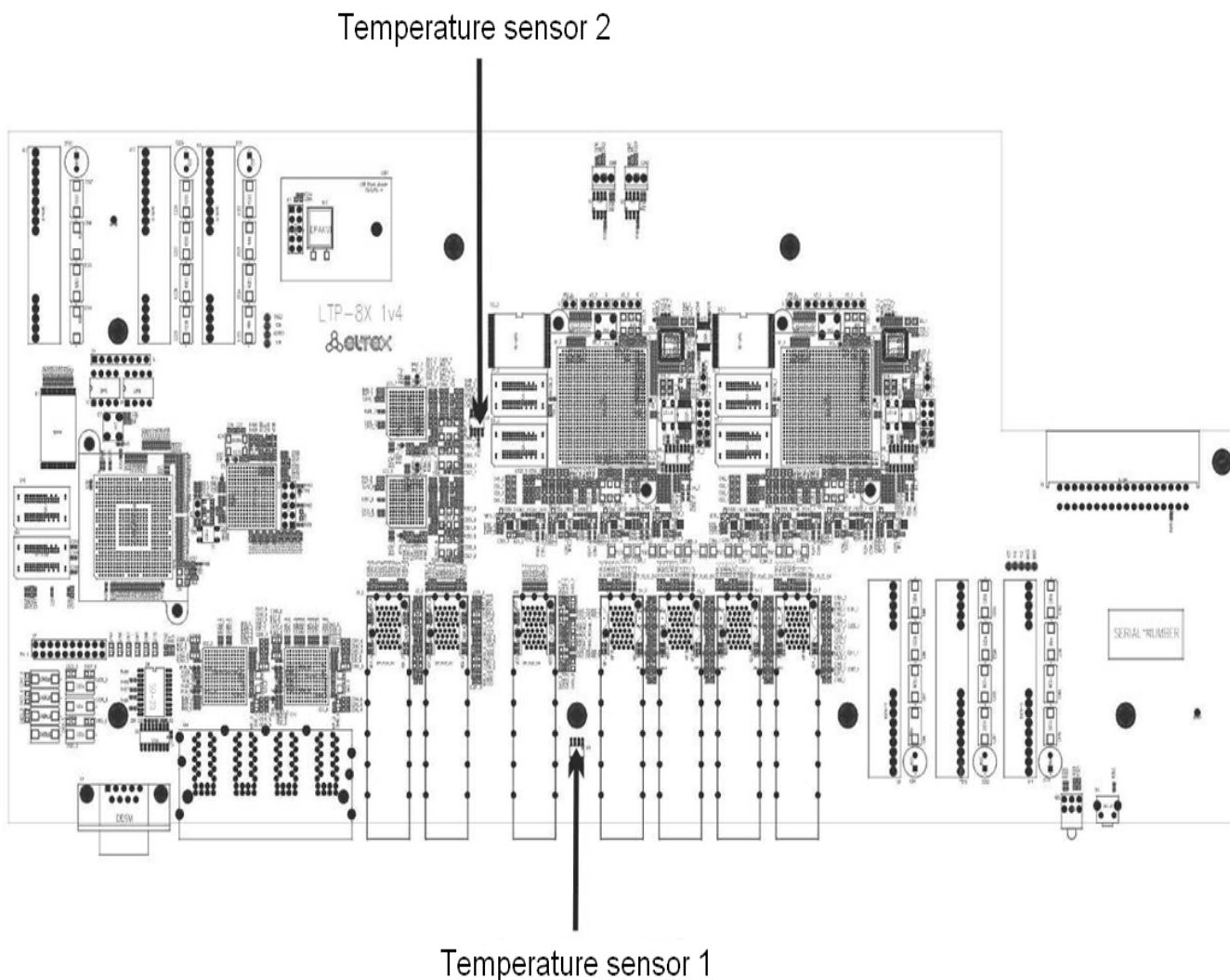


Figure 8 – Temperature sensors allocation

2.6.5 Ventilation system

There are ventilation openings on the device rear, front and side panels that serve to remove heat. The rear panel has two ventilation units installed ([Figure 5](#), [Figure 6](#) and [Figure 7](#)).

Air flows in through the perforated front and side panels, circulates through all internal components, cools them down, and then it is removed by fans located on the perforated rear panel.

The device contains 2 fans. The ventilation units are detachable. The procedure for assembly and dismantling is described in [Ventilation Units Replacement](#).


2.7 Safety rules and installation procedure

This chapter describes how to install the terminal in a rack and connect it to the power supply.

2.7.1 Safety requirements

General requirements

Any operations with the equipment should comply to the "Safety Regulations for Operation of Consumer's Electrical Installations".

 Operations with the terminal should be carried out only by personnel authorised in accordance with the safety requirements.

1. Before operating the device, all engineers should undergo special training.
2. The terminal should be connected only to properly functioning supplementary equipment.
3. The device could be permanently used under the following conditions:
 - ambient temperature from -5 to +40 °C;
 - relative humidity up to 80 % at +25 °C;
 - atmosphere pressure from 6.0×10^4 to 10.7×10^4 Pa (from 450 to 800 mm Hg).
4. The terminal should not be exposed to mechanical shock, vibration, smoke, dust, water, and chemicals.
5. To avoid components overheating which may result in device malfunction, do not block air vents or place objects on the equipment.

Electrical safety requirements

1. Prior to connecting the device to a power source, ensure that the equipment case is grounded with an earth bonding point. The earthing wire should be securely connected to the earth bonding point. The resistance between the earth bonding point and earthing busbar should be less than 0.1 Ω . Any PC and measurement instruments should be properly grounded prior to their connection to the terminal. The potential difference between the equipment case and the cases of the instruments should be less than 1 V.
2. Prior to turning the device on, ensure that all cables are undamaged and securely connected.
3. Make sure the device is off, when installing or removing the case.
4. Power modules of LTP-X rev.B should be replaced only when the device is powered off. Follow the procedure in [Terminal installation](#). Power modules of LTP-X rev.C/rev.D terminals can be installed and removed without powering the device off.
5. Follow the instructions given in [SFP transceivers replacement](#) to install or remove SFP transceivers. This operation does not require the terminal to be turned off.

2.7.2 Terminal installation

Check the device for visible mechanical damage before installing and turning it on. In case of any damage, stop the installation, fill in a corresponding document and contact your supplier. If the terminal was exposed to low temperatures for a long time before installation, leave it for 2 hours at ambient temperature prior to operation. If the device was exposed to high humidity for a long time, leave it for at least 12 hours in normal conditions prior to turning it on.

Support brackets mounting

The delivery package includes support brackets for rack installation and mounting screws to fix the terminal case on the brackets. To install the support brackets:

- **Step 1.** Align four mounting holes in the support bracket with the corresponding holes in the side panel of the device.
- **Step 2.** Use a screwdriver to screw the support bracket to the case.
- **Step 3.** Repeat steps 1 and 2 for the second support bracket.

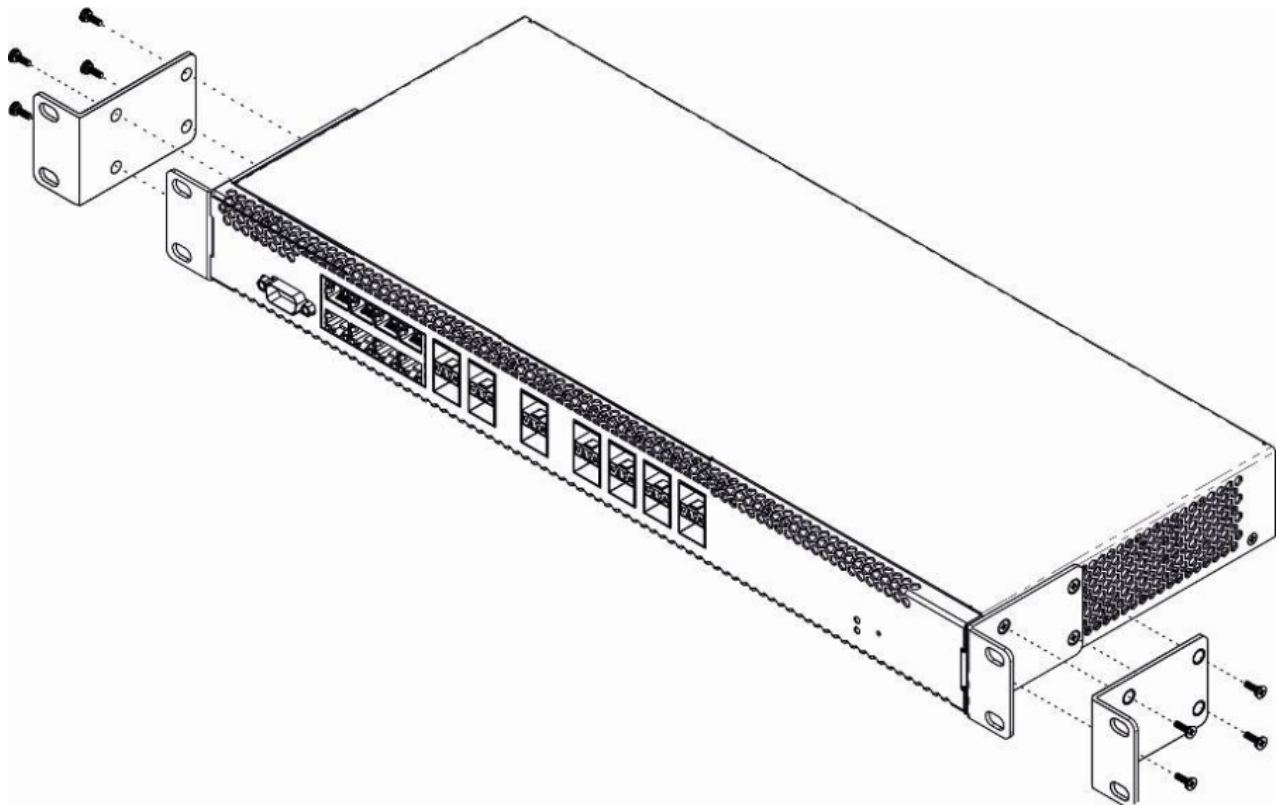


Figure 9 – Support brackets mounting

Terminal rack installation

To install the terminal to the rack:

- **Step 1.** Attach the terminal to the vertical guides of the rack.
- **Step 2.** Align mounting holes in the support bracket with the corresponding holes in the rack guides. Use the holes of the same level on both sides of the guides to ensure the device horizontal installation.
- **Step 3.** Use a screwdriver to screw the terminal to the rack.

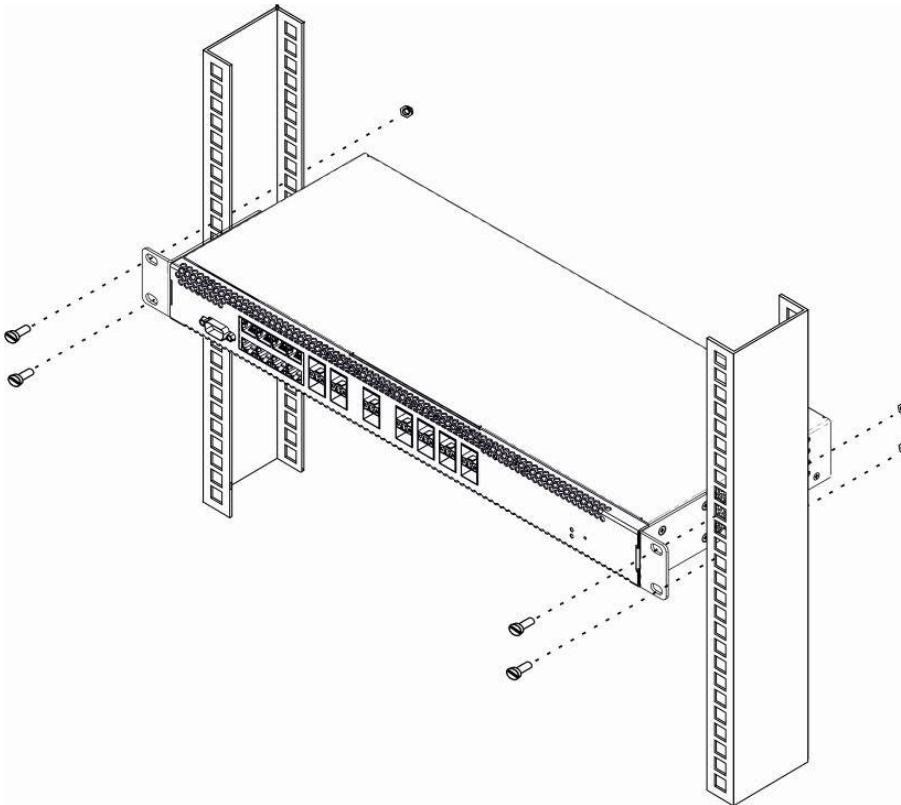


Figure 10 – Device rack installation

The terminal is horizontally ventilated. The side panels have air vents. Do not block the air vents to avoid components overheating and subsequent terminal malfunction.

⚠ To avoid overheating and provide necessary ventilation of the terminal, sufficient space should be provided above and below the terminal, not less than 10 cm.

Power module installation

Depending on power supply requirements, the LTP-4X/8X rev.B terminals can be supplemented with either an AC power module, 220 V, 50 Hz, or a DC power module, 48 V. Location of the power module is shown in Figure 11.

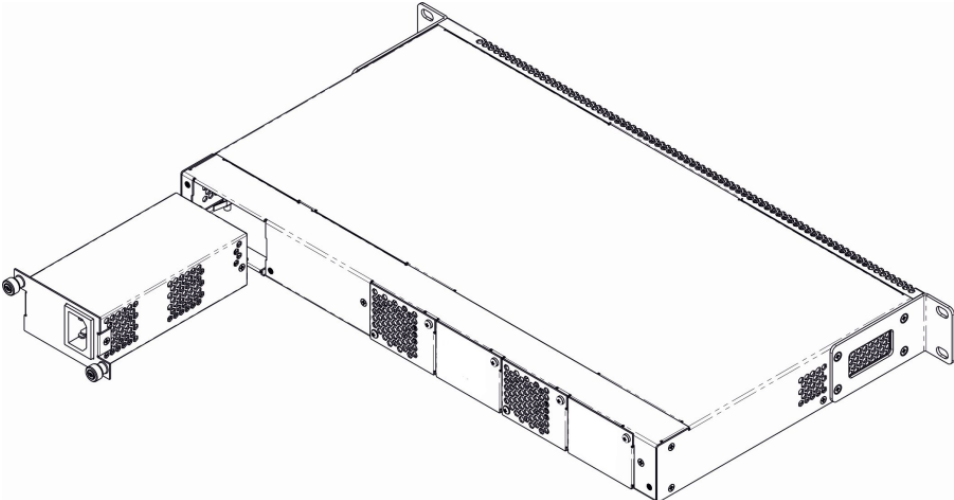


Figure 11 – Power module installation

The LTP-4X rev.C/rev.D and LTP-8X rev.C/rev.D terminals can use one or two power modules. The second power module installation is necessary when greater reliability is required. In case of using two power modules, it is allowed to use different power plants for supplying (with different voltage).

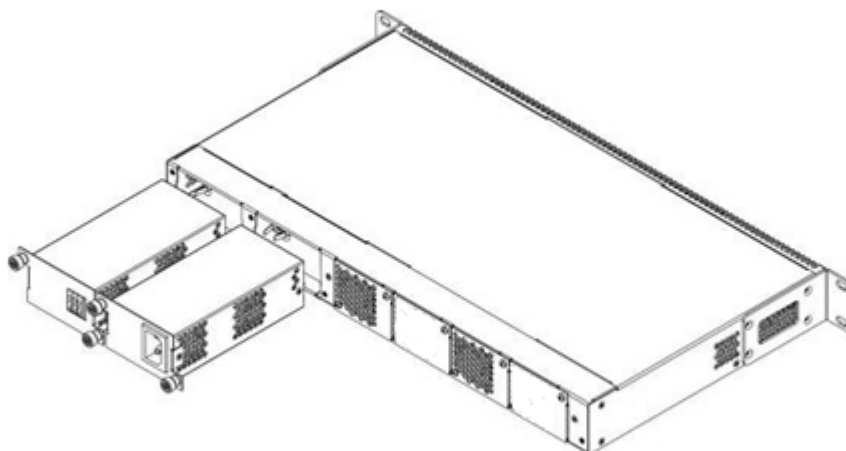


Figure 12 – Power module installation for LTP rev.C/rev.D

From the electric point of view, both places for power module installation are identical. In the context of device operation, the power module located closer to the edge is considered as the main module, and the one closer to the centre – as the backup module. Power modules can be inserted and removed without powering the device off. When additional power module is inserted or removed, the terminal continues operation without reboot.

To install a power module:

- **Step 1.** Install the power module into the socket shown in Fig. 11 or Fig. 12.
- **Step 2.** Screw the module to the case.
- **Step 3.** Follow the instructions in [Terminal installation](#) to power on.

The device installation order:

- **Step 1.** Mount the device. In case of installation to a 19" form-factor rack, mount the support brackets from the delivery package to the rack.
- **Step 2.** Ground the case of the device. This should be done prior to connecting the device to the power supply. An insulated multiconductor wire should be used for earthing. The device grounding process and the earthing wire section should comply with Electric Installation Code. The earth bonding point is located on the rear panel, see [Figure 5](#), [Figure 6](#) and [Figure 7](#).
- **Step 3.** If you intend to connect a PC or another device to the switch console port, the device must be properly grounded as well.
- **Step 4.** Connect the power supply cable to the device.
- **Step 5.** Turn the device on and check the front panel LEDs to make sure the terminal is in normal operating conditions.

3 Getting started with the terminal

3.1 Connecting to the terminal CLI

This chapter describes various connection methods for Command Line Interface (CLI) of the terminal. A serial port (hereafter – COM port) is recommended to use for the initial configuration of the terminal.

3.1.1 Connecting to CLI via COM port

This type of connection requires PC either to have an integrated COM port or to be supplied with an USB-COM adapter cable. The PC should also have a terminal program installed, e. g. Hyperterminal.

- **Step 1.** Use the *null modem* cable from the delivery package to connect the *console* port of the terminal to the PC COM port as shown in figure below.

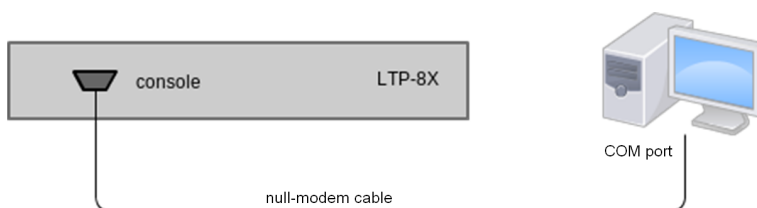


Figure 13 – Connecting the terminal to a PC via COM port

- **Step 2.** Launch the terminal program and create a new connection. Select the corresponding COM port in the Connect to drop-down list. Assign the port settings according to the table below. Click **<OK>**.

Table 8 – Port specifications

Parameter	Value
Speed	115200
Data bits	8
Parity	No
Stop bits	1
Flow control	None

- **Step 3.** Press **<Enter>**. Log into the terminal CLI.

⚠ Factory authorization settings:
login: **admin**, password: **password**.

```
*****
*   Optical line terminal LTP-8X rev.D   *
*****
LTP-8X login: admin
Password: *****

Eltex LTP-8X-rev.D software version 3.40.0 build 2358 on 10.12.2020 15:32
Technical support: https://eltex-co.ru/support
Mon Dec 28 10:56:29 LOCAL 2020
LTP-8X#
```

3.1.2 Connecting to CLI via Telnet protocol

The Telnet protocol connection is more universal than the connection via COM port. Connection to CLI can be established directly at the terminal location or via an IP network with the help of a remote desktop.

This section considers direct connection to CLI at the terminal location. Remote connection is similar, but requires changes in the terminal IP address that will be considered in detail in the [Network Settings](#) section.

In order to be connected to the terminal, a PC should have a Network Interface Card (NIC). Additionally you will need a network cable (Patching Cord RJ-45) of the required length, as it is not included in the terminal delivery package.

- **Step 1.** Connect one end of the network cable to any "GE Port" or "Combo GE" port of the terminal. Connect another end to NIC on the PC as shown in the figure below.

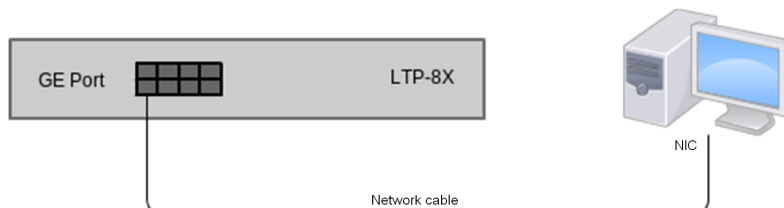


Figure 14 – Connecting the terminal to a PC via network cable

- **Step 2.** Assign IP settings for network connections. Set **192.168.1.1** as an IP address and **255.255.255.0** as a subnet mask.

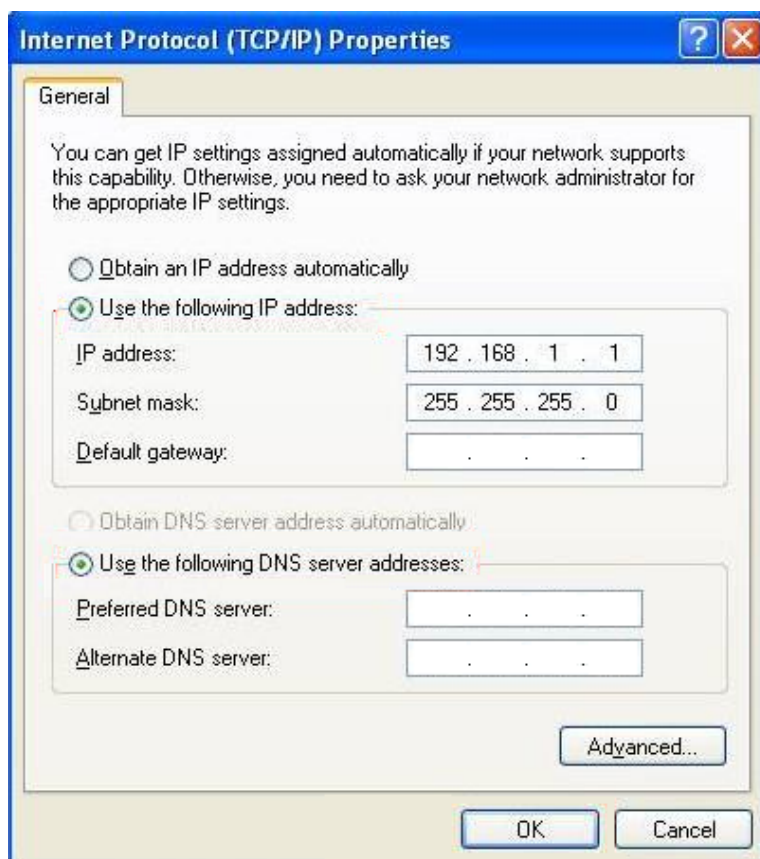


Figure 15 – Network connection configuration

- **Step 3.** On the PC, click Start > Run. Enter the **telnet** command and the terminal's IP address. The factory setting for the IP address is **192.168.1.2**. Click <OK>.

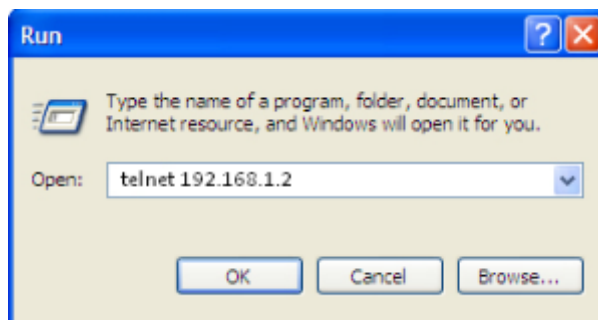


Figure 16 – Telnet client startup

- **Step 4.** Log into the terminal CLI.

⚠ Factory authorization settings:
login: **admin**, password: **password**.

```
Trying 192.168.1.2...
Connected to 192.168.1.2. Escape character is '^]'.

*****
*   Optical line terminal LTP-8X rev.D   *
*****

login: admin
Password:*****

Eltex LTP-8X-rev.D software version 3.40.0 build 2358 on 10.12.2020 15:32
Technical support: https://eltex-co.ru/support
Mon Dec 28 10:56:29 LOCAL 2020
```

3.1.3 Connecting to CLI via Secure Shell protocol

Secure Shell connection (SSH) has functionality similar to the Telnet protocol. However, as opposed to Telnet, Secure Shell encrypts all traffic data, including passwords. This enables secure remote connection via public IP networks.

This section considers direct connection to CLI at the terminal location. Remote connection is similar, but requires changes in the terminal IP address that will be considered in detail in the [Network Settings](#) section.

In order to be connected to the terminal, a PC should have a Network Interface Card (NIC). The PC should have an SSH client installed, e. g. PuTTY. Additionally you will need a network cable (Patching Cord RJ-45) of the required length, as it is not included in the terminal delivery package.

- **Step 1.** Perform steps 1 and 2 from the [Connecting to CLI via COM port](#) section.
- **Step 2.** Run PuTTY. Enter IP address of the terminal. The factory setting for the IP address is **192.168.1.2**. Select port **22** and **SSH** protocol type. Click **<Open>**.

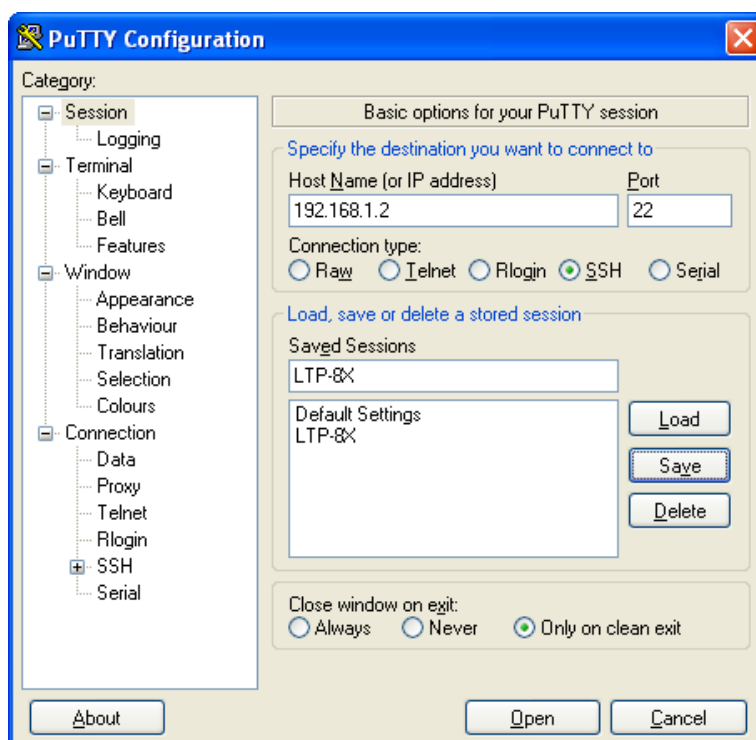


Figure 17 – SSH client startup

- **Step 3.** Log into the terminal CLI. Factory authorization settings:
login: **admin**, password: **password**.

```
login: admin Password: *****

Eltex LTP-8X-rev.D software version 3.40.0 build 2358 on 10.12.2020 15:32
Technical support: https://eltex-co.ru/support
Mon Dec 28 10:56:29 LOCAL 2020
LTP-8X#
```

3.2 Getting started with terminal CLI

CLI is the main means of communication between user and the terminal. This chapter considers general operations in CLI: commands grouping, automatic code completion, and history.

3.2.1 CLI views hierarchy

Views are used in the terminal CLI to group commands and optimize their length.

Figure 18 shows a graphic chart of main views and the commands to switch between them.

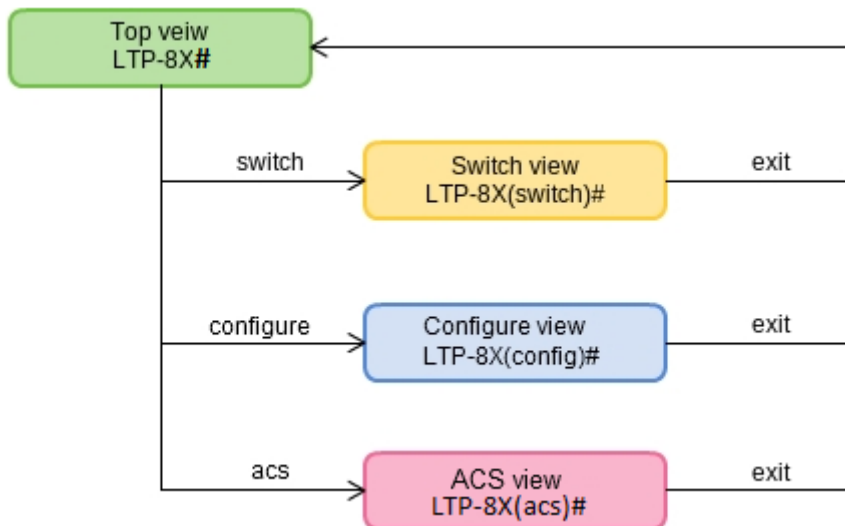


Figure 18 – CLI mode hierarchy

- The **Top view** includes general commands, which refer to the device in general. For example: view terminal parameters, firmware update, reboot, etc.;
- The **Switch configure view** groups commands related to the switch: VLAN, GE interfaces, LACP and others;
- The **Configure view** is a list of terminal configuration commands. E.g. user management, services configuration, GPON interface and ONT configuration, profile configuration, etc.

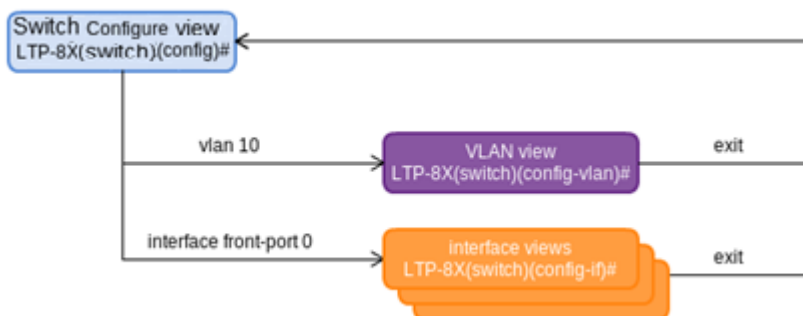


Figure 19 – Switch view hierarchy

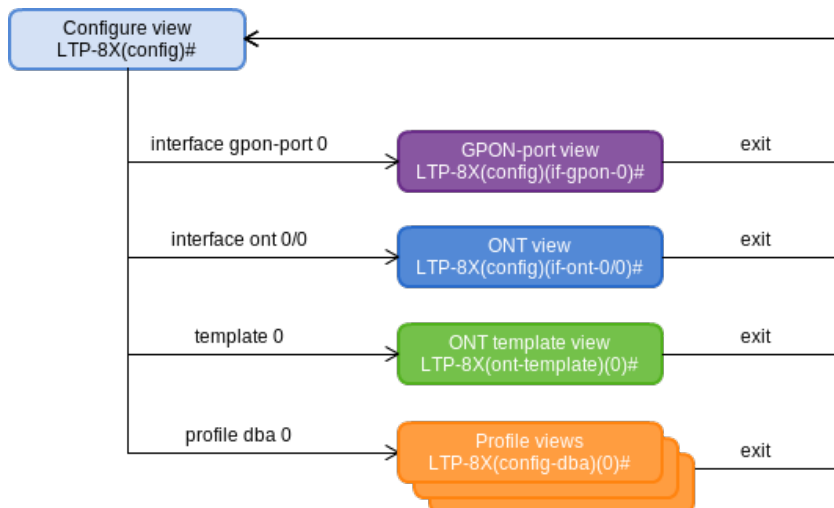


Figure 20 – Configure view hierarchy

Figure 20 shows the Configure view, which consists of four parts:

- The **GPON-port view** is used to configure GPON interfaces;
- The **ONT view** is used to configure the ONT;
- **ONT** configuration templates are modified in the **ONT template view**;
- The profile of the terminal configuration is configured in the **Profile view**.

3.2.2 CLI hotkeys

In order to speed up the operations with the command line, the following hotkeys have been added:

Hotkey	Result
Ctrl+C	Termination of the current operation; clear line
Ctrl+D	Transition up one level
Ctrl+Z	Transition to root section
Ctrl+A	Transition to the beginning of line
Ctrl+E	Transition to the end of line
Ctrl+U	Removal of characters to the left of a cursor
Ctrl+K	Removal of characters to the right of a cursor
Ctrl+W	Remove a word
Ctrl+B	Transition of a cursor one position backwards
Ctrl+F	Transition of a cursor one position ahead

3.2.3 CLI automatic command completion

In order to make work with CLI faster and easier, an automatic command completion is implemented. A good knowledge of CLI command system allows user to work with CLI as fast as with graphical interface.

For example, enter the **ex** command in the **Top view** and press **<Tab>**.

```
LTP-8X# ex<Tab>
LTP-8X# exit
```

As this view has only one command with the **ex** prefix, CLI automatically completes it.

If there are several commands with this prefix, CLI shows hints with possible options.

```
LTP-8X# co<Tab>
commit configure copy
LTP-8X# con<Tab>
LTP-8X# configure
```

3.2.4 CLI command history

Sometimes it might be necessary to execute the same set of operations several times. To make the work with repeating commands easier, the terminal CLI keeps the command history.

The list of previously entered commands can be displayed by using the **show history** command.

```
LTP-8X# show history
Last CLI commands:
show version
configure terminal
exit
show history
LTP-8X#
```

Use the **<Up>** and **<Down>** cursor keys to scroll the command history and the **<Enter>** key to execute the selected command.

```
LTP-8X# <Up>
LTP-8X# show management <Up>
LTP-8X# switch <Up>
LTP-8X# exit <Up>
LTP-8X# show uptime <Enter>
up 1 day, 23:44
```

3.2.5 Group operations

Group operations can be performed on such terminal configuration objects as interfaces and ONT. It is especially convenient, when you have to apply the same actions to multiple objects.

To perform a group operation, select the range of object IDs instead of one object ID. This feature is supported by a majority of CLI commands.

For example, enable fec for all ONTs in a certain channel.

```
LTP-8X(config)# interface ont 0/0-127
LTP-8X(config)(if-ont-0/0-127)# fec
```

Or view the list of active ones in the first 4 GPON channels.

```
LTP-8X# show interface ont 0-3 ont online

GPON-port 0 has no online ONTs
GPON-port 1 has no online ONTs
GPON-port 2 has no online ONTs
GPON-port 3 has no online ONTs

Total ONT count: 0
```

4 Configuring the terminal

4.1 Terminal configuration

A collection of all terminal settings is referred to as configuration. This chapter provides information on the parts which configuration consists of. It also defines lifecycle of configuration and describes main operations, which can be performed.

4.1.1 Configuration structure

The terminal configuration can be conventionally divided into 3 parts. Figure below shows the configuration structure.

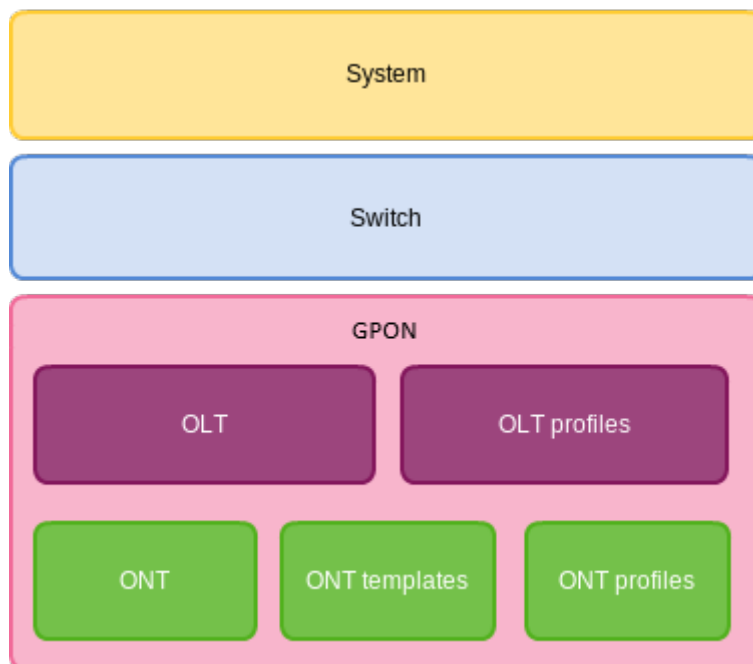


Figure 21 – Terminal configuration structure

System is a general system part. This group includes such settings as: network, service settings, user table, etc.

Switch represents a switch configuration. This group includes configuration parameters for Ethernet interfaces of the front panel, as well as VLAN settings.

GPON contains 5 subparts:

- **OLT** – GPON OLT and GPON interface settings;
- **OLT profiles** – OLT profile part consists of address table profiles, VLAN profiles, DHCP RA and PPPoE IA profiles;
- **ONT** – ONT configuration base;
- **ONT templates** – ONT templates;
- **ONT profiles** – ONT profiles.

4.1.2 Configuration lifecycle

The terminal configuration may have the following states:

- **RUNNING**– active configuration. It refers to the current configuration of the terminal;
- **CANDIDATE**– an edited configuration;
- **NVRAM** – a configuration stored in non-volatile memory. This configuration will be used as RUNNING after the device is loaded.

The RUNNING configuration is loaded to a new CLI session and becomes available for review (CANDIDATE). After changing the configuration (CANDIDATE) in the CLI session, user can either enter the **commit** command to accept the changes or use the **rollback** command to discard the changes and apply the current (RUNNING) configuration. The **save** command saves the RUNNING configuration into NVRAM of the terminal.

Figure below shows a chart of configuration lifecycle.

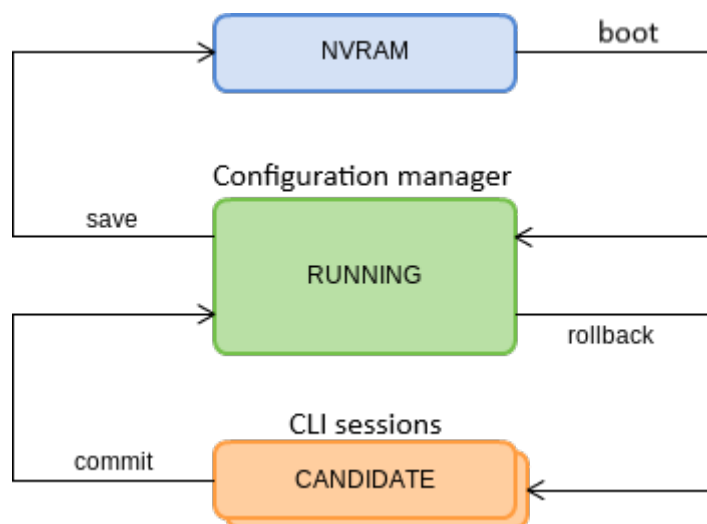


Figure 22 – Configuration lifecycle of the terminal diagram

4.1.3 Configuration autosave

In some cases, for example, when several operators are working on the terminal or the terminal is automatically configured through OSS/BSS, it may be convenient to organize a centralized saving of the configuration into NVRAM at a specified time or at a specified time interval. The terminal allows this with the help of a configuration autosave mechanism.

For daily autosave of the configuration, define a time when autosave should be implemented.

```
LTP-8X(config)# config autosave hour 3 minute 44
```

For autosave at specified time intervals, define the interval in seconds.

```
LTP-8X(config)# config autosave period 3600
```

Check the entered data by using the **do show config** command.

```
LTP-4X(config)# do show config
Config:
  Daily autosave: at 03:44
  Periodic autosave: every 3600 seconds
LTP-4X(config)#
```


For disabling a mode, use the **no** command.

```
LTP-4X(config)# no config autosave hour
LTP-4X(config)# no config autosave period
```

Apply the changes.

```
LTP-8X(config)# do commit
```

4.1.4 Creating a configuration backup

Configuration backups allow the terminal operation to be quickly restored after abnormal situations or replacement. Manual or triggered (on events) creation of backups is recommended at a regular basis.

Terminal configuration is uploaded to a TFTP server which is available in the management network. The **copy** command is used to upload the data. Pass the uploaded terminal configuration `fs://config` and destination URI as parameters.

```
LTP-8X# copy fs://config tftp://192.168.1.1/config
Upload backup file to TFTP-server..
```

Configure a triggered upload to create backups automatically.

- **Step 1.** Go to the **configure view** and select the URI of the configuration backup.

```
LTP-8X# configure terminal
LTP-8X(config)# backup uri tftp://192.168.1.1/config
```

- **Step 2.** The terminal can be adjusted to upload configuration every time the configuration is saved if necessary.

```
LTP-8X(config)# backup on save
```

- **Step 3.** The terminal can be adjusted to use a timer for configuration upload if necessary. In this case, additionally set the timer period in seconds.

```
LTP-8X(config)# backup on timer
LTP-8X(config)# backup timer period 3600
```

- **Step 4.** Check the entered data by using the **do show backup** command.

```
LTP-8X(config)# do show backup
Tftp:
  Backup on conf save: enabled
  Backup on timer: enabled
  Backup on timer period: 3600
  Backup uri: 'tftp://192.168.1.1/config'
```

- **Step 5.** Apply the changes.

```
LTP-8X(config)# do commit
```

4.1.5 Configuration restore

The terminal configuration is restored from the TFTP/FTP/HTTP server which is available in the management network. The **copy** command is used to restore the data. Define source URI as parameter and [fs://config](#) as restored configuration.


```
LTP-8X# copy tftp://10.0.105.1/config fs://config
Download file from TFTP-server..
Reading of the configuration file..
Configuration have been successfully restored (all not saved changes was lost)
```

4.1.6 Configuration reset

To reset a terminal configuration to factory settings, use the **default** command.

```
LTP-8X# default
Do you really want to set up default configuration? (y/n) y
Configuration have been reseted to default.

Terminal will be reloaded.
```

 Resetting a configuration of a remote terminal also resets network settings. The terminal will not be available for operation until the network settings are reconfigured.

4.2 Network settings

This chapter describes adjustment of network settings for the terminal. Adjusting network settings enables remote control and integration with OSS/BSS systems.

4.2.1 Network parameters configuration

It is recommended to adjust network settings via COM port connection. This will prevent issues with connection loss upstream the terminal being adjusted. Be very careful when using remote adjustment.

- **Step 1.** Use the **show management** command to view the current network settings.

```
LTP-8X# show management
Network:
  Hostname: 'LTP-8X'
  Ipaddr: 192.168.1.2
  Netmask: 255.255.255.0
  Vlan management: 1
  Gateway: 0.0.0.0
  Vlan prio: 7
  Dscp: 63
  Additional vlan: <list is empty>
```

- **Step 2.** Switch to the **configure view**. Set the terminal name by using the **hostname** command.

```
LTP-8X# configure terminal
LTP-8X(config)# hostname LTP-8X-1
```

- **Step 3.** Set the terminal IP address by using the **management ip** command.

```
LTP-8X(config)# management ip 10.0.0.1
```

- **Step 4.** Set the subnet mask by using the **management mask** command.

```
LTP-8X(config)# management mask 255.0.0.0
```

- **Step 5.** Set the default gateway by using the **management gateway** command.

```
LTP-8X(config)# management gateway 10.0.0.254
```

- **Step 6.** Set the management VLAN of the terminal by using the **management vid** command if necessary. Use the **management cos** command to set the **P-bit** parameter for the management VLAN.

```
LTP-8X(config)# management vid 9
LTP-8X(config)# management cos 5
```

⚠ Proper operation of the inband management function requires VLAN adjustment in the **switch view** as described in [VLAN configuration](#).

- **Step 7.** Set MAC address aging time by using the **gpon network mac-age-time** command. Pass the time in seconds as a parameter.

```
LTP-8X(config)# gpon network mac-age-time 7200
```

- **Step 8.** The network settings will change as soon as the configuration is applied. No terminal reboot is needed.

```
LTP-8X(config)# do commit
```

4.3 User management

This chapter is devoted to management of the terminal users.

⚠ The factory settings provide only one user, i. e. the device administrator.

login: admin
password: password

When starting to configure the terminal, it is recommended to change the password of the 'admin' user.

For security reasons, there is a strictly defined set of permissions, which can be delegated to terminal users. For these purposes, each user gets his own level of privileges. Level 0 corresponds to a minimum set of permissions, Level 15 – to a maximum set of permissions.

CLI commands are ranked by the level of privileges. Level 0 commands are available to all users. Level 15 commands are available only to Level 15 users. Thus, the level of commands available to a user does not exceed the user's level.

The levels of privileges can be modified as required.

- **Step 1.** Check the current settings of privileges by using the **show privileges** command.

```
LTP-8X# show privileges
Level      Privileges
0          !, exit
1          view-ont
2          ont-operation
3          view-ont, ont-operation
4          view-ont, config-ont
           ont-operation
5          view-gpon, view-ont
           view-ont-profile, ont-operation
6          view-gpon, view-ont
           view-ont-profile, config-gpon
           ont-operation, config-ont-profile
7          view-switch, view-gpon
           view-ont, view-ont-profile
           view-switch-interfaces
8          view-switch, view-gpon
           view-ont, view-ont-profile
           view-switch-interfaces, config-switch
           config-switch-interfaces
```

9	view-switch, view-gpon view-ont, view-ont-profile view-switch-interfaces, config-switch config-gpon, config-ont ont-operation, config-ont-profile config-switch-interfaces
10	view-switch, view-alarm view-system, view-general view-gpon, view-ont view-ont-profile, view-switch-interfaces
11	view-switch, view-alarm view-system, view-general view-gpon, view-ont view-ont-profile, view-switch-interfaces config-alarm, config-system config-general
12	view-switch, view-alarm view-system, view-general view-gpon, view-ont view-ont-profile, view-switch-interfaces config-switch, config-alarm config-system, config-general config-switch-interfaces
13	view-gpon, view-ont view-ont-profile
14	–
15	view-switch, view-alarm view-system, view-general view-gpon, view-ont view-ont-profile, view-switch-interfaces config-switch, config-alarm config-system, config-general config-gpon, config-ont ont-operation, config-ont-profile config-switch-interfaces

- **Step 2.** Switch to the **configure view**. Set the required permissions corresponding to the level by using the **privilege** command, e. g. set permissions allowing Level 1 to view configuration of the internal switch.

```
LTP-8X# configure terminal
LTP-8X(config)# privilege 1 view-switch
```

- **Step 3.** Settings of privileges will be applied immediately. No terminal reboot is needed.

```
LTP-8X(config)# do commit
```

The list of operations and the default levels are shown in the table below.

Table 9 – Permissions and the required level of privileges

Level	Privileges
0	!, exit
1	view-ont
2	ont-operation
3	view-ont, ont-operation
4	view-ont, config-ont, ont-operation
5	view-gpon, view-ont, view-ont-profile, ont-operation
6	view-gpon, view-ont, view-ont-profile, config-gpon, ont-operation, config-ont-profile
7	view-switch, view-gpon, view-ont, view-ont-profile, view-switch-interfaces
8	view-switch, view-gpon, view-ont, view-ont-profile, view-switch-interfaces, config-switch, config-switch-interfaces
9	view-switch, view-gpon, view-ont, view-ont-profile, view-switch-interfaces, config-switch, config-gpon, config-ont, ont-operation, config-ont-profile, config-switch-interfaces
10	view-switch, view-alarm, view-system, view-general, view-gpon, view-ont, view-ont-profile, view-switch-interfaces,
11	view-switch, view-alarm, view-system, view-general, view-gpon, view-ont, view-ont-profile, view-switch-interfaces, config-alarm, config-system, config-general
12	view-switch, view-alarm, view-system, view-general, view-gpon, view-ont, view-ont-profile, view-switch-interfaces, config-switch, config-alarm, config-system, config-general, config-switch-interfaces
13	view-gpon, view-ont, view-ont-profile
14	–
15	view-switch, view-alarm, view-system, view-general, view-gpon, view-ont, view-ont-profile, view-switch-interfaces, config-switch, config-alarm, config-system, config-general, config-gpon, config-ont, ont-operation, config-ont-profile, config-switch-interfaces

4.3.1 User list preview

To view the list of terminal users, enter the **show users config** command.

```
LTP-8X(config)# do show users config
##          Name      Privilege
 1          root       15
 2          admin      15
 3          remote     15
```

The **admin**, **root** and **remote** users always exist and cannot be deleted or duplicated. The terminal supports up to 16 users.

4.3.2 Adding a new user

In order to operate effectively and safely, the terminal, as a rule, requires one or several additional users. To add a new user, enter the **user** command in the **configure view**.

```
LTP-8X(config)# user operator
LTP-8X(config)# do show users config
##          Name      Privilege
 1          root       15
 2          admin      15
 3          remote     15
 4          operator    0
LTP-8X(config)#
```

Pass the name of the new user to the **user** command as a parameter. The name should not be longer than 32 characters. The name should not contain special characters.

4.3.3 Changing user password

To change user password, enter the **user** command. Pass the user name and a new password as parameters.

```
LTP-8X(config)# user operator password newpassword
```

The password should not be longer than 31 characters and shorter than 8 characters. If the password contains a space, use quotations for the password.

4.3.4 Viewing and changing user access rights

To manage user access rights, a user priority system is implemented. A newly created user is granted with a minimal set of permissions.

```
LTP-8X(config)# user operator
LTP-8X(config)# do show users config
  ##          Name      Privilege
  1           root       15
  2           admin      15
  3           remote     15
  4           operator    0
LTP-8X(config)#
```

To change the user priority level, enter the **user** command. Pass the user name and a new priority as parameters.

```
LTP-8X(config)# user operator privilege 15
LTP-8X(config)# do show users config
  ##          Name      Privilege
  1           root       15
  2           admin      15
  3           remote     15
  4           operator    15
LTP-8X(config)#
```

4.3.5 Deleting a user

To delete a user, enter the **no user** command in the **configure view**. Pass the user name as a parameter.

```
LTP-8X# configure terminal
LTP-8X(config)# no user operator
```

4.4 AAA configuration

This chapter describes configuring of services and protocols related to authentication, authorization and accounting.

⚠ Hereafter, the term 'authorization' means authorization of the commands – defining rights for executing commands on a remote server.
 Authorization of a user – a process of obtaining a specified permission set, combined with authentication process.

LTP-X supports **radius** and **tacacs+** AAA protocols. Below is a table of the functionality of these protocols.

Table 10 – Permissions and the required level of privileges

Function and protocol	Tacacs+	Radius
Authentication	+	+
Authorization	+	-
Accounting start-stop	+	+
Accounting commands	+	-

4.4.1 Configuring servers

The principles of servers configuration are common for supported protocols. You can configure an IP address, key, response timeout and a data exchange port for each server. You can set up to 3 servers for the **RADIUS**. The LTP will apply to the servers according to their priorities. If the priority is not set, the 0 priority (the highest) will be used by default.

- **Step 1.** Configure IP address of radius/tacacs+ server.

```
LTP-8X# configure terminal
LTP-8X(config)# radius-server host 10.10.10.1 priority 0
LTP-8X(config)# radius-server host 10.10.10.2 priority 1
LTP-8X(config)# radius-server host 10.10.10.3 priority 2
LTP-8X(config)# tacacs-server host 10.10.10.4
```

- **Step 2.** Define an encryption key used while data exchange with the server.

```
LTP-8X(config)# radius-server key 12345678-r0
LTP-8X(config)# radius-server key 12345678-r1 priority 1
LTP-8X(config)# radius-server key 12345678-r2 priority 2
LTP-8X(config)# tacacs-server key 12345678
```

- **Step 3.** Define server response timeout.

```
LTP-8X(config)# radius-server timeout 3
LTP-8X(config)# radius-server timeout 3 priority 1
LTP-8X(config)# radius-server timeout 3 priority 2
LTP-8X(config)# tacacs-server timeout 3
```

- **Step 4.** Define a port for data exchange with the server (if necessary).

```
LTP-8X(config)# radius-server port 50005
LTP-8X(config)# radius-server port 50006 priority 1
LTP-8X(config)# radius-server port 50007 priority 2
LTP-8X(config)# tacacs-server port 50008
```

- **Step 5.** Apply the changes.

```
LTP-8X(config)# do commit
```

4.4.2 AAA methods configuration

By default, every AAA function is implemented locally – local user data base is used for authentication and authorization, accounting via a remote server is disabled.

For using of configured in previous steps servers, define a method of a function performing.

- **Step 1.** Select an authentication method.

```
LTP-8X# configure terminal
LTP-8X(config)# aaa authentication radius
```

- **Step 2.** Select an authorization method.

```
LTP-8X# configure terminal
LTP-8X(config)# aaa authorization tacacs+
```

- **Step 3.** Select a CLI session start/stop accounting method.

```
LTP-8X# configure terminal
LTP-8X(config)# aaa accounting start-stop radius
```

- **Step 4.** Select a method of commands accounting.

```
LTP-8X# configure terminal
LTP-8X(config)# aaa accounting commands tacacs+
```

- **Step 5.** Apply the changes.

```
LTP-8X(config)# do commit
```

In order to disable a function, use the **no** command.

```
LTP-8X# configure terminal
LTP-8X(config)# no aaa accounting commands
```

⚠ In case server configured for a function unavailable or key is not defined properly, the function will be implemented locally.

4.5 Services configuration

This chapter describes configuration of integrated terminal services.

4.5.1 SNMPD configuration

To work with the Eltex.EMS management system, the terminal should be configured to work with Simple Network Management Protocol (SNMP).

- **Step 1.** Switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Enable the SNMP agent of the terminal by using the **snmp enable** command.

```
LTP-8X(config)# ip snmp enable
```

- **Step 3.** Enable ACL check by using the **snmp access-control** command if necessary. Add the record into the whitelist by using the **snmp allow** command. Pass the IP address of the host which will be used to connect to the SNMP agent, as a parameter.

```
LTP-8X(config)# ip snmp access-control
LTP-8X(config)# ip snmp allow ip 192.168.1.13
```

- **Step 4.** Configure SNMP trap replication to allow the management system to receive the traps. For example, add 2 replicators and specify to send v2 SNMP traps to 192.168.1.13 and v1 traps to 192.168.1.113. To do this, use the **ip snmp traps** command.

⚠ It is possible to configure several receivers of SNMP traps of the same version.


```
LTP-8X(config)# ip snmp traps 192.168.1.13 type v2
LTP-8X(config)# ip snmp traps 192.168.1.113 type v1
```

- **Step 5.** Check the entered data by using the **show ip snmp** command.

```
LTP-8X(config)# do show ip snmp
  Snmp:
    Enabled: true
    Access control: false
    Allow ip: <list is empty>
    Traps [0]:
      Type: v2
      Ipaddr: 192.168.1.13
    Traps [1]:
      Type: v1
      Ipaddr: 192.168.1.113
    Version: v2
    Community read-only [0]: 'QwYva0dvS3N'
    Community read-only [1]: 'QwYva0dvS3N'
    Community read-only [2]: 'QwYva0dvS3N'
    Community read-write [0]: 'LQtfx9v3m9+qA=='
    Community read-write [1]: 'LQtfx9v3m9+qA=='
    Community read-write [2]: 'LQtfx9v3m9+qA=='
    Trap community: '9qXUEDwUMAg'
    Location: 'admin'
    Contact: 'admin'
    Alias: <for showing use separate command>
    EngineID: 0x6C2A20B42CB28232FABEA8EE19
    Users: <for showing use separate command>
```

- **Step 6.** The settings of the SNMP agent change as soon as the configuration is applied. No terminal reboot is needed.

```
LTP-8X(config)# do commit
```

 The types and purpose of SNMP traps are closely connected with the log of active alarms.

You need to configure users to operate with SNMPv3.

- **Step 1.** Set the version of SNMP agent to 3.

```
LTP-8X(config)# ip snmp version v3
```

- **Step 2.** Add users and set the privilege levels.

```
LTP-8X(config)# ip snmp user "rwuser" auth-password "rwpass" enc-password "rwencr"
access rw
LTP-8X(config)# ip snmp user "rouser" auth-password "ropass" enc-password "roencr"
access ro
```

- **Step 3.** Check the configuration.

```
LTP-8X(config)# do show ip snmp users
SNMP users
~~~~~

User name                permissions
-----
rwuser                   read-write
rouser                   read-only

2 SNMP users.
```

⚠ The SNMPv3 agent supports authNoPriv and authPriv methods. The encryption of the password performs according to the MD5 algorithm.

4.5.2 NTPD configuration

The terminal has no integrated **real-time** clocks with a battery. For the events in system log to show correct time and for automated operations to be performed in time, time synchronisation should be adjusted with the help of the NTP protocol.

- **Step 1.** Switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Enable time synchronisation by using the **ip ntp enable** command. Specify the IP address to be used for synchronisation in the **ip ntp ip** command.

```
LTP-8X(config)# ip ntp enable
LTP-8X(config)# ip ntp ip 192.168.1.254
```

- **Step 3.** Specify the synchronisation interval in seconds by using the **ip ntp interval** command.

```
LTP-8X(config)# ip ntp interval 3600
```

- **Step 4.** Use the **ip ntp timezone** and **ip ntp daylightsaving** commands to set the time zone of your region and indicate whether it should be switched to the daylight-saving time.

```
LTP-8X(config)# ip ntp timezone 7
LTP-8X(config)# ip ntp daylightsaving
```

- **Step 5.** Check the entered data by using the **do show ip ntp** command.

```
LTP-8X(config)# do show ip ntp
  Ntp:
    Enabled:                true
    Ntpserver:              192.168.1.254
    Interval:               3600
    Timezone:               7
    Daylightsaving:        true
LTP-8X(config)#
```

- **Step 6.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)# do commit
```

4.5.3 ACSD and DHCPD configuration

The terminal has an integrated auto configuration server (ACS). To ensure interaction between ONTs and ACS, ONTs should obtain IP addresses for their management interfaces. The terminal has an integrated DHCP server to solve this task. These two servers are interconnected and cannot work separately.

4.5.3.1 ACSD configuration

- **Step 1.** Switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Turn on the ACS server by using the **ip acs server enable** command.

```
LTP-8X(config)# ip acs server enable
```

- **Step 3.** If necessary, set the IP address, server mask, and identifier of the management VLAN, which will be used to send packets between ACS and ONTs. By default, mask **21** is set, which enables **2046** hosts per network.

```
LTP-8X(config)# ip acs server ip 192.168.200.9
LTP-8X(config)# ip acs server mask 255.255.255.0
LTP-8X(config)# ip acs server vid 200
```

- **Step 4.** In addition to HTTP, ACS can also use an extended version of this protocol that supports encryption – HTTPS. This is configured by the **ip acs server scheme** command.

```
LTP-8X(config)# ip acs server scheme http
```

- **Step 5.** If necessary, configure the login and password to be used by ONTs to access the ACS server.

```
LTP-8X(config)# ip acs server login acs
LTP-8X(config)# ip acs server password acsacs
```

4.5.3.2 DHCPD configuration

- **Step 1.** Start the DHCP server by using the **ip dhcp server enable** command.

```
LTP-8X(config)# ip dhcp server enable
```

- **Step 2.** Configure the range of IP addresses to be assigned by the server with the **ip dhcp server range** command and specify the first and the last addresses of the range.

```
LTP-8X(config)# ip dhcp server range 192.168.200.10 192.168.200.150
```

- **Step 3.** Set the maximum lease time in seconds, during which the server allows clients to use the addresses, by using the **ip dhcp server lease-time** command.

```
LTP-8X(config)# ip dhcp server lease-time 600
```

- **Step 4.** Use the **ip dhcp server option-43** command to configure output of option 43 in the DHCP offer packet for correct connection of ONTs to the ACS server. View general settings of **ACSD** and **DHCPD** to check the format of the option.

```
LTP-8X(config)# ip dhcp server option-43
```

- **Step 5.** If necessary, configure the delivery of static routes to the network to the ONT TR-interface (option 121).

```
LTP-8X(config)# ip dhcp server static-route net 172.20.240.0 mask 255.255.255.0 gateway
172.20.40.1
```


- **Step 6.** Check the changes by using the **do show ip acs server** command.

```
LTP-8X(config)# do show ip acs server
ACS server:
  Enabled:                true
  Ip:                     192.168.200.9
  Port:                   9595
  Mask:                   255.255.255.0
  Vid:                    200
  Scheme:                 'http'
  Login:                  'acs'
  Password:               'acsacs'
  External fw ip:        0.0.0.0
  External fw port:      9595
  Local fw port:         9696
ACS DHCP server:
  Enabled:                true
  Max lease time:        600
  Insert option 43:      true
  First IP:              192.168.200.10
  Last IP:               192.168.200.150
DHCP option 43 (will be generated automatically):
  URL:                   'http://192.168.200.9:9595'
  Login:                 'acs'
  Password:              'acsacs'
```

- **Step 7.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)# do commit
```

4.5.4 LOGD configuration

System log collects terminal history data and allows its further display. Adjustment of system log operates with such terms as module, filter level, and output device.

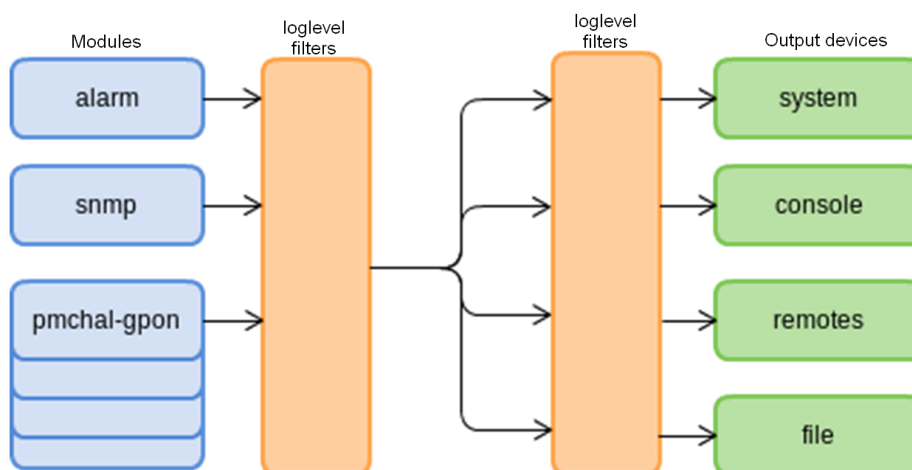


Figure 23 – Terminal system log

Messages of the system log are grouped into modules according to their functions. Configuration of the following modules is possible:


Table 11 – System log modules


Module	Description
alarm	Alarms log message
snmp	Messages from the SNMP agent
dhcpd	Messages from the integrated DHCP server
pmchal-ipc	Messages from the pmchal subsystem of interprocess communication
pmchal-gpon	GPON messages
pmchal-machine	Messages on operation of state machines for OLT, channels, and ONT
pmchal-olt	OLT general information
pmchal-gpon-port	Information about GPON channels
pmchal-ont	ONT information
pmchal-scheduler	Messages from the task scheduler subsystem
pmchal-rdn	Messages on GPON channels reservation
pmchal-dhcpra	Messages from DHCP Relay Agent
pmchal-dhcpv6ra	Messages from DHCPv6 Relay Agent
pmchal-pppoeia	Messages from PPPoE Intermediate Agent

A filtering level and additional display information can be specified for messages of each module. The filtering level sets the minimum importance level of the messages to be displayed in the log. The used filtering levels are listed in Table 12.

Table 12 – System log filtering levels

Level	Description
emergency	Further operation of the system is not possible
alert	The system requires emergency intervention
critical	Critical events
error	Operation errors
warning	Warnings
notice	Important events during normal operation
info	Information messages
debug	Debug messages
none	Messages are not registered in the log

 The emergency level is the maximum level, the debug level is the minimum one.

 Enabling the debug logging level increases the load on the system produced by LOGD. It is not recommended to use debug mode unless necessary.

The log subsystem allows display of the terminal operation log on different devices. All output devices can be used simultaneously.

Table 13 – System log output device

Output device	Name	Description
System log	system	The system log allows the log to be displayed locally or with the help of the syslog server.
Console	console	Being used for log display, the console allows system messages to be visible as soon as they are received in the terminal connected to the Console port.
CLI sessions	rsh	Being used for log display, CLI sessions allow system messages to be visible as soon as they are received in all CLI sessions connected via telnet or SSH.
File	file	Logging into a file allows system messages to be written directly to the file, which can be sent to support specialists for further analysis.

The log is saved in non-volatile memory by default. The system has 4 log rotated files of 1M each. The last 3 logs are archived to gzip.

4.5.4.1 Module configuration

Consider module configuration by the example of the **pmchal-gpon** module responsible for messages from the GPON subsystem. Other modules have similar configuration process.

- **Step 1.** Set the logging level using the **logging module pmchal-gpon loglevel command**.

```
LTP-8X(config)# logging module pmchal-gpon loglevel info
```

- **Step 2.** To view information about modules, use the **do show logging module pmchal-gpon** command.

```
LTP-8X(config)# do show logging module pmchal-gpon
Log:
  Submodule [pmchal-gpon]:
    Log level:                               notice
LTP-8X(config)#
```

- **Step 3.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)# do commit
```

4.5.4.2 Configuring command logging to syslog

The system is capable to record all the user's commands to syslog. Use the following command to activate the function.

```
LTP-8X(config)# logging commands
```

4.5.4.3 Configuring the Origin parameter

The system can add an additional origin-id parameter to messages sent to the Syslog server. It will be added to the beginning of the log message.

Only one additional parameter can be used at a time.

```
LTP-8X(config)# logging origin-id
hostname      The sysname will be used as the hostname field of a
               syslog message
string        The user defined string will be used as the hostname
               field of syslog header
ip            The IP address of the sending interface will be used
               as the hostname field of a syslog message
```

4.5.4.4 Configuring the log storage

Use the following command to record logs to non-volatile memory.

```
LTP-8X(config)# logging permanent
```

If you add "**no**" before the command, the logs will be recorded to RAM. In this case, the logs will be erased after reboot.

4.5.4.5 System log configuration


- **Step 1.** Use the **logging buffer** command to specify the memory size in bytes to be used for system log storage.

```
LTP-8X(config)# logging buffer 262144
```

- **Step 2.** If necessary, use the **logging remote** command to specify the IP address of the remote Syslog server to be used to display system log.

```
LTP-8X(config)# logging remote 192.168.1.43
```

- **Step 3.** Configure the output devices by using the **logging** command.

 Every output device may have its own filtering level or have the output disabled.

For example, it is possible to change the display level for the CLI sessions, which are not connected via the RS-232 console port, to "info" and disable output to file.

```
LTP-8X(config)# logging rsh loglevel info
LTP-8X(config)# logging file loglevel none
```

- **Step 4.** To view Syslog configuration, use the **do show logging settings** command.

```
LTP-8X(config)# do show logging settings
Log:
  Remote syslog:                192.168.1.30
  Remote syslog:                192.168.1.31
  Remote syslog:                192.168.1.55:520
  Remote syslog:                192.168.1.33
  Size:                          16384
  Save logs between boots:      true
  Log input commands:          false
  Destinations:
    System:                      notice
    Console:                     notice
    Remote shells:               info
    File:                         none
```

- **Step 5.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)# do commit
```

4.5.5 ALARMD configuration

ALARMD is a terminal alarms manager. Alarms manager enables troubleshooting and provides information about important events related to terminal operation.

A record in active alarms log (an event) corresponds to an event, which happened in the terminal. Types of events and their descriptions are provided in the following table.

Table 14 – Types of events in the active alarms log

Event	Description	Threshold
ram	Free RAM size decreased to the threshold	30 % *
login	User tried to log in or logged in by entering the credentials	-
config-save	User saved the configuration	-
firmware-update	LTP-8X firmware update completed successfully/ with errors	-
duplicate-mac	Two devices with the same MAC addresses detected	-
physical-layer-flapping	Flapping on Ethernet ports	-
pon-gpon-port-no-ont	The first ONT connected/the last ONT disconnected on channel	-
ont-physical-layer	ONT connected/disconnected	-
olt-update	OLT chip firmware update completed successfully/with errors	-
ont-update	ONT chip firmware update completed successfully/with errors	-
gpon-port-flapping	GPON interface flapping	-
ont-flapping	ONT flapping	-
download	File download completed successfully/with errors	-
battery-power	Switch ONT to battery power	-
battery-low	ONT battery low	Set in ONT

Event	Description	Threshold
lan-los	ONT Ethernet port lost connection	-
ont-config	Configuration of the connected ONT valid/invalid	-
file-delete	File deleted successfully/with errors	-
physical-layer-errors	Physical layer errors on Ethernet ports	-
physical-layer-block	Ethernet port blocked	-
link	Ethernet port status changed (up/down)	-
logout	User logged out	-
ont-dying-gasp	Dying Gasp signal received from ONT	-
ont-rei	Remote Error Indication (REI)	-
ont-power-off	ONT power off	-
config-change	OLT configuration changed	-
shutdown	SNMP agent shut down	-
oms	OMS-MIB operation completed successfully/with errors	-
ont-state-changed	ONT status changed	-
ont-config-changed	ONT configuration changed	-
gpon-port-state-changed	OLT channel configuration changed	-
pon-alarm-gpon-port	Event related to OLT channel	-
pon-alarm-onui	Event related to ONT	-
ont-update-inprogress	Updating ONT firmware	-
olt-device-reset	Resetting OLT chip	-

Event	Description	Threshold
ont-signal-degrade	The signal received from OLT is below the threshold value	-28 dBm
ont-high-rx-power	The signal received from ONT is above the threshold value	-8 dBm
ont-low-rx-power	The signal received from ONT is below the threshold value	
gpon-port-ont-count-overflow	ONT number on channel exceeded	
olt-device-not-working	GPON OLT configuration was loaded successfully/with errors	-
load-average	Average CPU load reached the threshold, estimated time is 1 minute	120*
free-space	Free drive space decreased to the threshold	30 %*
temperature	Temperature of one of the two OLT chips exceeded the threshold	60
fan	Fan rotation speed exceeded the safe operating limits	4800 < X < 9000*
system-reboot	System reboot alarm message	-
rsssi-update	RSSI value on ONT changed	-
storm-detected	The excess of the limit of broadcast/multicast/unknown unicast traffic transmission	-
power-supply	The status of the power supplies modules has been changed	-
ont-los-video-power	Loss of CaTV signal on ONT	-20
ont-low-video-power	Low CaTV signal level reached on the ONT	-10
ont-high-video-power	High CaTV signal level reached on the ONT	0

* The value can be adjusted.

Every record in the active alarms log has the parameters specified in Table 15 that are specified for every event type.

Table 15 – Parameters of events in the active alarms log

Token	Description
severity	Describes event severity. Has four statuses (info, minor, major, critical)
send-on-in	Specifies whether an SNMP trap should be sent when an event is added to the log. Has two states (true/false)
send-on-out	Specifies whether an SNMP trap should be sent when an event is deleted from the log. Has two states (true/false)
ttl	The time an event exists in the active alarms log (from 1 to 2,147,483,647). Specified in seconds. The parameter has several special values. 0 – the event exists in the log until a normalising event is received. -1 – an SNMP trap is sent (if specified), but the event is not recorded in the alarms log

4.5.5.1 Active alarms log configuration

- **Step 1.** To configure the active alarms log, switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Use the **alarm** command to specify the necessary event parameters. Event types are listed in [Table 14](#), the parameters and possible values are given in [Table 15](#).

```
LTP-8X(config)# alarm temperature severity critical
LTP-8X(config)# alarm temperature in
LTP-8X(config)# alarm temperature out
LTP-8X(config)# alarm temperature ttl 0
```

- **Step 3.** Apply the changes by using the **do commit** command.

```
LTP-8X(config)# do commit
```

4.6 VLAN Configuration

This chapter describes VLAN configuration in the terminal switch.

VLAN (Virtual Local Area Network) is a group of devices, which communicate on the channel level and are combined into a virtual network, connected to one or more network devices (GPON terminals or switches). VLAN is a very important tool for creating a flexible and configurable logical network topology over the physical topology of a GPON network. VLAN has two or more switch interfaces. A VLAN member interface can be either tagged or untagged. An outgoing packet of a tagged interface has a VLAN tag. An outgoing packet of an untagged interface has no VLAN tags. For more information about the configuration and rules of operation of interfaces, see the [VLAN Configuration](#).

4.6.1 Adding VLAN

- **Step 1.** VLAN is configured in the terminal switch. Use the **switch** and **configure** commands consecutively to switch to the **config view**.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Add a VLAN by using the **vlan** command. Pass VID as a parameter.

```
LTP-8X(switch)(config)# vlan 5
LTP-8X(switch)(config-vlan)#
```

⚠ CLI automatically switches **view** to work with the VLAN. The same command is used to configure existing VLANs.

4.6.2 VLAN Configuration

- **Step 1.** Add tagged interfaces by using the **tagged** command. Pass interface type and number (or a range) as parameters. The interface types and numbers are given in [Table 19](#), in the [Interface configuration](#) section.

```
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 1
```

- **Step 2.** Add untagged interfaces by using the **untagged** command if needed. Pass interface type and number (or a range) as parameters.

```
LTP-8X(switch)(config-vlan)# untagged front-port 1
```

- **Step 3.** Delete all unnecessary interfaces from the VLAN by using the **forbidden** command. Pass interface type and number (or a range) as parameters.

```
LTP-8X(switch)(config-vlan)# forbidden 10G-front-port 0 - 1
LTP-8X(switch)(config-vlan)# forbidden front-port 0 , front-port 2 , front-port 3
```

- **Step 4.** Disable IGMP snooping by using the **no ip igmp snooping enable** command if needed.

```
LTP-8X(switch)(config-vlan)# no ip igmp snooping enable
```

- **Step 5.** Configure the IGMP querier if needed. It can be enabled by using the **ip igmp snooping querier enable** command. The fast-leave mode is enabled by using the **ip igmp snooping querier fast-leave** command. By default, this mode is disabled.

DSCP and 802.1P marking for IGMP query is configured by using the **ip igmp snooping querier user-prio** and **ip igmp snooping querier dscp** commands.

The **upstream** IGMP packet source IP address spoofing is configured by using the **ip igmp snooping replace source-ip** command.

```
LTP-8X(switch)(config-vlan)# ip igmp snooping querier enable
LTP-8X(switch)(config-vlan)# ip igmp snooping querier fast-leave
LTP-8X(switch)(config-vlan)# ip igmp snooping querier user-prio 4
LTP-8X(switch)(config-vlan)# ip igmp snooping querier dscp 40
LTP-8X(switch)(config-vlan)# ip igmp snooping replace source-ip 192.168.21.2
```

- **Step 6.** Configure IGMP if needed.

Compatible versions (v1, v2, v3, or their combination):

```
LTP-8X(switch)(config-vlan)# ip igmp version v2-v3
```

Interval between queries:

```
LTP-8X(switch)(config-vlan)# ip igmp query-interval 125
```

Maximum query response time:

```
LTP-8X(switch)(config-vlan)# ip igmp query-response-interval 10
```

Interval between Group-Specific Queries:

```
LTP-8X(switch)(config-vlan)# ip igmp last-member-query-interval 1
```

Robustness:

```
LTP-8X(switch)(config-vlan)# ip igmp robustness 2
```

- **Step 7.** Disable MLD snooping by using the **no ipv6 mld snooping enable** command if needed.

```
LTP-8X(switch)(config-vlan)# no ipv6 mld snooping enable
```

- **Step 8.** Configure the MLD querier if needed. It can be enabled by using the **ipv6 mld snooping querier enable** command.

The fast-leave mode is enabled by using the **ipv6 mld snooping querier fast-leave** command. By default, this mode is disabled.

DSCP and 802.1P marking for MLD query is configured by means of the **ipv6 mld snooping querier user-prio** and **ipv6 mld snooping querier dscp** commands.

```
LTP-8X(switch)(config-vlan)# ipv6 mld snooping querier enable
LTP-8X(switch)(config-vlan)# ipv6 mld snooping querier fast-leave
LTP-8X(switch)(config-vlan)# ipv6 mld snooping querier user-prio 4
LTP-8X(switch)(config-vlan)# ipv6 mld snooping querier dscp 40
```

- **Step 9.** Configure MLD if needed.
Compatible versions (v1, v2):

```
LTP-8X(switch)(config-vlan)# ipv6 mld version v1-v2
```

Interval between queries:

```
LTP-8X(switch)(config-vlan)# ipv6 mld query-interval 125
```

Maximum query response time:

```
LTP-8X(switch)(config-vlan)# ipv6 mld query-response-interval 10
```

Interval between Group-Specific Queries:

```
LTP-8X(switch)(config-vlan)# ipv6 mld last-member-query-interval 1
```

Robustness:

```
LTP-8X(switch)(config-vlan)# ipv6 mld robustness 2
```

- **Step 10.** For further convenience, specify a VLAN name by using the **name** command. To clear the name, use the **no name** command. The default name is VID.

```
LTP-8X(switch)(config-vlan)# name iptv
```

- **Step 11.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# commit
```

4.6.3 VLAN Deletion

- **Step 1.** Delete a VLAN by using the **no vlan** command. Pass VID (or its range) as a parameter.

```
LTP-8X(switch)(config)# no vlan 5
```

4.7 Configuring access control list and policy

ACL (Access Control List) – the table which defined filtering rules for incoming traffic according to data transmitted in the incoming packets: protocols, TCP/UDP ports, IP address or MAC address. The ACL based on IPv4 and MAC should have different names. You can set one type of the lists per interface. Each access list contains up to 20 rules.

4.7.1 Configuring MAC access-list

In a MAC access list, filtering is implemented according to the following criteria and a mask:

Table 16 – The list of MAC access-list criteria

Criteria	Mask	Command example	Note
Src MAC	Yes	permit A8:F9:4B:00:00:00 FF:FF:FF:00:00:00 any	Mask 00:00:00:00:00:00 corresponds to any Mask FF:FF:FF:00:00:00 corresponds to the address range A8:F9:4B:00:00:00 - A8:F9:4B:FF:FF:FF
Dst MAC	Yes	permit any A8:F9:4B:00:00:00 FF:FF:FF:00:00:00	Mask FF:FF:FF:FF:FF:FF corresponds to one specific address
Vlan	No	permit any any vlan 10	
COS	Yes	permit any any vlan any cos 4 4	Mask 0 corresponds to any Mask 4(100) corresponds to cos 4(100), 5(101), 6(110), 7(111) Mask 7 corresponds to one specific cos
Ethertype	Yes	permit any any vlan any cos any ethertype 0x0800 0xFF00	Mask 0x0000 corresponds to any Mask 0xFF00 corresponds to the range 0x0800 - 0x08FF Mask 0xFFFF corresponds to one specific ethertype

- **Step 1.** Create a mac access-list.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# mac access-list extended eltexsrc
```

- **Step 2.** Configure rules and assign the list to a port.

```
LTP-8X(switch)(config-mac-al)# deny A8:f9:4B:00:AA:00 FF:FF:FF:FF:FF:00 any
LTP-8X(switch)(config-mac-al)# deny any any vlan any cos 7 7
LTP-8X(switch)(config-mac-al)# permit A8:F9:4B:00:00:00 FF:FF:FF:00:00:00 any vlan 2
cos 4 4
LTP-8X(switch)(config-mac-al)# exit
LTP-8X(switch)(config)# interface front-port 7
LTP-8X(switch)(config-if)# service-acl mac eltexsrc
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```

- **Step 3.** Check the access list configuration.

```
LTP-8X(switch)# show access-list

Extended MAC access list "eltexsrc"(#0), filters count: 3
  Rule 1 (deny):
    MAC SA      A8:F9:4B:00:AA:00 [FF:FF:FF:FF:FF:00]
  Rule 2 (deny):
    COS         7 [7]
  Rule 3 (permit):
    MAC SA      A8:F9:4B:00:00:00 [FF:FF:FF:00:00:00]
    Vlan        2
    COS         4 [4]
```

- **Step 4.** Check the list assignment to the port.

```
LTP-8X(switch)# show interfaces acl front-port 7
Interface      MAC access-list      IP access-list
front-port 0   eltexsrc              -
```

4.7.2 Configuring IP access-list

The rules of an IP access list support criteria that are available in a MAC access-list

Table 17 – The list of the IP access list-criteria

Criteria	Mask	Command example	Note
Proto ID	No	permit tcp ... permit udp ... permit any ... permit proto <id> ...	
Src IP	Yes	permit any 10.10.0.0 255.0.255.0 any	Mask 0.0.0.0 corresponds to any Mask 255.0.255.0 corresponds to the range 10.0.10.0 - 10.255.10.255
Dst IP	Yes	permit any any 10.10.0.0 255.0.255.0	Mask 255.255.255.255 corresponds to one specific address
DSCP	No	permit any any any dscp 48	
Precedence	No	permit any any any precedence 7	
Src MAC	Yes	permit any any any dscp any mac A8:F9:4B:00:00:00 FF:FF:FF: 00:00:00 any	Mask 00:00:00:00:00:00 corresponds to any
Dst MAC	Yes	permit any any any dscp any mac any A8:F9:4B:00:00:00 FF:FF:FF: 00:00:00	Mask FF:FF:FF:00:00:00 corresponds to the address range A8:F9:4B:00:00:00 - A8:F9:4B:FF:FF:FF Mask FF:FF:FF:FF:FF:FF corresponds to one specific address
Vlan	No	permit any any any dscp any mac any any vlan 10	
COS	Yes	permit any any any dscp any mac any any vlan any cos 4 4	Mask 0 corresponds to any Mask 4(100) corresponds to cos 4(100), 5(101), 6(110), 7(111) Mask 7 corresponds to one specific cos

Criteria	Mask	Command example	Note
Ethertype	Yes	<pre>permit any any any dscp any mac any any vlan any cos any ethertype 0x0800 0xFF00</pre>	<p>Mask 0x0000 corresponds to any</p> <p>Mask 0xFF00 corresponds to the range 0x0800 - 0x08FF</p> <p>Mask 0xFFFF corresponds to one specific ethertype</p>

- **Step 1. Create an ip access-list.**

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip access-list extended filter5
```

- **Step 2. Configure rules and assign the list to a port.**

```
LTP-8X(switch)(config-ip-al)# deny tcp 10.10.5.0 255.255.255.0 any any any
LTP-8X(switch)(config-ip-al)# permit tcp 10.10.0.0 255.255.0.0 any any any
LTP-8X(switch)(config-ip-al)# exit
LTP-8X(switch)(config)# interface front-port 7
LTP-8X(switch)(config-if)# service-acl ip filter5
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```

- **Step 3. Check the access-list configuration.**

```
LTP-8X(switch)# show access-list

Extended IP access list "filter5" (#10), filters count: 2

Rule 1 (deny):
  IPv4 protocol 6 (TCP)
  IP SA         10.10.5.0 [255.255.255.0]
  Sport        8080
Rule 2 (permit):
  IPv4 protocol 6 (TCP)
  IP SA         10.10.0.0 [255.255.0.0]
```

- **Step 4. Check the access-list assignment to the port.**

```
LTP-8X(switch)# show interfaces acl front-port 7
Interface      MAC access-list      IP access-list
front-port 0   eltexsrc              filter5
```

4.7.3 Configuring ACL based on a bit mask

The filtering based on a bit mask is available in MAC and IP access-lists. The configuration is implemented with the help of offset-list.

Command format:

```
offset-list list1 <offset-type> <offset> <byte-mask> <byte-value> ...
```

You can configure up to 5 unique offset-lists on the OLT.

Table 18 – The list of the available offset-lists

offset-list	Type	Limits
mac	I2	0..127
mac	dst-mac	0..5
mac	src-mac	0..5
mac	inner-tag	0..1
mac	outer-tag	0..1
mac	ethtype	0..1
ip	I3	0..23
ip	I4	0..89

```
permit any any vlan any cos any ethertype any offset-list eltex1p
```

- **Step 1.** Create an access-list.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# mac access-list extended Eltex0UI
```

- **Step 2.** Configure rules and assign the access-list to a port.

```
LTP-8X(switch)(config-mac-al)# offset-list e1 l2 0 FF A8 l2 1 FF F9 l2 2 FF 4B
LTP-8X(switch)(config-mac-al)# offset-list e2 l2 0 FF E0 l2 1 FF D9 l2 2 FF E3
LTP-8X(switch)(config-mac-al)# permit any any vlan any cos any ethertype any offset-
list e1
LTP-8X(switch)(config-mac-al)# permit any any vlan any cos any ethertype any offset-
list e2
LTP-8X(switch)(config-mac-al)# exit
LTP-8X(switch)(config)# interface pon-port 0
LTP-8X(switch)(config-if)# service-acl mac OUIfilter
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```

- **Step 3.** Check the access-list configuration.

```
LTP-8X(switch)# show access-list
Extended MAC access list "EltexOUI"(#2), filters count: 2
  Offset lists:
    e1          l2:0:FF:A8 l2:1:FF:F9 l2:2:FF:4B
    e2          l2:0:FF:E0 l2:1:FF:D9 l2:2:FF:E3
  Rule 1 (permit):
    Offset-list e1
  Rule 2 (permit):
    Offset-list e2
```

4.7.4 Configuring policies

Configuring policies allows you to perform various manipulations on classified traffic, such as **cos**, **dscp**, **queue** setting.

- **Step 1.** Create an access-list according to which the traffic will be classified.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip access-list extended sip-dhcp-acl
LTP-8X(switch)(config-ip-al)# permit udp any 68 any 67
LTP-8X(switch)(config-ip-al)# permit udp any any any 5060
LTP-8X(switch)(config-ip-al)# exit
```

- **Step 2.** Create a traffic class.

```
LTP-8X(switch)(config)# class-map sip-dhcp-class
LTP-8X(switch)(config-class 'sip-dhcp-class')# match access-group sip-dhcp-acl
LTP-8X(switch)(config-class 'sip-dhcp-class')# exit
```

- **Step 3.** Set policy.

```
LTP-8X(switch)(config)# policy-map cos7
LTP-8X(switch)(policy-class 'cos7')# class sip-dhcp-class
LTP-8X(switch)(traffic-class 'sip-dhcp-class')# cos 7
LTP-8X(switch)(traffic-class 'sip-dhcp-class')# exit
LTP-8X(switch)(policy-class 'cos7')# exit
LTP-8X(switch)(config)# interface pon-port 0
LTP-8X(switch)(config-if)# service-policy cos7
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```

- **Step 4.** Check the configuration of the policy and classes.

```
LTP-8X(switch)# show access-list
Extended IP access list "sip-dhcp-acl"(#8), filters count: 2
  Rule 1 (permit):
    IPv4 protocol  17 (UDP)
    Sport          68
    Dport          67
  Rule 2 (permit):
    IPv4 protocol  17 (UDP)
    Dport          5060
LTP-8X(switch)# show interfaces acl pon-port 0
Interface      MAC access-list      IP access-list      Policy-
map
pon-port 0    -                      -                      cos7
```

While the configuration, you should remember that **deny** in an ACL rule exclude the traffic from processing according to policy.

4.8 IGMP and MLD configuration in terminal switch

This chapter describes IGMP and MLD configuration in the terminal switch.

4.8.1 Enabling snooping

- **Step 1. Snooping** is configured globally in the terminal switch. Execute the **switch** and **configure** commands consecutively to switch to the **config view**.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Enable IGMP snooping by using the **ip igmp snooping** command.

```
LTP-8X(switch)(config)# ip igmp snooping
```

- **Step 3.** Enable MLD snooping by using the **ipv6 mld snooping** command.

```
LTP-8X(switch)(config)# ipv6 mld snooping
```



- Snooping is globally enabled in all VLANs.
- MLD snooping is not supported for Model 1.

4.8.2 Enabling report proxy

- **Step 1.** Enable IGMP report proxy between VLANs by using the **ip igmp proxy report enable** command.

```
LTP-8X(switch)(config)# ip igmp proxy report enable
```

- **Step 2.** Set IGMP report proxy rules by using the **ip igmp proxy report range** command. As parameters, pass a range of acceptable groups and the proxy direction as a VID pair.

```
LTP-8X(switch)(config)# ip igmp proxy report range 224.0.0.0 239.255.255.255 from 200 to 98
```

- **Step 3.** Enable MLD report proxy between VLANs by using the **ipv6 mld proxy report enable** command.

```
LTP-8X(switch)(config)# ipv6 mld proxy report enable
```

- **Step 4.** Set MLD report proxy rules by using the **ipv6 mld proxy report range** command. As parameters, pass a range of acceptable groups and the proxy direction as a VID pair.

```
LTP-8X(switch)(config)# ipv6 mld proxy report range ff15:0::1 ff15:0::ffff from 300 to 98
```



To enable proxy from all VLANs, use the "from all to <VLAN>" structure.

4.9 Interface configuration

This chapter describes configuration of terminal interfaces.

Terminal interfaces can be divided into two groups: Ethernet interfaces and GPON interfaces. Ethernet interfaces are used for terminal connection to operator's network core. GPON interfaces are used for ONT connections.

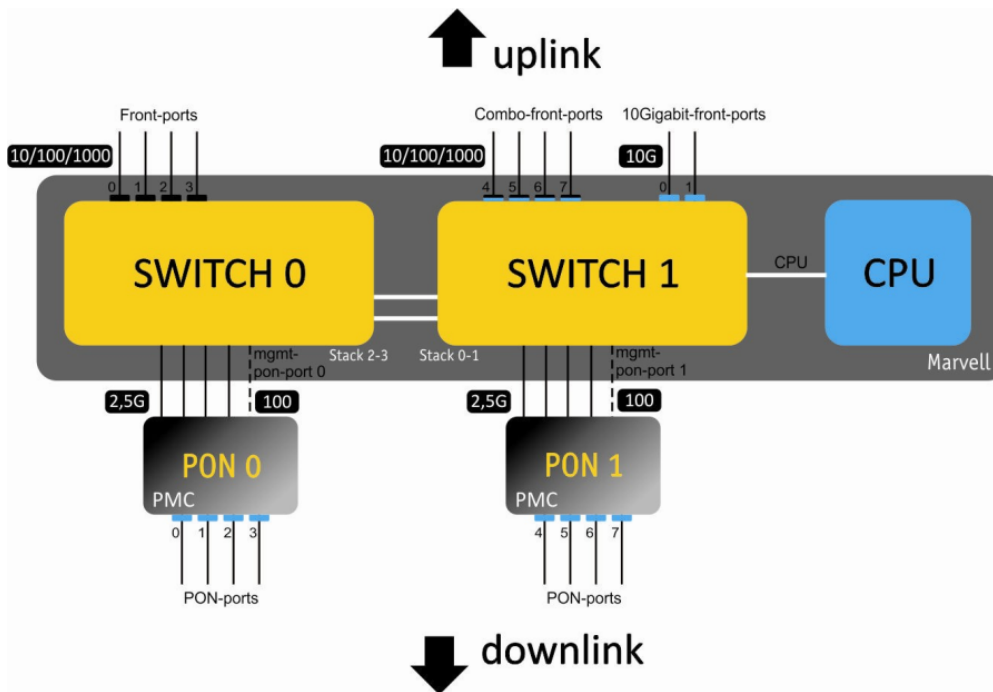


Figure 24 – Set of terminal interfaces

Table 19 shows types of terminal switch interfaces.

Table 19 – Interfaces types and numbers

Interface	Note	Quantity	Range
10G-front-port		2	[0..1]
front-port	for LTP-4X	4	[0..3]
	for LTP-8X	8	[0..7]
pon-port	for LTP-4X	4	[0..3]
	for LTP-8X	8	[0..7]

4.9.1 Ethernet interface configuration

- **Step 1.** Switch to the view of the interface (of interface group), which settings should be changed.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# interface front-port 0
LTP-8X(switch)(config-if)#
```

- **Step 2.** Enable the interface by using the **no shutdown** command. On the contrary, the **shutdown** command disables the interface.

```
LTP-8X(switch)(config-if)# no shutdown
```

- **Step 3.** Enable or disable flow control (IEEE 802.3x PAUSE) by using the **flow-control** command.

```
LTP-8X(switch)(config-if)# flow-control on
```

- **Step 4.** Enable or disable incoming packets filtering by using the **ingress-filtering** command. Only the packets of the VLANs, which have this interface, will pass the enabled filter. Other packets will be filtered out. If the filter is disabled, a packet will be processed regardless of its VID field.

```
LTP-8X(switch)(config-if)# ingress-filtering
```

- **Step 5.** Specify a rule for VLAN tags processing for incoming packets by using the **frame-types** command. As a parameter, specify the packets to be allowed: either **tagged** (tagged only) or **all** (both tagged and untagged).

```
LTP-8X(switch)(config-if)# frame-types tagged
```

- **Step 6.** Specify the port pvid, i. e. the VLAN, which will accommodate untagged packets. Specify the **pup** value, which is the priority of untagged packets.

```
LTP-8X(switch)(config-if)# pvid 100
LTP-8X(switch)(config-if)# pup 0
```

- **Step 7.** If necessary, enable or disable packets transfer from this interface to another one (or a range of interfaces) by using the **bridging to** command. Pass interface type and number (or a range) as parameters. The interface types and numbers are given in [Table 19](#). All front-port interfaces are isolated by default, however data can be sent to any pon-port interface. The same is applicable to pon-port interfaces, which are isolated from each other, but can send data to any front-port interfaces.

```
LTP-8X(switch)(config-if)# bridging to front-port 1
```

- **Step 8.** If needed, use the **spanning-tree** command group to adjust the STP protocol.

```
LTP-8X(switch)(config-if)# spanning-tree enable
LTP-8X(switch)(config-if)# spanning-tree priority 32
LTP-8X(switch)(config-if)# spanning-tree pathcost 0
LTP-8X(switch)(config-if)# spanning-tree admin-p2p auto
LTP-8X(switch)(config-if)# spanning-tree admin-edge
```

- **Step 9.** If needed, set band limits for Broadcast, Multicast, Unknown Unicast and the whole traffic by using the **rate-limit bc/mc/uu**, and **shaper** commands correspondingly. As parameters, pass the maximum band width in kbps and the maximum length of uninterrupted transmission of packet batches in bytes.

```
LTP-8X(switch)(config-if)# rate-limit bc 1000 2048
LTP-8X(switch)(config-if)# rate-limit mc 1000 2048
LTP-8X(switch)(config-if)# shaper 100000 4000
```

- **Step 10.** Set automatic determination of speed and duplex of the interface either by using the **speed auto** command or manually.

```
LTP-8X(switch)(config-if)# speed auto
```

- **Step 11.** Set the interface description by the **description** command.

```
LTP-8X(switch)(config-if)# description org-uplink
```

- **Step 12.** Enable **mac notification trap** if necessary. The device will send snmp-trap when learning new MAC or when deleting the old one.

```
LTP-8X(switch)(config-if)# snmp trap mac-notification added
LTP-8X(switch)(config-if)# snmp trap mac-notification removed
```

- **Step 13.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```


4.9.2 Configuring Storm Control

A storm appears due to excessive number of broadcast or/and multicast messages transmitted on the network via a single port simultaneously. It leads to an overload of the network resources and appearing of delays. A storm also can be caused by loopback segments of an Ethernet network. The switch evaluates the rate of incoming broadcast, multicast and unknown unicast traffic for port with enabled Storm Control and drops packets if the rate exceeds the set maximum value.

There is an opportunity to record a storm event to the log and disable the port for a specified time (in seconds).

```
LTP-8X(switch)(config-if)# rate-limit uu 1000 2048
LTP-8X(switch)(config-if)# rate-limit mc 1000 2048 logging
LTP-8X(switch)(config-if)# rate-limit bc 1000 2048 logging shutdown 30
```

For manual enabling of the port after blocking by Storm Control, use the **clear storm** command.

```
LTP-8X(switch)# clear storm front-port 0
```

4.9.3 GPON interface configuration

- **Step 1.** Switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Activate traffic encryption with the **gpon olt encryption** command if necessary. Specify the encryption key renewal period with the **gpon olt encryption key-update** command. Pass time period in seconds as a parameter.

```
LTP-8X(config)# gpon olt encryption
LTP-8X(config)# gpon olt encryption key-update 60
```

- **Step 3.** Specify ONT authentication method with the **gpon olt authentication** command. ONTs can be authenticated by password, serial number, or both.

```
LTP-8X(config)# gpon olt authentication both
```

- **Step 4.** Specify time of ONT blocking (in minutes) in case of MAC duplication or storm appearing. For details see the [Configuring Storm Control](#) section.

```
LTP-8X(config)# gpon olt ont-block-time 1
```

It is possible to receive a PON password of non-configured ONTs in an ALARM trap.

```
LTP-8X(config)# gpon olt password-in-trap
```

- **Step 5.** Switch to GPON interface configuration.


```
LTP-8X(config)# interface gpon-port 0-7
```

- **Step 6.** Enable or disable interfaces with the **no shutdown** or **shutdown** command respectively if necessary.

```
LTP-8X(config)(if-gpon-0-7)# no shutdown
```

- **Step 7.** Activate FEC for interfaces with the **fec** command if necessary.

```
LTP-8X(config)(if-gpon-0-7)# fec
```


 In case of using FEC, the real bandwidth decreases by ~10 %

- **Step 8.** If necessary, enable the ability to migrate MAC addresses for selected interfaces.

```
LTP-8X(config)(if-gpon-0-7)# mac-migration
```

- **Step 9.** Adjust time settings of optical transceivers if needed.

```
LTP-8X(config)(if-gpon-0-7)# optics use-custom
LTP-8X(config)(if-gpon-0-7)# optics ...
```

 Optical transceivers should be adjusted only by agreement with Eltex Service Center.

- **Step 10.** If necessary, enable unknown multicast with the following command.

```
LTP-8X(config)(if-gpon-7)# unknown-multicast-forward enable
```

- **Step 11.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)(if-gpon-0-7)# exit
LTP-8X(config)# do commit
```


4.9.4 GPON port force enable

LTP-X devices have the ability to forcibly enable GPON ports that are disabled in the configuration

```
LTP-8X# show interface gpon-port 7 state
Reading: .
Gpon-port status information:
  Gpon-port:                7
  State:                    DISABLED
  ONT count:                0
  Force-mode:               disabled
  ONT autofind:             enabled
  SFP vendor:               Ligent
  SFP product number:       LTE3680M-BC
  SFP vendor revision:      1.0
  SFP temperature [C]:      67
  SFP voltage [V]:          3.28
  SFP tx bias current [mA]: n/a
  SFP tx power [dBm]:       n/a
```


To forcibly enable the port, put it into the **force mode**. The command is applied without entering the **commit** command.

```
LTP-8X# force-mode interface gpon-port 7
```

 The command will not apply to an enabled gpon-port.

As a result, the port will be enabled until the next reconfiguration or reboot.

```
LTP-8X# show interface gpon-port 7 state
Reading: .
Gpon-port status information:
  Gpon-port:                7
  State:                    OK
  ONT count:                0
  Force-mode:               enabled
  ONT autofind:             enabled
  SFP vendor:               Ligent
  SFP product number:       LTE3680M-BC
  SFP vendor revision:      1.0
  SFP temperature [C]:      65
  SFP voltage [V]:          3.25
  SFP tx bias current [mA]: 16.81
  SFP tx power [dBm]:       3.34
```

 The **force-mode** command stops if the device is reconfigured or rebooted, because it is not saved in the configuration.

4.9.5 Unknown-multicast traffic forwarding

LTP-X devices have the ability to forward unknown-multicast to broadcast-gem-port. Configuration is performed for each GPON port separately.

```
LTP-8X# configure terminal
LTP-8X(config)# interface gpon-port 0
LTP-8X(config)(if-gpon-0)# unknown-multicast-forward enable
LTP-8X(config)(if-gpon-0)# unknown-multicast-forward to broadcast-gem
```

⚠ This functionality is required for some protocols, such as IS-IS. After applying the settings, the specified GPON port will be reconfigured, which will lead to the reconfiguration of all ONTs on the port.

4.9.6 GPON ports redundancy configuration

GPON port redundancy is designed to increase the reliability of the PON network. There are several types of redundancy: Type-A, Type-B, Type-C and Type-D. LTP-X supports Type-B redundancy. Type-B redundancy provides the ability to automatically switch between channels by using an additional GPON port. There are several ONT connection schemes (Figure 25 and Figure 26).

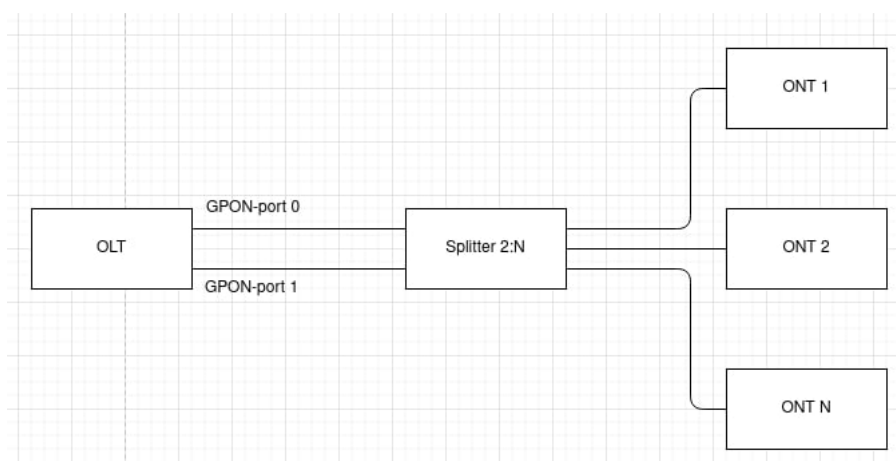


Figure 25 – Type-B redundancy. Connection scheme 1

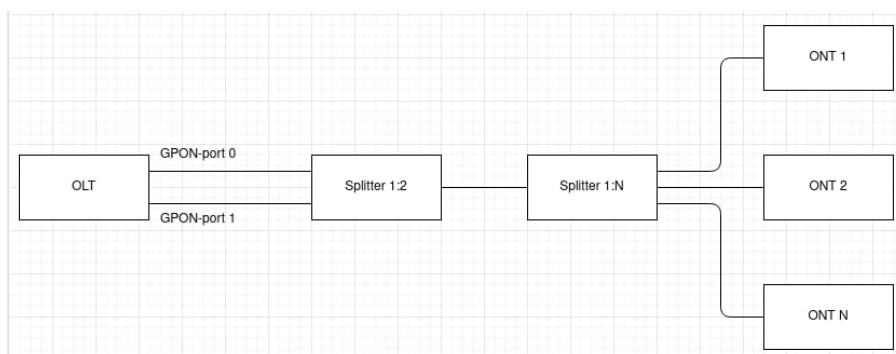


Figure 26 – Type-B redundancy. Connection scheme 2

⚠ Before beginning to operate with redundancy 1, make sure that OLT supports it.

Redundancy is supported on the following boards:

- LTP-4X/8X-rev.C with PLD version 14 and higher;
- LTP-4X/8X rev.D.

The necessary information can be obtained by using the **show system environment** command.

```
LTP-8X# show system environment
System information:
  CPU load average (1m, 5m, 15m):  0.60  0.44  0.31
  Free RAM/Total RAM (Mbytes):      175/495
  Temperature (sensor1/sensor2):    40C/50C
  Reset button:                      enabled

  Fan configured speed, %:           auto
  Fan minimum speed, %:              15
  Fan speed levels, %:               16 27 39 51 64 76 88 100

  Fan state (fan0/fan1):             8640rpm 8760rpm

  PLD FW version:                    14

  TYPE:                              LTP-8X-rev.C
  HW_revision:                       1v4
  SN:                                 GP2B000860
  MAC:                               E0:D9:E3:DF:E4:D0

Power supply information:
  Module 1: PM160 220/12 1vX
    Type: Alternate current(AC)
    Intact: 1
  Module 2: PM150(75) 48/12 1vX
    Type: Direct current(DC)
    Intact: 0
```

Before connecting an ONT, check the list of supported ONTs (Table 20). For the proper redundancy operation, it is necessary to connect ONT to OLT according to one of the schemes ([Figure 25](#) and [Figure 26](#)).

Table 20 – List of supported ONTs

Device	The version with which support began
NTU-1(C)	3.26.4
NTU-1 rev.B	3.28.1
NTU-RG-5421G(C)-Wac	1.2.1
NTU-RG-5421G-Wz	
NTU-52V(C)	
NTU-RG-5402G-W	

Device	The version with which support began
NTU-RG-5440G-Wac	2.1.0
NTU-RG-5440G-Wz	

- **Step 1.** The redundancy configuration is performed with the **gpon olt redundancy gpon-port** command.

⚠ Redundancy can only be configured on 4 pairs of ports – 0-1, 2-3, 4-5 and 6-7, other combinations are not supported.

The **gpon olt redundancy gpon-port** command allows you to configure redundancy on one or more pairs at once.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt redundancy gpon-port 0-1,2-3,4-5,6-7
LTP-8X(config)# do commit
```

Once configured, the even-numbered port defaults to the primary channel and the odd-numbered port to the redundant channel.

```
LTP-8X# show interface gpon-port 0-1 state
Reading: ..
Gpon-ports status information:
  Gpon-port:                0                1
  State:                    OK                REDUNDANT
  ONT count:                 0                0
  Force-mode:                disabled         disabled
  ONT autofind:              enabled         enabled
  SFP vendor:                Ligent           Ligent
  SFP product number:        LTE3680M-BC    LTE3680M-BC
  SFP vendor revision:       1.0          1.0
  SFP temperature [C]:       70            39
  SFP voltage [V]:           3.19          3.24
  SFP tx bias current [mA]:  17.29         n/a
  SFP tx power [dBm]:        3.54          n/a
```

- **Step 2.** Configure the ONT on an even-numbered port.

⚠ ONT configuration is performed only on even-numbered ports (0, 2, 4 and 6), odd-numbered ports use the configuration from even-numbered ports.

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/2
LTP-8X(config)(if-ont-0/2)# serial ELTX62108400
LTP-8X(config)(if-ont-0/2)# do commit
```

Once configured, the ONT will appear in the OK state on the main channel and in the REDUNDANT state on the redundant channel.

- **Step 3.** To display ONT information on a pair of channels, use the **show interface ont x-x redundant** command.

```
LTP-8X# show interface gpon-port 0-1 state
Reading: ..
Gpon-ports status information:
  Gpon-port:           0           1
  State:              OK         REDUNDANT
  ONT count:          1           1
  Force-mode:         disabled    disabled
  ONT autofind:       enabled     enabled
  SFP vendor:         Ligent      Ligent
  SFP product number:  LTE3680M-BC  LTE3680M-BC
  SFP vendor revision: 1.0       1.0
  SFP temperature [C]: 78         67
```

```

SFP voltage [V]:           3.18           3.23
SFP tx bias current [mA]:  18.94           n/a
SFP tx power [dBm]:       3.54           n/a
LTP-8X# show interface ont 0-1 redundant

-----
GPON-port 0 ONT redundant list
-----

  ##      Serial  ONT ID  GPON-port  Status  RSSI[dBm]  Version
EquipmentID
  1  ELTX62108400    2      0      OK      -10.71    3.28.1.69
NTU-1

-----
GPON-port 1 ONT redundant list
-----

  ##      Serial  ONT ID  GPON-port  Status  RSSI[dBm]  Version
EquipmentID
  1  ELTX62108400    2      1  REDUNDANT      n/a    3.28.1.69
NTU-1

Total ONT count: 2
```

In case of malfunction on the main channel, such as line breakage, there will be a seamless channel change – the redundant channel will become the main channel, the main channel in this case will go to redundant state. Seamless channel change is the transition of all ONTs from the main channel to the redundant channel without interrupting client sessions.

```
LTP-8X# show interface ont 0-1 redundant
```

```
-----
GPON-port 0 ONT redundant list
-----
```

EquipmentID	##	Serial	ONT ID	GPON-port	Status	RSSI[dBm]	Version
NTU-1	1	ELTX62108400	2	0	REDUNDANT	n/a	3.28.1.69

```
-----
GPON-port 1 ONT redundant list
-----
```

EquipmentID	##	Serial	ONT ID	GPON-port	Status	RSSI[dBm]	Version	EquipmentID
NTU-1	1	ELTX62108400	2	1	OK	-14.85	3.28.1.69	NTU-1

```
Total ONT count: 2
```

⚠ Once the communication line is restored, there will be no switching back. The next switch will only occur if there is a malfunction on the current main channel.

4.9.7 Port Mirroring configuration

Port mirroring is used to duplicate the traffic on monitored ports by sending ingress or and/or egress packets to the controlling port. Users can define a controlled port and controlling ports and select the type of the traffic (ingress or egress), which will be sent to the controlling port.

4.9.7.1 Configuration of the controlled port

- **Step 1. Mirroring** is configured in the terminal switch. Execute the **switch** and **configure** commands consecutively to switch to the **config view**.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Configure the pon-port mirroring for ingress and egress traffic.

```
LTP-8X(switch)(config)# mirror rx interface pon-port 0
LTP-8X(switch)(config)# mirror tx interface pon-port 0
```

- **Step 3.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config)# commit
```


4.9.7.2 Configuration of the controlling port

- **Step 1.** Switch to the **switch** config **view** by using the **switch** and **configure** commands.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Configure mirroring and traffic analysis for any front-port.

```
LTP-8X(switch)(config)# mirror rx analyzer front-port 7
LTP-8X(switch)(config)# mirror tx analyzer front-port 7
```

- **Step 3.** If necessary, add a VLAN tag to be used for all mirrored traffic and packet priority.

```
LTP-8X(switch)(config)# mirror add-tag
LTP-8X(switch)(config)# mirror rx added-tag-config vlan 1555 user-prio 0
LTP-8X(switch)(config)# mirror tx added-tag-config vlan 1555 user-prio 0
```

- **Step 4.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config)# commit
```

4.10 LLDP configuration

Link Layer Discovery Protocol (LLDP) is a Data link layer protocol that allows network devices to announce information about themselves and their capabilities to the network, as well as to collect this information about neighboring devices. The standard RFC mib 1.0.8802 are supported by the SNMP agent.

4.10.1 LLDP configuration

- **Step 1.** Activate the LLDP.

```
LTP-8X(switch)(config)# lldp enable
```

- **Step 2.** If necessary, configure LLDPDU transfer mode.

```
LTP-8X(switch)(config)# interface front-port 0
LTP-8X(switch)(config-if)# lldp mode transmit-receive
```

- **Step 3.** Configure optional LLDP-TLVs for ports.

```
LTP-8X(switch)(config-if)# lldp optional-tlv sys-desc
LTP-8X(switch)(config-if)# lldp optional-tlv port-desc
```

- **Step 4.** Specify the amount of time for the receiver to keep LLDP packets before dropping them.

```
LTP-8X(switch)(config)# lldp hold-multiplier 5
```

This value will be transmitted to the receiving side in the LLDP update packets; and should be an increment for the LLDP timer. Thus, the lifetime of LLDP packets is calculated by the formula.

```
TTL = min(65535,LLDP-Timer * LLDP-HoldMultiplier)
```

- **Step 5.** Set the reinitialization time of LLDP.

```
LTP-8X(switch)(config)# lldp reinit 3
```

- **Step 6.** Specify how often the device will send LLDP information updates.

```
LTP-8X(switch)(config)# lldp timer 60
```

- **Step 7.** Specify the delay between the subsequent LLDP packet transmissions caused by the changes of values or status in the local LLDP MIB database.

```
LTP-8X(switch)(config)# lldp tx-delay 3
```

It is recommended that this delay be less than $0.25 * \text{LLDP-Timer}$.

- **Step 8.** Specify the processing mode of LLDP packets.

LLDP packet processing mode:

- filtering – LLDP packets are filtered if LLDP is disabled on the switch;
- flooding – LLDP packets are transmitted if LLDP is disabled on the switch.

```
LTP-8X(switch)(config)# lldp lldpdu flooding
```

- **Step 9.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config)# commit
```

4.11 ERPS configuration

ERPS (Ethernet Ring Protection Switching) – link layer protocol designed to increase the stability and reliability of a data network by creating a ring topology with logical blocking of interfaces. It is realized by reducing recovery network time in case of breakdown. Recovery time does not exceed 1 second. It is much less than network change over time in case of spanning tree protocols usage.

4.11.1 ERPS configuration

- **Step 1.** Enable ERPS.

```
LTP-8X(switch)(config)# erps enable
```

- **Step 2.** Create an ERPS ring with the R-APS VLAN identifier through which service traffic will be transmitted.

```
LTP-8X(switch)(config)# erps vlan 700
```

- **Step 3.** Specify **east/west port**.

```
LTP-8X(switch)(config-erps)# port east front-port 3  
LTP-8X(switch)(config-erps)# port west port-channel 1
```

- **Step 4.** Set the range of secure VLANs.

```
LTP-8X(switch)(config-erps)# protected vlan add 100-103
```

- **Step 5.** If necessary, assign the RPL port with the **owner/neighbor** command.

```
LTP-8X(switch)(config-erps)# rpl east owner
```

- **Step 6.** Change the timers if necessary.

```
LTP-8X(switch)(config-erps)# timer guard 10  
LTP-8X(switch)(config-erps)# timer holdoff 100  
LTP-8X(switch)(config-erps)# timer wtr 1
```

- **Step 7.** Specify a subring if necessary.

```
LTP-8X(switch)(config-erps)# sub-ring vlan 750
```

- **Step 8.** Enable the ring by the **enable** command.

```
LTP-8X(switch)(config-erps)# ring enable
```

- **Step 9.** View the status of the generated ERPS ring.

```
LTP-8X(switch)# show erps vlan 700
R-APS VLAN : 700
Admin Status : Enabled
West Port : port-channel 1 (Signal Fail)
East Port : front-port 1 (Forwarding)
RPL Port : East
RPL Owner : Enabled (Active)
Protected VLANs : 100-103
Ring MEL : 1
Holdoff Time : 100 msec
Guard Time : 10 msec
WTR Time : 1 min
Current Ring State : Protection
Revertive : Yes
Compatibility with version : 2

Sub-Ring R-APS VLAN   TC Propagation State
-----
750                   Disable
```

4.12 ARP-Inspection configuration

The ARP Inspection function is dedicated to defense against attacks which use ARP (for instance, ARP-spoofing – ARP traffic interception). ARP Inspection is implemented on the basis of static correspondence between IP and MAC addresses defined for VLAN.

4.12.1 ARP-Inspection configuration

- **Step 1.** Switch to the **switch** config **view** by using the **switch** and **configure** commands.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Enable **arp inspection**, add static entries.

```
LTP-8X(switch)(config)# ip arp inspection
LTP-8X(switch)(config)# ip arp inspection static-table 1.1.1.1 A8:F9:4B:11:11:01
LTP-8X(switch)(config)# ip arp inspection static-table 1.1.1.2 A8:F9:4B:11:11:10 vlan
10
```

- **Step 3.** Configure trusted and untrusted interfaces.

```
LTP-8X(switch)(config)# interface front-port 7
LTP-8X(switch)(config-if)# no ip arp inspection trusted
LTP-8X(switch)(config)# interface front-port 0 – 6
LTP-8X(switch)(config-if)# ip arp inspection trusted
```

- **Step 4.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config)# commit
```

4.12.2 QoS rules configuration

The traffic prioritization and allocation by hardware queues (IEEE 802.1p/DSCP) are implemented on the basis of set rules in the system.

Table 21 – Traffic prioritization methods

Method	Description
0	All the priorities are equal
1	Packet selection according to IEEE 802.1p
2	Packet selection only according to IP ToS (Type of Service) on 3 level – support for Differentiated Services Codepoint (DSCP)
3	Interaction according to either 802.1p or DSCP/TOS

- **Step 1.** Set a queue on which packets will be transmitted without preset rules. The 0 queue has the least priority.

```
LTP-8X(switch)(config)# qos default 0
```

- **Step 2.** Set a traffic prioritization method by using the **qos type** command. Send a type of prioritization as an argument.

```
LTP-8X(switch)(config)# qos type 1
```

- **Step 3.** Using **qos map** command, set rules for translation of 802.1p and DSCP/TOS to a queue number. Send field type and priorities lists as parameters.

```
LTP-8X(switch)(config)# qos map 1 0-4,15,63 to 6
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
LTP-8X(switch)# show qos
Priority assignment by 802.1p packet field
Default priority queue is 0
DSCP queues:
7: 63
6:
5:
4:
3:
2:
1:
0:
802.1p queues:
7: 7
6: 6
5: 5
4: 4
3: 3
2: 2
1: 1
0: 0
WRR queues disabled
WRR values for queues 7..0: 8 7 6 5 4 3 2 1
```

4.12.3 Weighted Round Robin (WRR) configuration

Weighted Round Robin (WRR) – an algorithm which distribute throughput by classes, using a scheme of weighted round robin. The OLT has 8 hardware queues.

- **Step 1.** Enable WRR and set 4 queues (0, 1, 2, 3) which will be processed by the algorithm. The other queues will be strict. The WRR queues are enumerated from 0.

```
LTP-8X(switch)(config)# qos wrr enable 4
```

- **Step 2.** The weight of each queue, starting with the 7th.

```
LTP-8X(switch)(config)# qos wrr queues 1 1 1 1 60 20 15 5
```

- **Step 3.** Save the configuration.

```
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
LTP-8X(switch)# exit
LTP-8X# save
```

4.13 LAG configuration

This chapter describes configuration of uplink interfaces aggregation. Link aggregation (IEEE 802.3ad) is a technology that allows multiple physical links to be combined into one logical link (aggregation group). Aggregation group has a higher throughput and is very reliable.



Figure 27 – Multiple physical links combined to an aggregation group

The terminal supports two interface aggregation modes: static and dynamic. Static aggregation implies that all communication links of a group are always active. As for dynamic aggregation, link activity is dynamically determined during operation via LACP protocol.

Table 22 – Operation modes of aggregation groups

Mode	Description
static	Link aggregation protocol is not used
lacp	LACP is used

The terminal has several algorithms of load balancing within aggregation groups.

Table 23 – Load balancing modes

Mode	Description
ip	Based on IP addresses of sender and receiver
ip-l4	Based on IP addresses of sender and receiver, and L4
mac	Based on MAC addresses of sender and receiver
mac-ip	Based on MAC and IP addresses of sender and receiver
mac-ip-l4	Based on MAC and IP addresses and L4 of sender and receiver

The terminal supports two LACP modes. Passive – the terminal does not initiate creation of a logical link, but processes incoming LACP packets. Active – the terminal creates an aggregated communication link and initiates parameters conformance. The parameters are coordinated if equipment operates in active or passive LACP modes.

4.13.1 LAG configuration

LAG configuration represents configuration of static aggregation and LACP. To configure LAG, perform the steps marked blue in Figure 28. LACP configuration requires all steps to be performed.

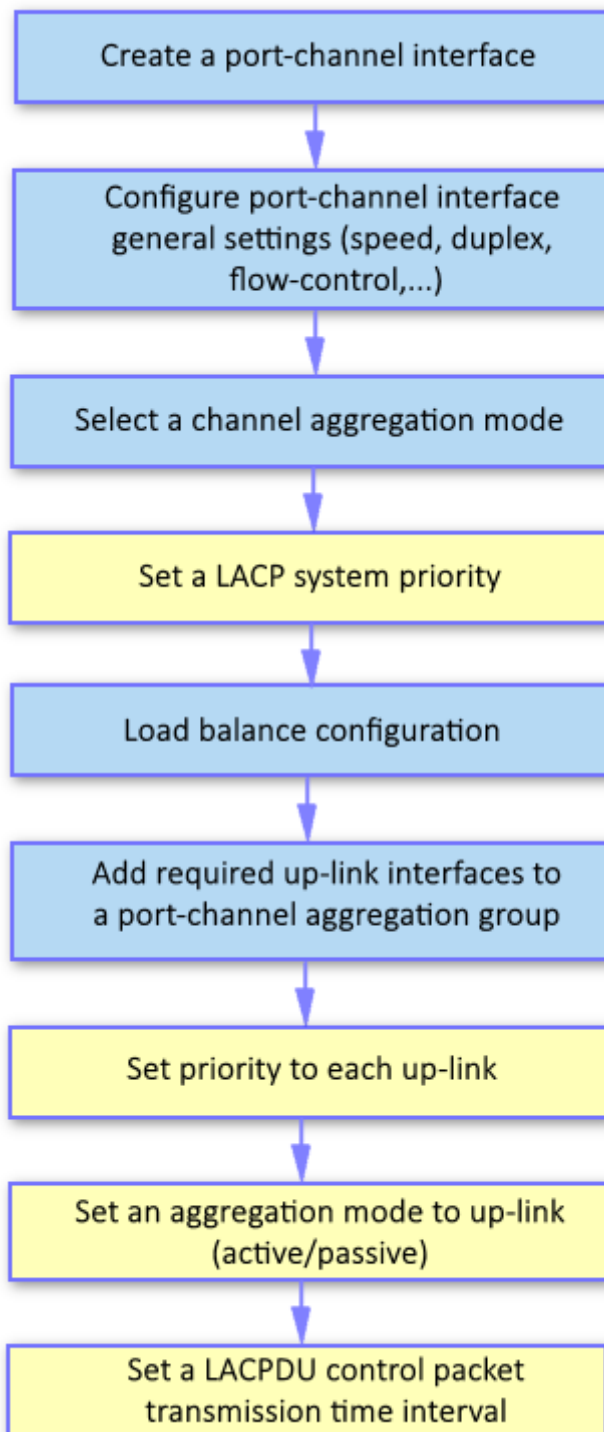


Figure 28 – LAG and LACP configuration procedure

- **Step 1.** LAG is configured in the terminal switch. Execute the **switch** and **configure** commands consecutively to switch to the **config view**.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)#
```

- **Step 2.** Create a port-channel logical interface by using the **interface port-channel** command. As a parameter, pass the number of the interface being created. Up to ten logical interfaces can be created.

```
LTP-8X(switch)(config)# interface port-channel 3
LTP-8X(switch)(config-if)#
```

- **Step 3.** Set general interface parameters: speed, duplex, flow-control, etc. Interfaces configuration is described in detail in the [Interface configuration](#) section.
- **Step 4.** Configure aggregation by using the **mode** command. Pass the operation mode as a parameter. Operation modes are specified in [Table 22](#).

```
LTP-8X(switch)(config-if)# mode lacp
```

- **Step 5.** This step should only be performed for LACP configuration. Set a LACP system priority by using the **lacp system-priority** command. The **no lacp system-priority** command returns 32768 (default value).

```
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# lacp system-priority 32541
```

⚠ The **lacp system-priority** command can be executed in the **configure view** of the terminal switch.

- **Step 6.** Specify load balancing rules by using the **port-channel load-balance** command if needed. Pass the load balancing mode as a parameter. Balance modes are specified in [Table 23](#).

```
LTP-8X(switch)(config)# port-channel load-balance ip
```

⚠ The **port-channel load-balance** command can be executed in the **configure view** of the terminal switch.

- **Step 7.** When used for load balancing, L4 parameters require a long hash. Enable the long hash by using the **port-channel l4-long-hash enable** command.

```
LTP-8X(switch)(config)# port-channel l4-long-hash enable
```

⚠ The **port-channel l4-long-hash** command can be executed in the **configure view** of the terminal switch.

- **Step 8.** Add physical interfaces into the logical one by using the **channel-group** command. As a parameter, pass the number of the logical interface.

```
LTP-8X(switch)(config)# interface front-port 0 - 4
LTP-8X(switch)(config-if-range)# channel-group port-channel 3
```

⚠ The **channel-group** command can be executed in the **configure view** of an interface (a range) of the switch.

- **Step 9.** This step should only be performed for LACP configuration. Set a priority for a physical interface by using the **lACP port-priority** command if necessary. The **no lACP port-priority** command resets port priority to the default value of 32768; 1 is the highest priority.

```
LTP-8X(switch)(config-if-range)# no lACP port-priority
LTP-8X(switch)(config-if-range)# exit
LTP-8X(switch)(config)# interface front-port 0
LTP-8X(switch)(config-if)# lACP port-priority 256
```

⚠ The **lACP port-priority** command can be executed in the **configure view** of a switch interface.

- **Step 10.** This step should only be performed for LACP configuration. Use the **lACP mode** command to set an active or passive LACP mode.

```
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# interface port-channel 3
LTP-8X(switch)(config-if)# lACP mode active
```

- **Step 11.** This step should only be performed for LACP configuration. In case of the active LACP mode, set an interval for transmission of LACP control packets by using the **lACP rate** command. Pass slow (30 seconds) or fast (1 second) as a parameter.

```
LTP-8X(switch)(config-if)# lACP rate slow
```

- **Step 12.** Apply the configuration by using the **commit** command.

```
LTP-8X(switch)(config-if)# exit
LTP-8X(switch)(config)# commit
```

4.14 DHCP Relay Agent configuration

This chapter describes configuration of DHCP Relay Agent in the terminal.

DHCP Relay Agent is used to provide a DHCP server with additional information about a received DHCP request. This may include information about the terminal running DHCP Relay Agent as well as information about the ONT, which sent the DHCP request. DHCP packets are modified by interception and further processing in the terminal CPU.

The DHCP server analyses DHCP option 82 and identifies the ONT. DHCP Relay Agent allows the option to be both transparently transmitted from the ONT and formed/rewritten according to a specified format. DHCP option 82 is especially useful for networks, which have no private VLANs dedicated for each user.

DHCP Relay Agent supports configurable formats for both Circuit ID and Remote ID. The format of the suboptions is configured with the help of the tokens listed in Table 24. The placeholders will be replaced with corresponding values, while the rest of the words will be passed as is.

Table 24 – DHCP Option 82 tokens

Token	Description
%HOSTNAME%	Terminal network name
%MNGIP%	Terminal IP address
%GPON-PORT%	Number of the OLT channel the DHCP request arrived from
%ONTID%	ID of the ONT, which sent the DHCP request
%PONSERIAL%	Serial number of the ONT, which sent the DHCP request
%GEMID%	ID of the GEM port the DHCP request arrived to
%VLAN0%	External VID
%VLAN1%	Internal VID
%MAC%	MAC address of the ONT, which sent the request
%OLTMAC%	OLT MAC address
%OPT60%	DHCP option 60 received from the ONT
%OPT82_CID%	Circuit ID received from the ONT
%OPT82_RID%	Remote ID received from the ONT
%DESCR%	First 20 characters of ONT description

In addition to DHCP option 82, DHCP Relay Agent has some more functions related to network security. It provides protection from DoS attacks by setting a threshold for intensity of DHCP messages, which are received from ONT. Exceeding the threshold blocks DHCP requests. The blocking time can be configured. It also protects from illegal DHCP servers by controlling the source IP address of DHCP responses. Transmitted are only the DHCP responses, which arrived from IP addresses of trusted DHCP servers.

4.14.1 DHCP Relay Agent profiles management

A set of profiles is used for DHCP Relay Agent configuration. All VLANs use dhcp-ra-00 profile by default. The configuration is flexible as it allows DHCP profiles to be assigned not only to a terminal on the whole, but separately to each VLAN as well. To assign a profile, the following steps should be taken.

- **Step 1.** Assign the default profile for all VLANs with the help of the **gpon olt profile dhcp-ra dhcp-ra-00** command.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt profile dhcp-ra dhcp-ra-00
```

- **Step 2.** Create a new DHCP Relay Agent profile with the help of the **profile dhcp-ra** command if necessary. Pass profile name as a parameter.

```
LTP-8X(config)# profile dhcp-ra dhcp-ra-01
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# exit
```

- **Step 3.** Assign the newly created profile to a selected VLAN with the **gpon olt profile dhcp-ra dhcp-ra-01** command. As a parameter, pass the VID, which requires individual configuration.

```
LTP-8X(config)# gpon olt profile dhcp-ra dhcp-ra-01 vid 1000
```

- **Step 4.** Check the changes by using the **show gpon olt configuration** command.

```
LTP-8X(config)# do show gpon olt configuration
Profile dhcp-ra:          dhcp-ra-00          OLT Profile DHCP Relay Agent 0
```

```
Profile dhcp-ra per VLAN 1000 [0]:
Profile:                  dhcp-ra-01          OLT Profile DHCP Relay Agent 1
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config)# do commit
```

 To apply the changes, the OLT should be reconfigured.

4.14.2 DHCP Relay Agent profiles configuration

- **Step 1.** Switch to the corresponding **DHCP Relay Agent** profile.

```
LTP-8X(config)# profile dhcp-ra dhcp-ra-01
```

- **Step 2.** Enable DHCP traffic processing with the **enable** command.

```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# enable
```

- **Step 3.** Enable insert/overwrite of DHCP option 82 with the help of the **overwrite-option82** command if needed.

```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# overwrite-option82
```

- **Step 4.** Specify the DHCP option 82 format with the help of the **overwrite-option82 circuit-id** and **overwrite-option82 remote-id** commands if needed. A list of possible tokens is given in [Table 24](#).

```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# overwrite-option82 circuit-id "%HOSTNAME% %MAC%
%OPT82_CID%"
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# overwrite-option82 remote-id "%OPT82_RID%"
```

- **Step 5.** Enable DoS attack protection with the help of the **dos-block** command if needed. Specify a threshold for the number of DHCP queries per second that will block queries when exceeded. Use the **dos-block packet-limit** command for it. Use the **dos-block block-time** command to specify the blocking time in seconds.


```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# dos-block
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# dos-block packet-limit 200
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# dos-block block-time 300
```

- **Step 6.** Set a list of trusted DHCP servers with the help of the **trusted primary** and **trusted secondary** commands. Specify a response timeout for DHCP servers by using the **trusted timeout** command. Activate filters with the help of the **trusted** command.

```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# trusted primary 10.0.0.1
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# trusted secondary 10.0.0.2
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# trusted timeout 100
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# trusted
```

- **Step 7.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dhcp-ra)("dhcp-ra-01")# do commit
```

 To apply the changes, the OLT should be reconfigured.

4.14.3 Active DHCP leases monitoring

When enabled, DHCP-RA allows monitoring of DHCP leases. To view the list of sessions, use the **do show interface gpon-port 0 dhcp sessions** command.

```
LTP-4X# show interface gpon-port 1 dhcp sessions
  DHCP sessions (2):
##      Serial      ONT  Service      IP          MAC          Vid   GEM  Life time
1  454C5458690000E8  1/4    1    192.168.101.102  A8:F9:4B:E5:67:8B  1101  433   3587
2  454C5458690000E8  1/4    0    192.168.200.51  A8:F9:4B:E5:67:8A   600   432  86307
```

It is also possible to remove dynamic entries from the DHCP snooping table with the **clear dhcp-sessions interface ont** command.

```
LTP-8X# clear dhcp-sessions interface ont <0-7>[/0-127]
```

4.14.4 Broadcast-unicast relay configuration

To reduce the broadcast traffic and avoid responses from illegal DHCP-servers, unicast messages can be configured to interact with the specified DHCP Relay Agent. Relay Agent can be individually started for each separate VLAN. The service allows processing only for the packets, which have only one 802.1q tag.

- **Step 1.** Create an L3 interface by specifying the IP address of the VLAN the service is provided for. If the address of the DHCP server is in the same network as the management interface, skip Step 3. If the DHCP server is in the VLAN, which is specified in cross-connect, the IP address of the interface being created should be in the same network as the DHCP server, and you should skip Step 3.

```
LTP-8X(switch)(config)# vlan 2000
LTP-8X(switch)(config-vlan)# ip address 10.10.10.1/32
```

- **Step 2.** Specify up to 3 addresses of DHCP servers.

```
LTP-8X(switch)(config-vlan)# ip dhcp relay 192.168.56.1
LTP-8X(switch)(config-vlan)# ip dhcp relay 192.168.56.2
```

- **Step 3.** Create an L3 interface by specifying the IP address of the VLAN, which is used for switching in the network where the DHCP server is located.

```
LTP-8X(switch)(config)# vlan 1209
LTP-8X(switch)(config-vlan)# ip address 192.168.209.240/24
```

- **Step 4.** If the addresses of the DHCP servers are located after the router available after the specified L3 interface, configure a static route.

```
LTP-8X# configure terminal
LTP-8X(config)# ip route prefix 192.168.56.0 mask 24 gateway 192.168.209.5
LTP-8X(config)# do commit
```

- **Step 5.** If VLAN in which interception of DHCP requests is implemented is the same as management VLAN of OLT (e.g. OLT connects to only one VLAN or traffic untagged), you need to explicitly enable redirection of DHCP requests on the VLAN.

```
LTP-8X(switch)(config)# vlan 1209
LTP-8X(switch)(config-vlan)# ip dhcp relaying
```

4.15 PPPoE Intermediate Agent configuration

This chapter describes configuration of PPPoE Intermediate Agent of the terminal.

PPPoE Intermediate Agent is used to provide BRAS with additional information about a received PADI request. This may include information about the terminal running PPPoE Intermediate Agent as well as information about the ONT, which sent the PADI request. PADI packets are modified by interception and further processing in the terminal CPU.

BRAS analyses the Vendor Specific tag and identifies the ONT. PPPoE Intermediate Agent forms or rewrites the Vendor Specific tag using a specified format. Vendor Specific tags are especially useful for networks, which have no private VLANs dedicated for each user.

PPPoE Intermediate Agent supports configurable formats for Circuit ID and Remote ID. The format of the suboptions is configured with the help of the tokens listed in [Table 25](#). The placeholders will be replaced with corresponding values, while the rest of the words will be passed as is.

Table 25 – Vendor Specific tag tokens

Token	Description
%HOSTNAME%	Terminal network name
%MNGIP%	Terminal IP address
%GPON-PORT%	Number of the OLT channel the PADI request arrived
%ONTID%	ID of the ONT, which sent the PADI request
%PONSERIAL%	Serial number of the ONT, which sent the PADI
%GEMID%	ID of the GEM port the PADI request arrived to
%VLAN0%	External VID
%VLAN1%	Internal VID
%MAC%	MAC address of the ONT, which sent the request
%OLTMAC%	OLT`s MAC address
%DESCR%	First 20 characters of ONT description

In addition to vendor specific tag support, PPPoE Intermediate Agent has some more functions related to network security. It provides protection from DoS attacks by setting a threshold for intensity of PADI messages, which are received from ONT. Exceeding the threshold blocks PADI requests. The blocking time can be configured.

PPPoE Intermediate Agent also limits the number of simultaneous PPPoE sessions. The restriction can be set for both the total number of terminal sessions and for every ONT separately.

4.15.1 PPPoE Intermediate Agent profile configuration

To configure a PPPoE Intermediate Agent profile, the following steps should be taken.

- **Step 1.** Switch to the **PPPoE Intermediate Agent** profile.

```
LTP-8X# configure terminal
LTP-8X(config)# profile pppoe-ia pppoe-ia-00
LTP-8X(config-pppoe-ia)("pppoe-ia-00">#
```

- **Step 2.** Enable PPPoE traffic processing with the **enable** command.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># enable
```

- **Step 3.** Specify the vendor specific tag format with the help of the format circuit-id and format remote-id commands. A list of possible tokens is given in [Table 25](#).

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># format circuit-id "%HOSTNAME%"
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># format remote-id "%PONSERIAL%:%GEMID%"
```

- **Step 4.** Enable DoS attack protection with the help of the **dos-block** command if needed. Specify a threshold for the number of DHCP queries per second that will block queries when exceeded. Use the **dos-block packet-limit** command for it. Use the **dos-block block-time** command to specify the blocking time in seconds.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># dos-block
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># dos-block packet-limit 200
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># dos-block block-time 300
```

- **Step 5.** Set the limits of PPPoE sessions by using the **sessions-limit** command.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># sessions-limit 128 per-user 2
```

If there is no need to limit sessions for all ONTs, pass **unlimited** parameter in **session-limit per-user** command.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00"># sessions-limit per-user unlimited
```


If you need to disable limiting session for specified ONT (might be useful for SFP-ONU) and save limiting for others, define limiting globally in the profile and disable it in the interface ont settings.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# sessions-limit 8192 per-user 2
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# exit
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# pppoe-sessions-unlimit
```

- **Step 6.** Apply the changes by using the **commit** command.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# do commit
```

⚠ To apply the changes, the OLT should be reconfigured.

4.15.2 Active PPPoE sessions monitoring

Enabling PPPoE-IA allows active PPPoE sessions to be monitored. To view the list of sessions, use the following command.

```
LTP-8X(config)(if-ont-0/4)# do show interface gpon-port 0 pppoe session
PPPoE sessions (1):
## Serial          GPON-port Ont ID  Port  Client          Session ID  Duration
Unblock
1 454C54586700008C 0        4      353  A8:F9:4B:E3:16:5C 0x0003      0:00:27
0:00:00
```

4.15.3 Disabling session monitoring

The session monitoring is enabled in PPPoE-IA by default. Due to the fact that system resources are used for each session, in this mode, there are 8192 sessions to be initialized through the OLT (the maximum session-limit value).

If you need to bypass this limit and save opportunity to fill the Vendor-Specific tag fields, you can disable the monitoring. Use the following command.

```
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# no sessions-monitoring enable
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# do commit
```

To enable the monitoring, use the command:


```
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# sessions-monitoring enable
LTP-8X(config-pppoe-ia)("pppoe-ia-00")# do commit
```

⚠ PPPoE-IA is capable to detect sessions which are established while session monitoring is enabled. If a session was established before monitoring being enabled, re-initiate the session.

4.16 IP Source Guard configuration

The IP Source Guard function allows restriction of unauthorised usage of IP addresses in the network by linking IP and MAC addresses of the source to a specific service on a specific ONT. There are two operation modes:

1. To enable transmission of any traffic from clients, it is necessary to specify an explicit match between MAC and IP addresses of client equipment.
2. Client equipment obtains its address via the DHCP protocol. Based on data exchange between client equipment and the DHCP server, a DHCP snooping table is generated on the OLT that contains MAC-IP-GEM port matches and information about lease period. Only the packets with source MAC and source IP fields matching the records in the DHCP snooping table are passed from the client. To support client equipment with static IP addresses, static entries can be created in the dynamic mode.

 To enable the IP Source Guard functions, enable DHCP-RA. For more information on DHCP-RA, see [DHCP Relay Agent configuration](#). These functions are not supported in Model 1 (for more information about models, see [Service Models](#)). When IP Source Guard is enabled, any non-IP traffic is forbidden.

4.16.1 IP Source Guard configuration

- **Step 1.** Switch to the **configure view**.

```
LTP-8X# configure terminal
```

- **Step 2.** Enable IP Source Guard and specify the mode.

```
LTP-8X(config)# ip source-guard enable
LTP-8X(config)# ip source-guard mode dynamic
```

- **Step 3.** Apply the changes by using the **do commit** command.

```
LTP-8X(config)# do commit
```

 After the IPSG mode has been enabled/disabled/changed, the OLT is reconfigured automatically.

To enable DHCP session reset for a device with the same MAC address, there is an option:

LTP-8X(config)# ip source-guard one-dynamic-binding-for-MAC

It will automatically overwrite the old session with the new one.

To add static matches, use the following command:

LTP-8X(config)# ip source-guard bind ip <IP> mac <MAC> interface-ont <ONT> service <NUM>

Where:

- **IP** – IP address of client equipment in X.X.X.X format;
- **MAC** – MAC address of client equipment in XX:XX:XX:XX:XX:XX format;

- **ONT** – ONT identifier in SLOT_ID/CNANNEL_ID/ONT_ID format;
- **NUM** – ONT service number, through which traffic with specific addresses will be transmitted, from 0 to 7.

To disable IP Source Guard and remove static matches, use the negative **no** command.

```
LTP-8X(config)# no ip source-guard enable
LTP-4X(config)# no ip source-guard bind ip <IP>
```

In case of OLT power supply loss, entries of DHCP snooping table might be lost. In this case the service will not work until the address is prolonged or received again. The problem usually occurs when lease time is long. You may solve the problem by saving of snooping table in non-volatile memory:

- **Step 1.** Configure saving of IP Source Guard entries by timer.

```
LTP-8X(config)# ip source-guard database enable
LTP-8X(config)# ip source-guard database update-freq 1020
```

- **Step 2.** If necessary, disable IP Source-Guard in the specified VLAN.

```
LTP-8X(config)# ip source-guard ignore-vlan 10
LTP-8X(config)# ip source-guard ignore-vlan 20
LTP-8X(config)# ip source-guard mode dynamic
```

- **Step 3.** Apply changes by the **do commit** command.

```
LTP-8X(config)# do commit
```

- **Step 4.** To view information about the status, mode, and static matches, use the **show** command.

```
LTP-8X# show ip source-guard
IP Source Guard:
  Enabled:                true
  Mode:                   dynamic
  Database enabled:       true
  Database update frequency: 1020
  Bind [0]:
    Ip:                   192.168.200.90
    Mac:                   00:22:B0:50:59:71
    Interface-ont:        0/4
    Service:              2
  Vlan [10]               Allowed
  Vlan [20]               Allowed
```

 IP Source Guard Database will work only if automatic time synchronization is implemented via NTP.

4.17 Configuring multicast traffic between ONTs within the same tree

The functionality allows you to turn multicast traffic to the same port from which it been received. The configuration consists of two parts: vlan configuration, multicast in which pon-port should be deployed, and on which the functional will operate.

Configuration:

- **Step 1.** Switch to the view of vlan whose settings you want to change.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 400
LTP-8X(switch)(config-vlan)#
```

- **Step 2.** Enable multicast loopback.

```
LTP-8X(switch)(config-vlan)# multicast loopback enable
```

- **Step 3.** Return to the config view and switch to the view interface whose settings you want to change.

```
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# interface pon-port 4
```

- **Step 4.** Enable multicast loopback and apply the changes.

```
LTP-8X(switch)(config-if)# multicast loopback enable
LTP-8X(switch)(config-if)# commit
```

5 ONT configuration

5.1 Service Models

This chapter considers main terms and classification of service models.

In general, a service model is based on a method which describes how the services are provided: «VLAN for Subscriber» or «VLAN for Service». The VLAN for Service architecture means that a service VLAN (S-VLAN) is used to provide all users with a certain service. The VLAN for Subscriber architecture implies that a client VLAN (C-VLAN) is used to provide a user with multiple services. These methods are often combined in practice and form a hybrid model, which uses S-VLAN and C-VLAN simultaneously.

VLAN for Subscriber architecture

A separate VLAN is used for each subscriber in the C-VLAN model. A dedicated C-VLAN is used to provide services to each user between the OLT and service routers. Service GEM ports are created for every OLT service between every ONT and the OLT. When a service request is generated upstream, records are added to the MAC table in the OLT according to C-VLAN. In case of downstream traffic, a corresponding GEM port is determined for a definite service according to the MAC table in the OLT.

If the destination address of the downstream transmission is unknown (broadcast or unknown unicast), i. e. the GEM port cannot be determined, two options are available:

- transmission through a dedicated broadcast GEM port;
- transmission to all GEM ports, which correspond to the services provided to the subscriber.

The destination address, in case it is unknown (broadcast or unknown unicast), will be determined based on the method implemented in a definite service model.

The architecture of this service model is shown in figure below.

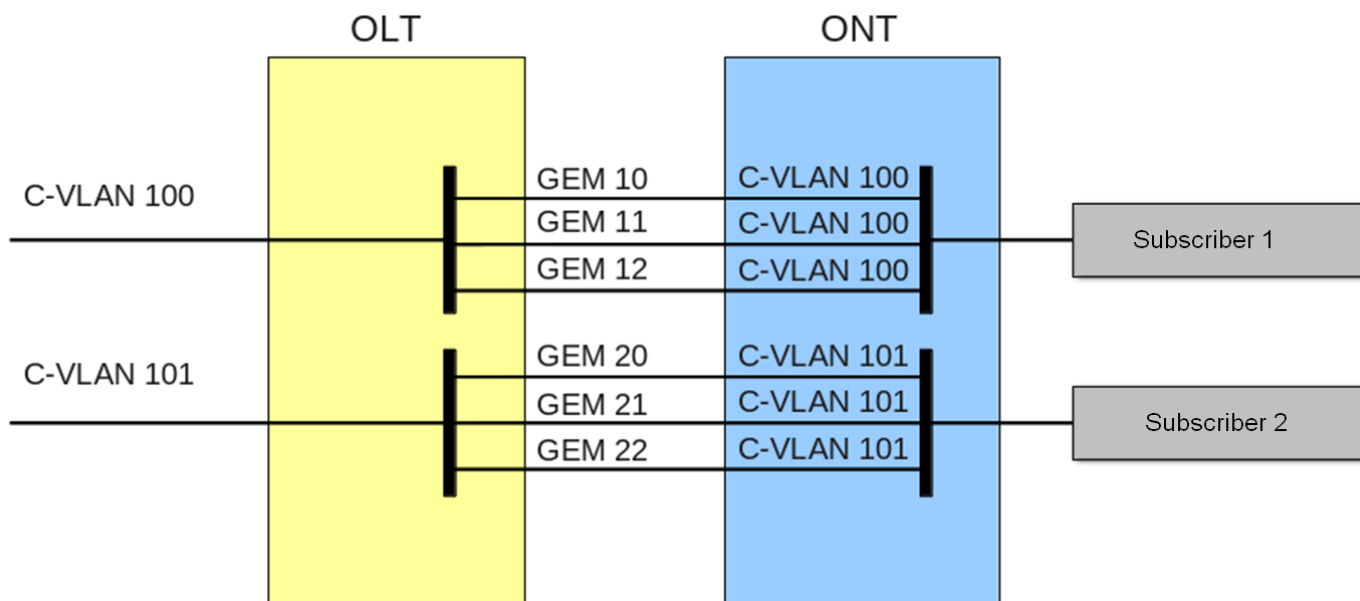


Figure 29 – "VLAN for Subscriber" service model architecture

VLAN for Service architecture

The S-VLAN model has a separate VLAN for every service. Consider its operation on an example of an abstract S-VLAN 100 service.

S-VLAN 100 is used between the OLT and service routers that is global for all subscribers in terms of this service. When a service request is generated upstream, records are added to the MAC table in the OLT according to S-VLAN and subscriber's MAC address. In case of downstream traffic, a corresponding subscriber of the service is determined based on the MAC table.

If the destination address of the downstream transmission is unknown (broadcast or unknown unicast), i. e. the GEM port cannot be determined, two options are available:

- transmission through a dedicated broadcast GEM port (traffic is transmitted to all subscribers);
- transmission to every subscriber through a GEM port corresponding to the service.

The destination address, in case it is unknown (broadcast or unknown unicast), will be determined based on the method implemented in a definite service model.

The architecture of this service model is shown in figure below.

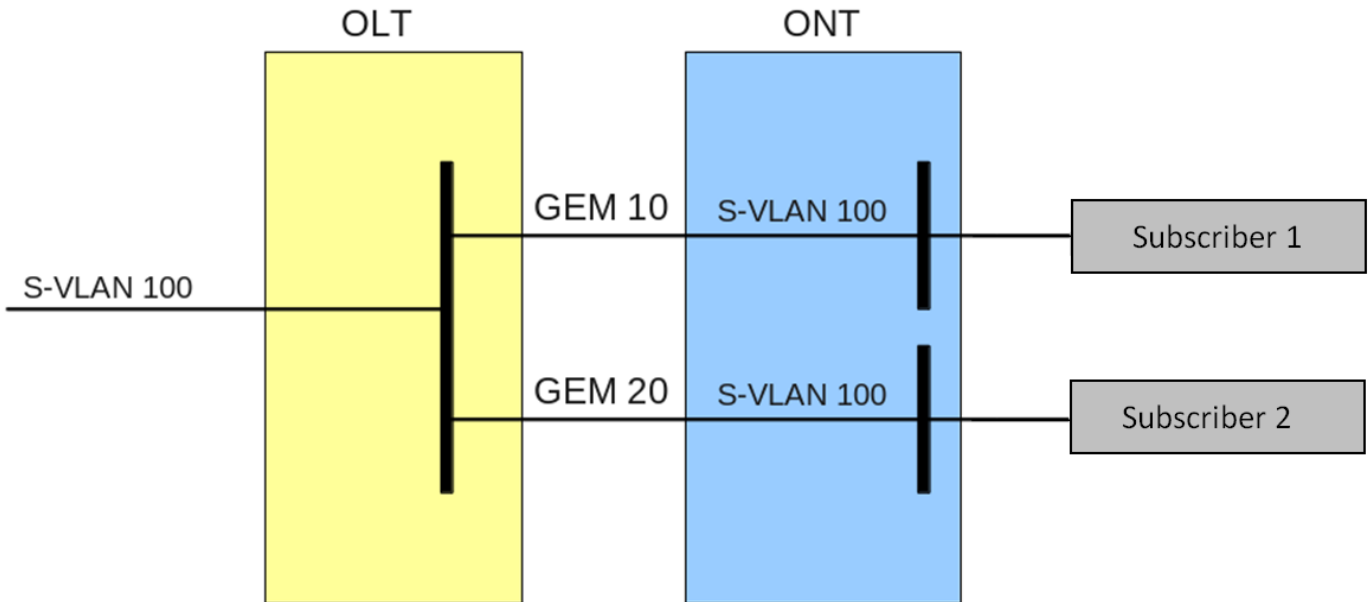


Figure 30 – "VLAN for Service" service model architecture

5.1.1 Operating principle

The configuration model concept is used for implementation of different service models in the terminal. A configuration model defines general principles for data communication channelling for both OLT and ONTs.

- Model 1 is an implementation of the VLAN for Subscriber service model. The model does not have dedicated broadcast GEM ports and uses U-VLAN on the ONT side.
- Model 2 is an implementation of the VLAN for Service service model. This model uses a dedicated broadcast GEM port.
- Model 3 is an implementation of the VLAN for Service service model. This model uses a dedicated broadcast GEM port. It differs from Model 2 by the order of S-VLAN to U-VLAN modification.

Table 26 – Service Models

	VLAN for Service	VLAN for Subscriber	Broadcast to Unicast GEM	Dedicated Broadcast GEM
Model 1	-	+	+	-
Model 2	+	-	-	+
Model 3	+	-	-	+

5.1.1.1 Model 1

Consider an example of Model 1 implementation.
The scheme of this service model is shown in the Figure 31.

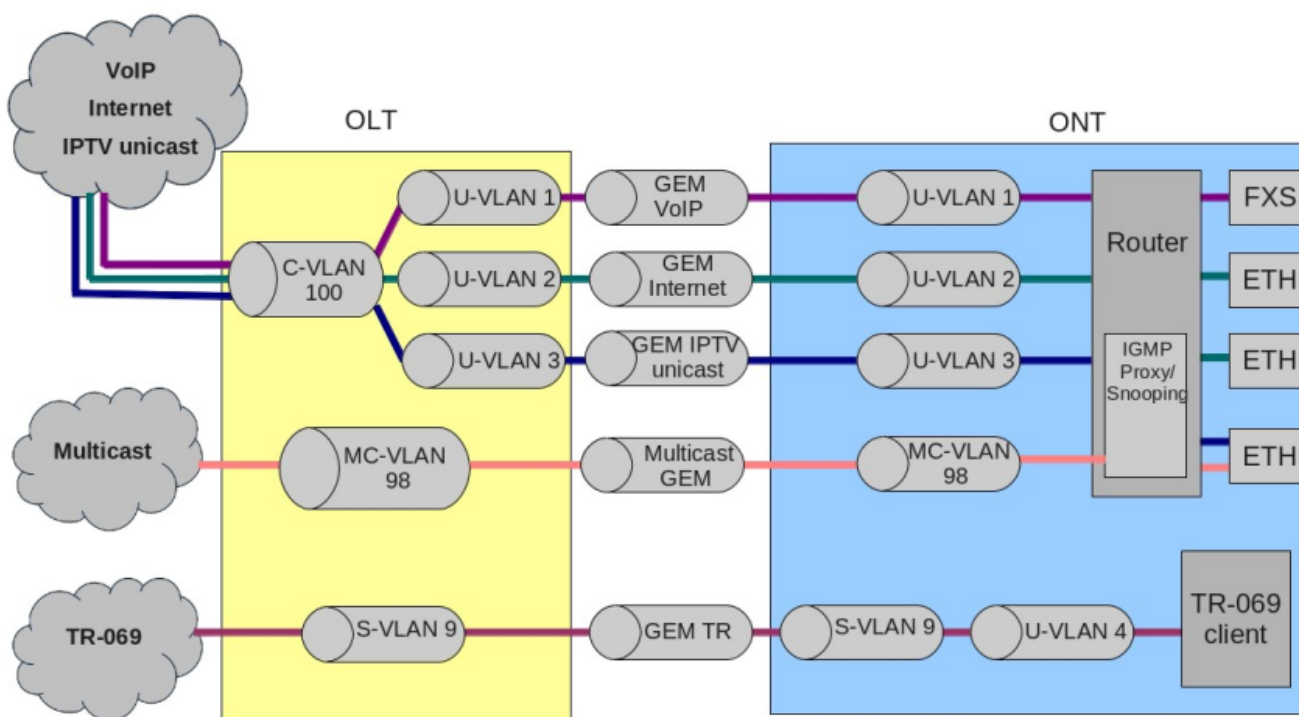


Figure 31 – Service Model 1 scheme

A C-VLAN is used between an ONT and service routers (BRAS, VoIP SR) that encapsulate services for one subscriber (one ONT), such as VoIP, Internet, and IPTV unicast. An S-VLAN that is global for all subscribers (ONTs) is used for the TR-069 management service. Corresponding GEM ports are created for every OLT service between the ONTs and OLT. A dedicated MC-VLAN is used for multicast transmissions.

The OLT casts C-VLAN (for VoIP, Internet, and IPTV unicast) or S-VLAN (for TR-069) for every service into a corresponding U-VLAN. An ONT associates the U-VLAN with corresponding ONT interfaces or program modules. For example, the TR-069 service is associated with a TR-069 client with the help of a corresponding interface. The VoIP, Internet, and IPTV unicast services can operate in the router or bridge modes depending on the ONT configuration. The chart shows all services configured in the router mode.

Broadcast and unknown unicast traffic is transmitted in this model by replicating a corresponding packet (broadcast or unknown unicast) to the OLT. C-VLAN replicates services to all associated GEM ports and at the same time translates data to the corresponding U-VLAN for each service. The TR-069 service is replicated between the corresponding GEM ports of all subscribers (ONTs). Thus, the model implements "VLAN for Subscriber" for the VoIP, Internet, and IPTV unicast services, but uses "VLAN for Service" for the TR-069 service.

5.1.1.2 Model 2

Consider an example of Model 2 implementation.

The chart of this service model is shown in the following figure.

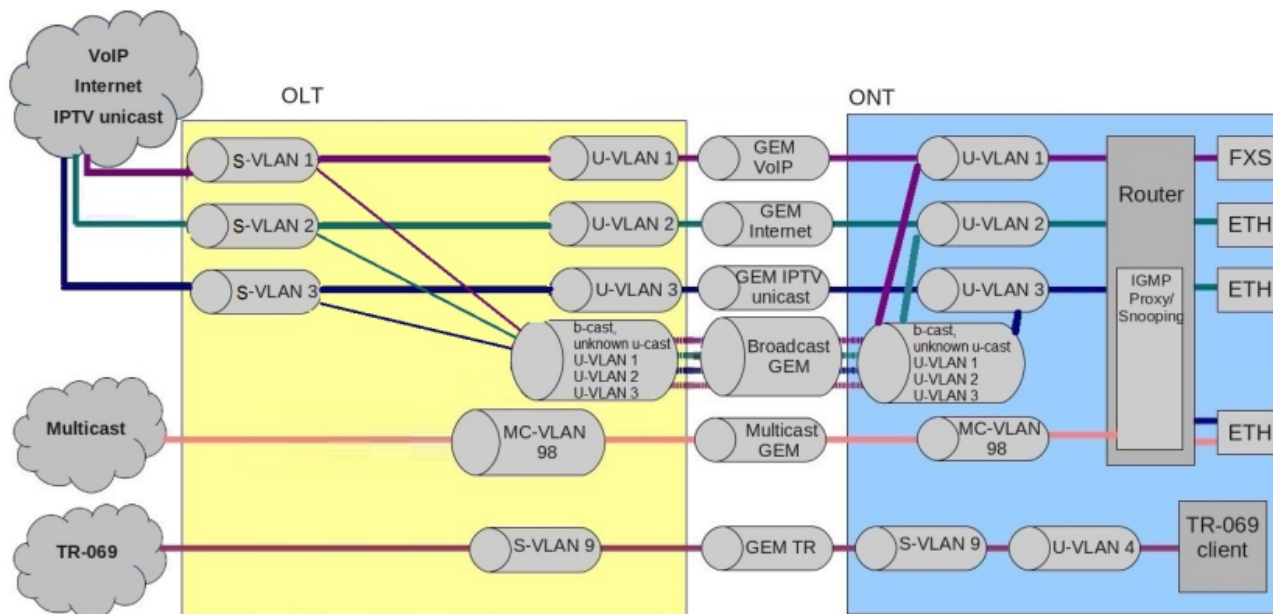


Figure 32 – Service Model 1 scheme

Dedicated S-VLANs are used between the OLT and service routers (BRAS, VoIP SR) for each of the following services: VoIP, Internet, IPTV unicast, TR-069. These S-VLANs are common for all subscribers (ONTs). Corresponding GEM ports are created for every OLT service between the ONTs and OLT. A dedicated MC-VLAN is used for multicast transmissions.

OLT transmits S-VLAN into a corresponding U-VLAN for each service. An ONT associates the U-VLAN with corresponding ONT interfaces or program modules. For example, the TR-069 service is associated with a TR-069 client with the help of a corresponding interface. The VoIP, Internet, and IPTV unicast services can operate in the router or bridge modes depending on the ONT configuration. The chart shows all services configured in the router mode.

All broadcast and unknown unicast traffic is redirected to a dedicated broadcast GEM port in this model. Broadcast and unknown unicast packets are sent to U-VLAN (for the VoIP, Internet, and IPTV unicast services) in the ONT.

This model is similar to Model 3 except the following: transmission of C-VLAN to U-VLAN is performed on the OLT side, while the VoIP, Internet, and IPTV unicast traffic comes to U-VLAN in the ONT.

Thus, the model implements "VLAN for Service" for the VoIP, Internet, IPTV unicast, and TR-069 services.

5.1.1.3 Model 3

Consider an example of Model 3 implementation.

The chart of this service model is shown in the following figure.

Dedicated S-VLANs are used between the OLT and service routers (BRAS, VoIP SR) for each of the following services: VoIP, Internet, IPTV unicast, TR-069. These S-VLANs are common for all subscribers (ONTs). Corresponding GEM ports are created for every OLT service between the ONTs and OLT. A dedicated MC-VLAN is used for multicast transmissions.

The VoIP, Internet, IPTV, and TR-069 unicast services are associated with S-VLAN in an ONT. The ONT transmits S-VLAN into a corresponding U-VLAN for each service. An ONT associates the U-VLAN with corresponding ONT interfaces or program modules. For example, the TR-069 service is associated with a TR-069 client with the help of a corresponding interface. The VoIP, Internet, and IPTV unicast services can operate in the router or bridge modes depending on the ONT configuration. The chart shows all services configured in the router mode.

All broadcast and unknown unicast traffic is redirected to a dedicated broadcast GEM port in this model. Broadcast and unknown unicast packets come to S-VLAN in the ONT. These packets are transmitted into the corresponding U-VLANs on the ONT side. In this case, broadcast and unknown unicast are replicated neither in the OLT nor in the ONT since every service has a separate S-VLAN for broadcast and unknown unicast traffic.

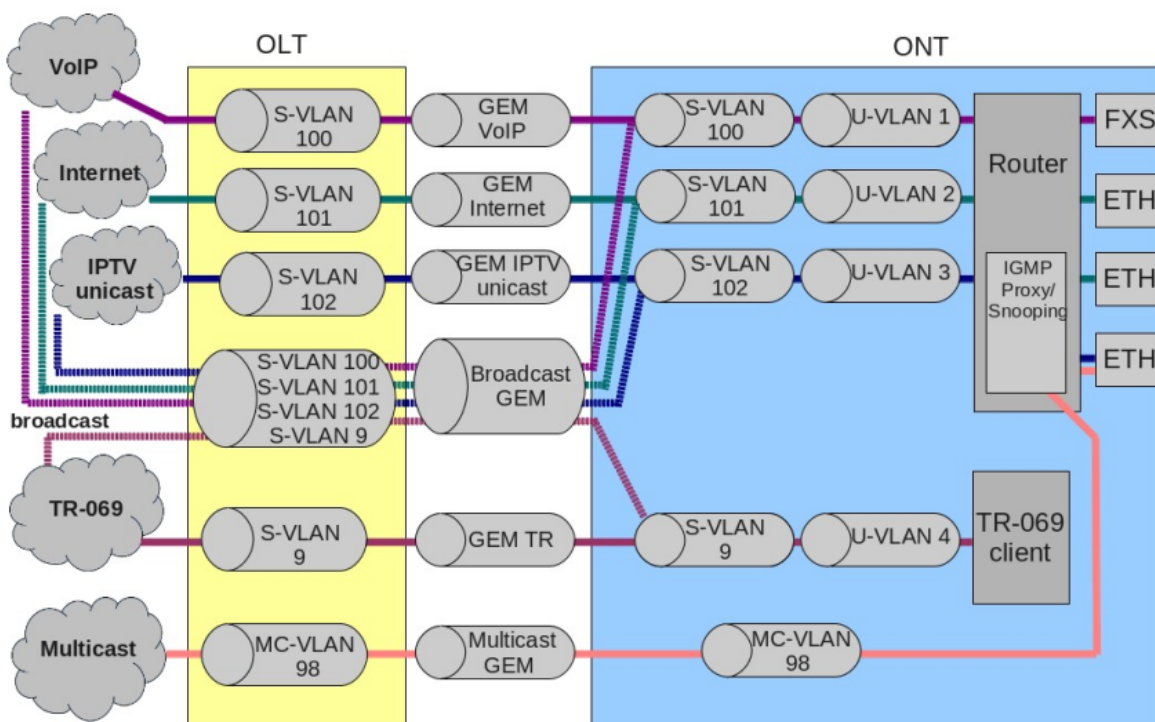


Figure 33 – Service Model 3 scheme

Thus, the model implements "VLAN for Service".

5.1.2 Model configuration

- **Step 1.** Check the current configuration with the help of the **show gpon olt configuration** command.

```
LTP-8X# show gpon olt configuration:  
. . .  
Datapath:  
Model: model2  
Broadcast gem port: 4095  
Multicast gem port: 4094  
. . .
```

- **Step 2.** Set the model by using the **gpon olt model** command.

```
LTP-8X# configure terminal  
LTP-8X(config)# gpon olt model 3
```

- **Step 3.** Apply the changes by using the **commit** command.

```
LTP-8X(config)# do commit
```

5.2 ONT licensing

By default, OLT supports only ELTEX ONTs operation. To enable any third-party ONTs, OLT requires a license. To purchase the license, contact ELTEX Marketing Department.

⚠ If a third-party ONT is connected to OLT without a license, the following entry will be made in the log file:
Jul 4 11:10:14 LTP-8X pmchal: error: [ONT2/0] License is not valid, configuration will not continue

5.2.1 Loading a license file to OLT

A license is a text file of the following format:

```
{
"version": "<VER>",
"type": "all",
"count": "<count>",
"sn": "<SN>",
"mac": "<MAC>",
"sign": "<hash>"
}
```

Where:

- **VER** – license file version number;
- **count** – number of third-party ONTs that can run on OLT;
- **SN** – LTP serial number;
- **MAC** – LTP MAC address;
- **hash** – license file digital signature.

There are two ways to load a license to OLT.

1. Use the **copy** command:

```
LTP-8X# copy tftp://<IP>/<PATH> fs://license
```

Download file from TFTP-server..

License successfully installed. Please reboot device for changes to make effect

Where:

- **IP** – TFTP server IP address;
- **PATH** – license file path on TFTP server.

2. Use CLI:

```
LTP-8X# license set ""<license>""  
License saved.  
License successfully installed.
```

Where:

- **license** – full content of the license file including curly brackets.
To view information about the license on the device, use the **show** command.

```
LTP-8X# show license  
Active license information:  
  License valid:          yes  
  Version:                1.2  
  Board SN:              GP2B000022  
  Licensed vendor:       all  
  Licensed ONT count:    10  
  Licensed ONT online:   3
```

The license file remains after device reload, firmware update, and configuration load. If OLT is reset to factory settings, the license is also deleted.

5.2.2 Deleting a license file from OLT

If necessary, you can delete a previously installed license using the **no license** command.

```
LTP-8X# no license  
License file removed.  
License successfully deleted from system.  
LTP-8X# show license  
Active license information:  
  No license installed
```

5.3 EasyConfig. EasyMode

5.3.1 LTP-X EasyMode

EasyMode is a function set of LTP optical terminals. EasyMode is dedicated to fast GPON deployment according to realized service model. EasyMode allows providers to configure Triple Play services promptly.

EasyMode can be used for:

- Acquaintance with GPON technology and ELTEX equipment;
- Fast testing of the main capabilities of the equipment;
- Automatic configuring of the equipment on a network.

5.3.2 Software and hardware requirements

The EasyMode is supported by the hardware of B and C revisions and by NTU terminals. For EasyMode operation, it is necessary to use the software no below than:

For LTP-8X(4X)	3.26.1
For NTU-1	3.24.0
For NTU-2W	3.25.1
For NTU-2V(C), NTU-RG-1402-GW	3.25.2
For NTU-RG-1421(31)G-Wac	3.28.1

Detailed information about the easy configuration mode is contained in the LTP EasyMode manual document, which can be found in the Download Center.

5.4 Automatic ONT activation

Automatic activation speeds up the process of adding new ONTs to an existing configuration with the necessary profiles.

5.4.1 Automatic ONT activation configuration

- **Step 1.** Enable automatic ONT activation.

```
LTP-8X(config)# gpon olt auto-activation ont enable
```

- **Step 2.** If necessary, specify a **template** that will be assigned to all auto-activated ONTs by default.

```
LTP-8X(config)# gpon olt auto-activation ont default template template-00
```

- **Step 3.** If necessary, specify a **template** that will be assigned to ONT depending on their type (EquipmentID), during automatic activation.

```
LTP-8X(config)# gpon olt auto-activation ont type NTU-1 template NTU1_2149
```

- **Step 4.** If necessary, specify the **gpon-port** on which this auto-activation rule will trigger.

```
TP-8X(config)# gpon olt auto-activation ont type NTU-1 template template-00 gpon-port 0-2
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config)# do commit
```

⚠ After applying the changes, the OLT will reconfigure. To apply ONT configuration changes that are added automatically, you must enter the **rollback** command first. Changes will not be made until the command is entered and an error will be issued indicating the need to enter.

5.5 ONT configuration

This chapter describes general principles of ONT configuration. It also defines configuration profiles.

ONT is configured with the help of a profile, which defines high-level expression of data communication channels. All operations related to channel creation are performed automatically. The way data communication channels are created depends on the selected service model.

ONT configuration includes assignment of configuration profiles and specification of ONT specific parameters. Configuration profiles allow general parameters to be set for all or for a range of ONTs. Profile parameters may include, for instance, DBA settings, configuration of VLAN operations in OLT and ONT,

settings of Ethernet ports in ONT. Specific ONT parameters allow each separate ONT to have its own settings specified. Such settings include, for example, GPON password, subscriber's VLAN, etc.

5.5.1 General principles of configuration

Service is the key term of ONT configuration. This term completely includes a communication channel, through which data is transferred from the interfaces located on the front panel of the terminal (see section [Interface configuration](#)) to users' ONT ports. There are two service profiles: cross-connect and dba. The cross-connect profile creates a GEM service port, the dba profile allocates an Alloc-ID for this ONT and associates a corresponding GEM port to the Alloc-ID.

Table 27 – ONT profiles

Profile	Description
cross-connect	Defines VLAN transformation in OLT and ONT
dba(alloc)	Defines upstream traffic parameters
shaping	Defines restrictions for upstream and downstream service traffic
management	Defines TR-69 management service parameters
ports	Defines user port groups in ONT as well as IGMP and multicast parameters for user ports

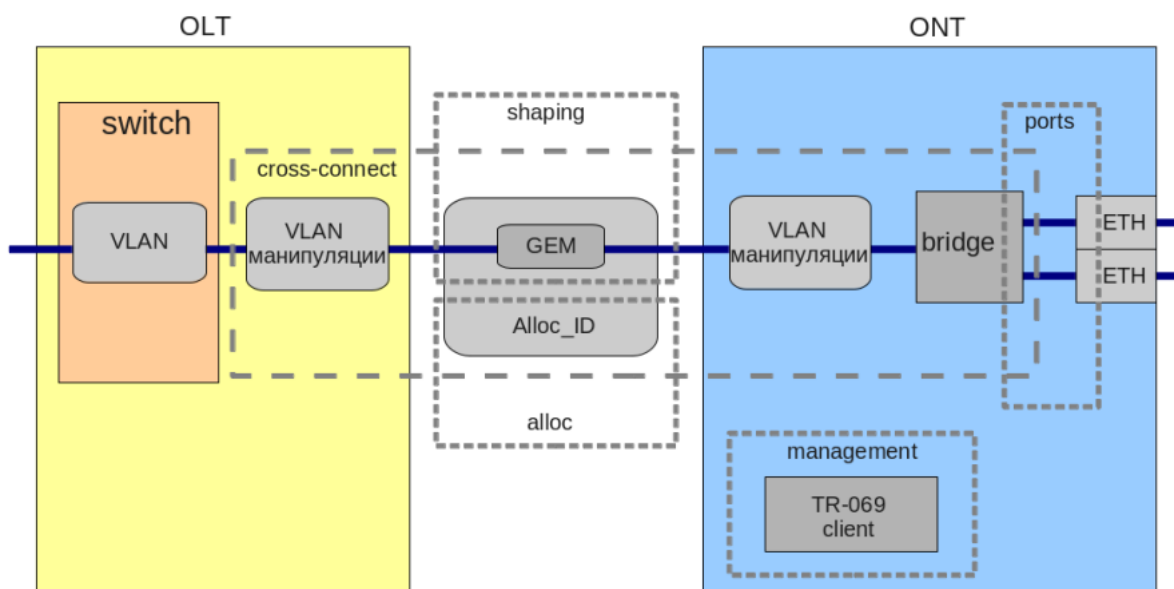


Figure 34 – ONT scope of operation

5.5.2 ONT profiles configuration

5.5.2.1 Cross-connect profile configuration

- **Step 1.** To configure a cross-connect profile, first you need to specify whether the service will be routed (transmitted through an ONT router) or bridged (use bridge connection). This can be done by changing the **model** parameter.
- **Step 2.** Then, you need to specify a service type in the **type** parameter. Some service types require the **iphost** parameter to be set that allows you to choose a definite instance of IP interface in the ONT.
- **Step 3.** A VLAN is configured in a cross-connect profile with the help of the following parameters: **tag mode, outer vid, outer cos, inner vid, user vid, and user cos.**
- **Step 4.** **Tag mode** enables upstream Q-in-Q mode; **outer vid, outer cos, and inner vid** specify internal and external Q-in-Q tags correspondingly. The CoS value of the internal tag is copied from the external one in this case. If the Q-in-Q mode is not used, only the **outer vid and outer cos parameters are valid.** The **user vid** and **user cos** parameters allow a tag to be specified, which will be used on the ONT side.
- **Step 5.** The **mac-table-limit** parameter allows restriction of records number in the MAC table of the OLT for this service.
- **Step 6.** The **priority** parameter allows allocation of all services of one T-CONT into queues with priorities (if ONT supports this method).

5.5.2.2 DBA profile configuration

This profile configures **dynamic bandwidth allocation (DBA)**. These parameters allow specification of any T-CONT type described in G.984.3.

- **Step 1.** First of all, choose **sla class** to define the basic DBA algorithm.
- **Step 2.** After that, configure **sla status-reporting** to define the type of ONT queues status report.
- **Step 3.** The **bandwidth fixed, bandwidth guaranteed, and bandwidth besteffort** parameters define the fixed, guaranteed, and best-effort bandwidth correspondingly.

DBA configuration is described in details in [DBA configuration](#).

5.5.2.3 Shaping profile configuration

Configuration of this profile allows restriction of upstream and downstream services.

- **Step 1.** Downstream restriction in OLT uses the **policing** algorithm. The restriction can either use one policer for all services or individual policers for each separate service. This is specified in the **one-policer** parameter. When one policer is used for all services, only **policer 0** should be specified; otherwise, policers for all services should be adjusted.
- **Step 2.** Upstream restriction in ONT uses the **shaping** algorithm. You can specify either a global shaper or individual shapers for unicast, multicast, and broadcast traffic (ONT functionality).

The configuration of **shaping** profile represented detailed in [Shaping configuration](#).

5.5.2.4 Ports profile configuration

The **ports** profile allows you to group ports in ONT. The profile also contains **IGMP** and **multicast** setting as they are separately adjusted for each port.

You can adjust up to 4 Ethernet ports and a VEIP virtual port, which will serve as a link between the OMCI and RG domains in ONT.

- **Step 1.** Ethernet ports are grouped with the help of the **bridge-group** parameter. Value 0 means that the port is associated with the RG domain (router). Other values mean port association with the OMCI domain, i. e. the port can be directly used in OLT to establish a data communication channel.

- **Step 2. IGMP and multicast** configuration is described in detail in [IGMP and MLD configuration in terminal switch](#).

5.5.2.5 Management profile configuration

The **management** profile enables specific configuration of the TR-069 management protocol, namely configuration of a TR-client in ONT.

- **Step 1.** The **omci-configuration** parameter defines the TR client configuration which can be done either automatically with DHCP (all other parameters of the profile are not used in this case) or with OMCI using the profile settings.
- **Step 2.** The **url** parameter corresponds to the address of the auto configuration server (ACS), which access parameters are defined by the **username** and **password** parameters.

The TR-069 protocol configuration is described in detail in [VoIP configuration](#).

5.5.3 Re-defining the parameters set in the cross-connect profile. Custom parameters

In some cases, it is necessary to define unique VLAN ID/802.1p tags for ONT. For solving this problem, you can use custom parameters instead of creating a profile.

5.5.3.1 Custom svid


```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 custom svid 1234
```

If **cross-connect** profile defined in the specified service has **tag-mode double-tagged**, VLAN ID of the external tag will be replaced. For **single-tagged** service, VLAN ID of the single tag will be replaced.

5.5.3.2 Custom cvid

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 custom cvid 1234
```

If **cross-connect** profile defined in the specified service has **tag-mode double-tagged**, VLAN ID of the internal tag will be replaced. For **single-tagged** service, VLAN ID of the single tag will be replaced.

 If you set custom svid and cvid simultaneously for single-tagged service, svid will be used for replacing the VLAN ID.

5.5.3.3 Custom cos

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 custom cos 3
```

Replaces 802.1p field in a tag.

5.5.4 ONT configuration procedure

Figure below shows a step-by-step procedure of ONT configuration.

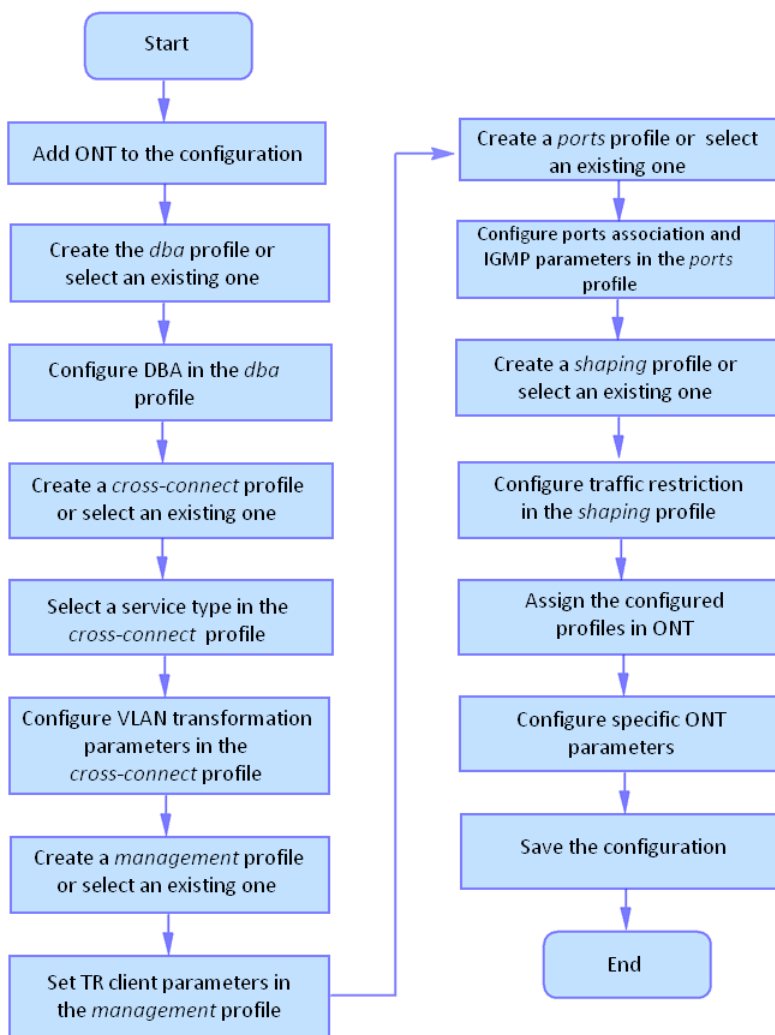



Figure 35 – ONT configuration procedure

- **Step 1.** Prior to proceed to ONT configuration, add an ONT into the OLT configuration. For an ONT to be added and configured, it does not need to be physically connected to the OLT. You can view the list of inactive ONTs with the help of the **show interface ont <gpon-port> unactivated** command.

```
LTP-8X# show interface ont 0 unactivated
-----
GPON-port 0 ONT unactivated list
-----
## Serial      ONT ID Channel Status  RSSI[dBm]  Version  EquipmentID
1 ELTX5C00008C n/a 0  UNACTIVATED  n/a    n/a  n/a
2 ELTX1A00001A n/a 0  UNACTIVATED  n/a    n/a  n/a
Total ONT count: 2
```

- **Step 2.** To specify ONT settings, go to the corresponding **view** with the help of the **interface ont** command. Specify ONT serial number, password, or their combination.

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# serial ELTX5C00008C
LTP-8X(config)(if-ont-0/0)# password 0000000000
```

 NTU-SFP-100 uses PON-Password «default» by default.

- **Step 3.** Apply the configuration by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0)# do commit
```

- **Step 4.** View the ONT configuration by using the **do show interface ont 0/0 configuration** command.

```
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
-----
                                [ONT0/0] configuration
-----
Description: ''
Status: UP
Serial: ELTX5C00008C
Password: '0000000000'
Fec up: false
Downstream broadcast: true
Downstream broadcast filter: true
Ber interval: none
Ber update period: 60
Rf port state: disabled
Omc error tolerant: false
Profile shaping: shaping-00          ONT Profile Shaping 0
Profile ports: ports-00             ONT Profile Ports 0
Profile management: unassigned
Custom model: none
Template: unassigned
```

5.5.4.1 Model 1

Consider configuration of a data communication channel, which is based on Model 1 and implements "VLAN for Subscriber" (except for the control service, which is implemented in S-VLAN).

Routed mode

Configure the Internet (PPPoE), IPTV unicast, and management services via the TR-069 protocol. Set the VLAN ID for the subscriber to 200, U-VLAN IDs to 10 and 11 for each service respectively. Traffic between the OLT and ONT will be transmitted into VLAN 10 and 11. Multicast traffic will be transmitted to VLAN 98, management will be performed via VLAN 9.

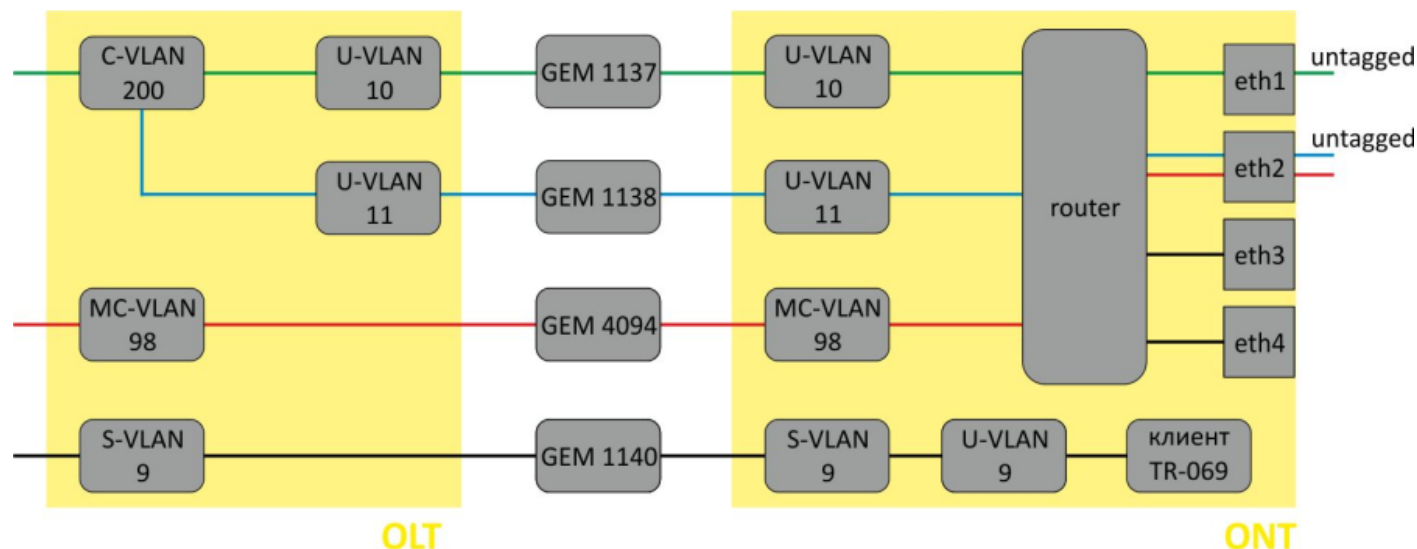


Figure 36 – Routed service abstract representation for Model 1

- **Step 1.** Assign a service model.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt model 1
```

- **Step 2.** Create an Internet **cross-connect** profile for the configuration. By default, the profile uses a routed service. Configure a U-VLAN with the help of the **user vid** command (it equals 10 for the first service in this case).

```
LTP-8X(config)# profile cross-connect Internet
LTP-8X(config-cross-connect)("Internet")# user vid 10
```

- **Step 3.** Check the changes made.


```
LTP-8X(config-cross-connect)("Internet")# do show profile cross-connect
Internet
Name: 'Internet'
Description: 'ONT Profile Cross Connect 1'
Model: ont-rg
Bridge group: -
Tag mode: single-tagged
Outer vid: 1
Outer cos: unused
Inner vid: -
U vid: 10
U cos: unused
Mac table entry limit: unlimited
Type: general
Iphost eid: 0
Priority queue: 0
```

- **Step 4.** By analogy with the described above, create another cross-connect profile (UC_IPTV) for the second service and configure it with U-VLAN 11.

```
LTP-8X(config)# profile cross-connect UC_IPTV
LTP-8X(config-cross-connect)("UC_IPTV")# user vid 11
```

- **Step 5.** Check the changes made.

```
LTP-8X(config-cross-connect)("UC_IPTV")# do show profile cross-connect UC_IPTV
Name: 'UC_IPTV'
Description: 'ONT Profile Cross Connect 2'
Model: ont-rg
Bridge group: -
Tag mode: single-tagged
Outer vid: 1
Outer cos: unused
Inner vid: -
U vid: 11
U cos: unused
Mac table entry limit: unlimited
Type: general
Iphost eid: 0
Priority queue: 0
```

 Use web configurator or ACS to adjust necessary settings for these services in the ONT.

- **Step 6.** Specify DBA parameters. To do this, create a dba profile and adjust the corresponding settings. We set a value of a guaranteed bandwidth in this example.

```
LTP-8X(config)# profile dba AllServices
LTP-8X(config-dba)("AllServices")# bandwidth guaranteed 500
```

- **Step 7.** Check the changes made.

```
LTP-8X(config-dba)("AllServices")# do show profile dba AllServices
Name:                                     'AllServices'
Description:                               'ONT Profile DBA 1'
Dba:
  Sla data:
    Service class:                         type5
    Status reporting:                       nsr
    Alloc size:                             0
    Alloc period:                           0
    Fixed bandwidth:                        0
    Guaranteed bandwidth:                   500
    Besteffort bandwidth:                   1244000
  T-CONT allocation scheme:                 share T-CONT with same profile
```

- **Step 8.** To configure multicast traffic, create a **ports** profile, specify groups allowed for viewing, a VLAN to send IGMP packets, and the rules for relaying multicast traffic in the downstream direction across the VLAN for the UC_IPTV service.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.1
239.255.255.255
LTP-8X(config-ports)("Ports1")# veip upstream vid 11
LTP-8X(config-ports)("Ports1")# veip upstream tag-control replace-tag
LTP-8X(config-ports)("Ports1")# veip downstream vid 11
LTP-8X(config-ports)("Ports1")# veip downstream tag-control replace-tag
```

- **Step 9.** Check the changes made.

```
LTP-8X(config-ports)("Ports1")# do show profile ports
Ports1
...
  Multicast dynamic entry [0]:
    Vlan id:                               98
    First group ip:                         224.0.0.1
    Last group ip:                          239.255.255.255

  Veip:
    Multicast enable:                       true
    Multicast port settings:
      Upstream igmp vid:                    11
      Upstream igmp prio:                    0
      Upstream igmp tag control:             replace tag
      Downstream multicast vid:              11
      Downstream multicast prio:              0
      Downstream multicast tag control:       replace tag
      Max groups:                            0
      Max multicast bandwidth:                0
```

- **Step 10.** Configure a management profile. To do this, create a **cross-connect** profile and assign it with the **management** type.

```
LTP-8X(config)# profile cross-connect management
LTP-8X(config-cross-connect)("management")# outer vid 9
LTP-8X(config-cross-connect)("management")# type management
```

- **Step 11.** Check the changes made.

```
LTP-8X(config-cross-connect)("management")# do show profile cross-connect management
Name:                                     'management'
Description:                              'ONT Profile Cross Connect 2'
Model:                                     ont-rg
Bridge group:                             -
Tag mode:                                  single-tagged
Outer vid:                                 9
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                     untagged
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                     management
IP host index:                             0
Priority queue:                             0
```

- **Step 12.** Assign the created profiles in the ONT.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect Internet
LTP-8X(config)(if-ont-0/0)# service 1 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 1 profile cross-connect UC_IPTV
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# service 2 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 2 profile cross-connect management
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
```

```
-----
[ONT0/0] configuration
-----
```

```
Description: ''
Status: UP
Serial: ELTX5C00008C
...
Service [0]:
Profile cross connect: Internet      ONT Profile Cross Connect 1
Profile dba: AllServices             ONT Profile DBA 1
Service [1]:
Profile cross connect: UC_IPTV      ONT Profile Cross Connect 2
Profile dba: AllServices             ONT Profile DBA 1
Service [2]:
Profile cross connect: management    ONT Profile Cross Connect 3
Profile dba: AllServices             ONT Profile DBA 1
...
Profile ports: Ports1              ONT Profile Ports 1
```

- **Step 13.** VLAN for Subscriber requires a C-VLAN to be assigned for this ONT (subscriber). Assign S-VLAN 200 for the Internet and IPTV services by using the **service X custom** command (where X – service number). The management service operates in an S-VLAN, therefore no C-VLAN is defined for this service.

```
LTP-8X(config)(if-ont-0/0)# service 0 custom cvid 200
LTP-8X(config)(if-ont-0/0)# service 1 custom cvid 200
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
...
Service [0]:
  Profile cross connect: Internet    ONT Profile Cross Connect 1
  Profile dba: AllServices           ONT Profile DBA 1
  Custom svlan: 200
  Custom CoS: unused
Service [1]:
  Profile cross connect: UC_IPTV
  Profile dba: AllServices           ONT Profile DBA 1
  Custom svlan: 200
  Custom CoS: Unused
```


- **Step 14.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0)# do commit
```

- **Step 15.** Configure VLAN 200, 201, 9, and 98 in the **switch view** (see [VLAN configuration](#)).

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 200,201,98,9
LTP-8X(switch)(config-vlan-range)# tagged front-port 0
LTP-8X(switch)(config-vlan-range)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan-range)# exit
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
```

- **Step 16.** Configure IGMP Proxy in the **switch view** for VLAN 98, enable the IGMP Proxy mode globally, and set the range of allowed IGMP groups. Also, enable IGMP snooping globally.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# ip igmp proxy report range 232.1.0.1 232.1.0.100 from all to 98
LTP-8X(switch)(config)# ip igmp proxy report enable
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
```

Bridged mode

Configure the Internet (PPPoE), IPTV unicast, and management services via the TR-069 protocol. Set the subscriber VLAN ID to 200. Configure transmission of tagged traffic to LAN port 1. To do this, set the U-VLAN ID to 10. Traffic to port 2 will be transmitted untagged. Multicast traffic will be transmitted to VLAN 98, management will be performed via VLAN 9.

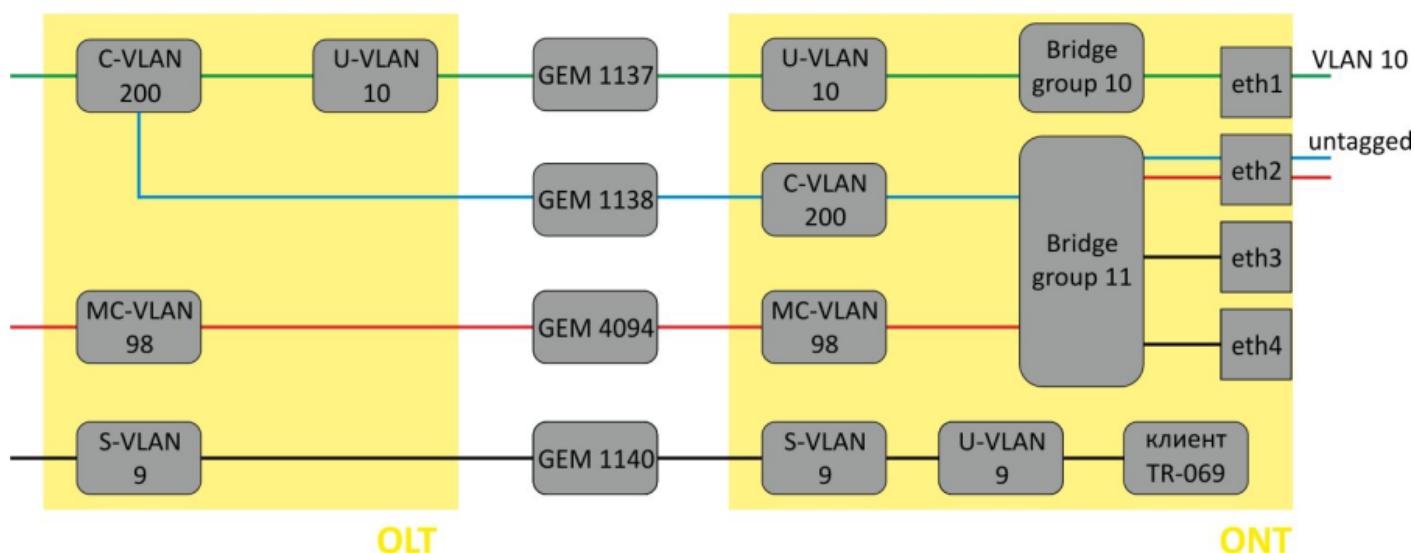


Figure 37 – Bridged service abstract representation for Model 1

- **Step 1.** Create an Internet cross-connect profile to configure PPPoE in the bridge. Configure the bridged service specifying the bridge group the ONT port will be connected to (in this case, it is equal to 10 for the first service), define a U-VLAN for transmission of tagged traffic to the port.

```
LTP-8X(config)# profile cross-connect Internet
LTP-8X(config-cross-connect)("Internet")# bridge
LTP-8X(config-cross-connect)("Internet")# bridge group 10
LTP-8X(config-cross-connect)("Internet")# user vid 10
```

- **Step 2.** Check the changes made.

```
LTP-8X(config-cross-connect)("Internet")# do show profile cross-connect Internet
Name:                                     'Internet'
Description:                             'ONT Profile Cross Connect 1'
Model:                                    ont
Bridge group:                             10
Tag mode:                                 single-tagged
Outer vid:                                 1
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                    untagged
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                     general
IP host index:                            0
Priority queue:                            0
```

- **Step 3.** By analogy with the described above, create another **cross-connect** profile (UC_IPTV) for the second service and configure it with bridge group 11.

```
LTP-8X(config)# profile cross-connect UC_IPTV
LTP-8X(config-cross-connect)("UC_IPTV")# bridge
LTP-8X(config-cross-connect)("UC_IPTV")# bridge group 11
```

- **Step 4.** Check the changes made.

```
LTP-8X(config-cross-connect)("UC_IPTV")# do show profile cross-connect UC_IPTV
Name:                                     'UC_UPTV'
Description:                             'ONT Profile Cross Connect 2'
Model:                                    ont
Bridge group:                             11
Tag mode:                                 single-tagged
Outer vid:                                 1
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                    untagged
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                     general
IP host index:                            0
Priority queue:                            0
```

- **Step 5.** Specify **DBA** parameters. To do this, create a dba profile and adjust the corresponding settings. We set a value of a guaranteed bandwidth in this example.

```
LTP-8X(config)# profile dba AllServices
LTP-8X(config-dba)("AllServices")# bandwidth guaranteed 500
```

- **Step 6.** Check the changes made.

```
LTP-8X(config-dba)("AllServices")# do show profile dba AllServices
  Name:                               'AllServices'
  Description:                         'ONT Profile DBA 1'
  Dba:
    Sla data:
      Service class:                   type5
      Status reporting:                nsr
      Alloc size:                      0
      Alloc period:                   0
      Fixed bandwidth:                 0
      Guaranteed bandwidth:            500
      Besteffort bandwidth:            1244000
  T-CONT allocation scheme:            share T-CONT with same profile
```

- **Step 7.** Associate the **bridge group** with an ONT port. To do this, create a ports profile and set the **bridge group** parameter to 10 for the eth0 port and to 11 for the eth1 port. Set the rules of multicast traffic processing for port 1.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# port 0 bridge group 10
LTP-8X(config-ports)("Ports1")# port 1 bridge group 11
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.1
239.255.255.255
LTP-8X(config-ports)("Ports1")# port 1 multicast
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream vid 98
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream tag-control remove-tag
```

- **Step 8.** Check the changes made.

```

LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
...
  Igmp settings:
...
    Multicast dynamic entry [0]:
      Vlan id:                98
      First group ip:         224.0.0.1
      Last group ip:          239.255.255.255
...
    Port [0]:
      Speed:                  auto
      Duplex:                  auto
      Bridge group:           10
      Spanning tree for bridge group: false
      Multicast enable:       true
      Multicast port settings:
        Upstream igmp vid:    1
        Upstream igmp prio:   0
        Upstream igmp tag control: pass
        Downstream multicast vid: 1
        Downstream multicast prio: 0
        Downstream multicast tag control: pass
        Max groups:           0
        Max multicast bandwidth: 0
      Shaper downstream:
        Enable:                false
        Committed rate:        1000000
      Shaper upstream:
        Enable:                false
        Committed rate:        1000000
    Port [1]:
      Speed:                  auto
      Duplex:                  auto
      Bridge group:           11
      Spanning tree for bridge group: false
      Multicast enable:       false
      Multicast port settings:
        Upstream igmp vid:    1
        Upstream igmp prio:   0
        Upstream igmp tag control: pass
        Downstream multicast vid: 98
        Downstream multicast prio: 0
        Downstream multicast tag control: remove-tag
        Max groups:           0
        Max multicast bandwidth: 0
      Shaper downstream:
        Enable:                false
        Committed rate:        1000000
      Shaper upstream:
        Enable:                false
        Committed rate:        1000000

```

- **Step 9.** Configure a management profile. To do this, create a cross-connect profile and assign it with the **management** type and the **bridge** model.

```
LTP-8X(config)# profile cross-connect management
LTP-8X(config-cross-connect)("management")# bridge
LTP-8X(config-cross-connect)("management")# outer vid 9
LTP-8X(config-cross-connect)("management")# type management
```

- **Step 10.** Check the changes made.

```
LTP-8X(config-cross-connect)("management")# do show profile cross-connect management
  Name:                               'management'
  Description:                          'ONT Profile Cross Connect 2'
  Model:                                 ont
  Bridge group:                          255
  Tag mode:                              single-tagged
  Outer vid:                             9
  Outer cos:                             unused
  Inner vid:                             -
  U vid:                                 untagged
  U cos:                                 unused
  Mac table entry limit:                 unlimited
  Type:                                  management
  IP host index:                         0
  Priority queue:                         0
```

- **Step 11.** Assign the created profiles in the ONT.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect Internet
LTP-8X(config)(if-ont-0/0)# service 1 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 1 profile cross-connect UC_IPTV
LTP-8X(config)(if-ont-0/0)# service 2 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 2 profile cross-connect management
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
```

```
-----
[ONT0/0] configuration
-----
```

```
  Description:                          ''
  Enabled:                               true
  Serial:                                ELTX5C00008C
  Password:                              '0000000000'
  Fec up:                                false
  Easy mode:                             false
  Downstream broadcast:                  true
  Downstream broadcast filter:           true
  Ber interval:                          none
  Ber update period:                     60
  Rf port state:                         disabled
  Omci error tolerant:                   false
```

```

Service [0]:
  Profile cross connect:      Internet          ONT Profile Cross Connect 1
  Profile dba:                AllServices      ONT Profile DBA 1
  Custom cross connect:      disabled
Service [1]:
  Profile cross connect:      UC_IPTV          ONT Profile Cross Connect 2
  Profile dba:                AllServices      ONT Profile DBA 1
  Custom cross connect:      disabled
Service [2]:
  Profile cross connect:      management       ONT Profile Cross Connect 3
  Profile dba:                AllServices      ONT Profile DBA 1
  Custom cross connect:      disabled
Profile shaping:             shaping-00       ONT Profile Shaping 0
Profile ports:               Ports1          ONT Profile Ports 1
Profile management:          unassigned
Template:                     unassigned
Pppoe sessions unlimited:    false

```

- **Step 12.** VLAN for Subscriber requires a C-VLAN to be assigned for this ONT (subscriber). Assign unique VLAN ID 200 for the Internet and IPTV services by using the **service X custom** command (where X – service number). The management service operates in an S-VLAN, therefore, settings from the profile are used for the service.

```

LTP-8X(config)(if-ont-0/0)# service 0 custom svid 200
LTP-8X(config)(if-ont-0/0)# service 1 custom svid 200
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
...

Service [0]:
  Profile cross connect:      Service1sh      ONT Profile Cross
Connect 1
  Profile dba:                AllServices      ONT Profile DBA 1
  Custom cross connect:      enabled
    Custom s-vid:             200
    Custom c-vid:             unused
    Custom CoS:               unused

```

- **Step 13.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0)# do commit
```

- **Step 14.** Configure VLAN 200 in the **switch view** (see [VLAN configuration](#)).

```

LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 200
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit

```

- **Step 15.** Configure IGMP Proxy in the **switch view** for VLAN 98, enable the IGMP Proxy mode globally, and set the range of allowed IGMP groups. Also, enable IGMP snooping globally.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip igmp proxy report enable
LTP-8X(switch)(config)# ip igmp proxy report range 232.1.0.1 232.1.0.100 from all to 98
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
```

5.5.4.2 Model 2

Model 2 is a hybrid of Model 1 and Model 3. It is based on «VLAN for Service». Model 2 services configuration is similar to Model 3.

5.5.4.3 Model 3

Consider configuration of ONT data communication for Model 3, which implements the «VLAN for Service» principle.

Routed mode

Configure the Internet (PPPoE), IPTV unicast, and management services via the TR-069 protocol. Set the VLAN ID to 200 for Internet, to 201 for IPTV unicast. Services will be provided by operator in these VLANs. Set U-VLANs to 200 and 201 for each service respectively. These VLANs will transmit traffic to the subscriber device. Multicast traffic will be transmitted to VLAN 98, management will be performed via VLAN 9.

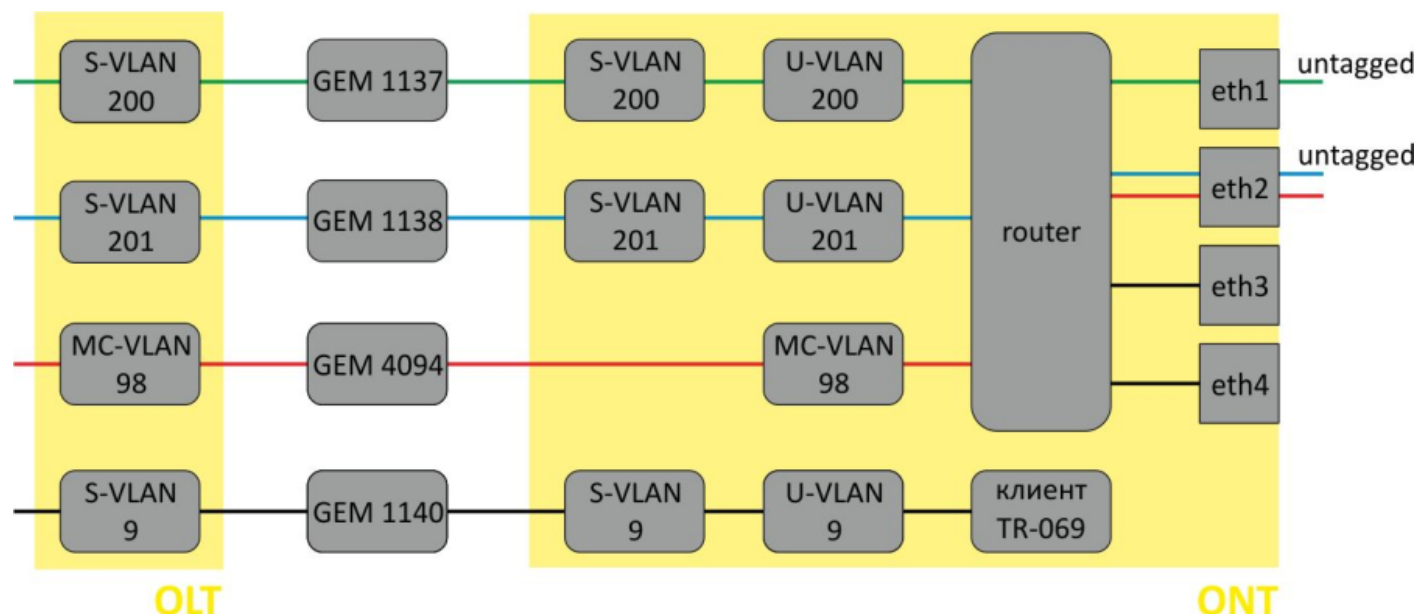


Figure 38 – Routed service abstract representation for Model 3

- **Step 1.** Assign a service model.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt model 3
```

- **Step 2.** Create an Internet cross-connect profile for the configuration. By default, the profile uses a routed service. Configure a U-VLAN with the help of the **u-vid** command (it equals 200 for the first service in this case). To assign an S-VLAN, use the **outer vid 200** command.

```
LTP-8X(config)# profile cross-connect Internet
LTP-8X(config-cross-connect)("Internet")# user vid 200
LTP-8X(config-cross-connect)("Internet")# outer vid 200
```

- **Step 3.** Check the changes made.

```
LTP-8X(config-cross-connect)("Internet")# do show profile cross-connect Internet
Name:                                     'Internet'
Description:                             'ONT Profile Cross Connect 1'
Model:                                    ont-rg
Bridge group:                             -
Tag mode:                                  single-tagged
Outer vid:                                 200
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                     200
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                     general
IP host index:                             0
Priority queue:                             0
```

- **Step 4.** By analogy with the described above, create another cross-connect profile (UC_IPTV) for the second service and configure it with U-VLAN 201, S-VLAN 201.

```
LTP-8X(config)# profile cross-connect UC_IPTV
LTP-8X(config-cross-connect)("UC_IPTV")# user vid 201
LTP-8X(config-cross-connect)("UC_IPTV")# outer vid 201
```

- **Step 5.** Check the changes made.

```
LTP-8X(config-cross-connect)("UC_IPTV")# do show profile cross-connect UC_IPTV
Name:                                     'UC_IPTV'
Description:                             'ONT Profile Cross Connect 2'
Model:                                    ont-rg
Bridge group:                             -
Tag mode:                                  single-tagged
Outer vid:                                 201
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                     201
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                     general
IP host index:                             0
Priority queue:                             0
```


- **Step 6.** Specify DBA parameters. To do this, create a **dba** profile and adjust the corresponding settings. We set a value of a guaranteed bandwidth in this example.

```
LTP-8X(config)# profile dba AllServices
LTP-8X(config-dba)("AllServices")# bandwidth guaranteed 500
```

- **Step 7.** Check the changes made.

```
LTP-8X(config-dba)("AllServices")# do show profile dba AllServices
Name:                               'AllServices'
Description:                         'ONT Profile DBA 1'
Dba:
  Sla data:
    Service class:                   type5
    Status reporting:                nsr
    Alloc size:                       0
    Alloc period:                    0
    Fixed bandwidth:                 0
```

- **Step 8.** To configure multicast traffic, create a cross-connect profile and set the VLAN intended for multicast transmission as an S-VLAN and U-VLAN.

```
LTP-8X(config)# profile cross-connect MC_IPTV
LTP-8X(config-cross-connect)("MC_IPTV")# user vid 98
LTP-8X(config-cross-connect)("MC_IPTV")# outer vid 98
```

- **Step 9.** Check the changes made.

```
LTP-8X(config-cross-connect)("MC_IPTV")# do show profile cross-connect MC_IPTV
Name:                               'MC_IPTV'
Description:                         'ONT Profile Cross Connect 3'
Model:                               ont-rg
Bridge group:                        -
Tag mode:                             single-tagged
Outer vid:                             98
Outer cos:                             unused
Inner vid:                             -
U vid:                                 98
U cos:                                 unused
Mac table entry limit:                unlimited
Type:                                 general
IP host index:                         0
Priority queue:                         0
```

 Use web configurator or ACS to adjust necessary settings for these services in the ONT.

- **Step 10.** After that, to configure multicast traffic, create a **ports** profile, specify groups allowed for viewing, a VLAN to send IGMP packets, and the rules for relaying multicast traffic in the downstream direction across the VLAN for the UC_IPTV service.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.1
239.255.255.255
LTP-8X(config-ports)("Ports1")# veip upstream vid 98
LTP-8X(config-ports)("Ports1")# veip upstream tag-control replace-tag
LTP-8X(config-ports)("Ports1")# veip downstream vid 98
LTP-8X(config-ports)("Ports1")# veip downstream tag-control replace-tag
```

- **Step 11.** Check the changes made.

```
LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
...
  Igmp settings:
    Multicast dynamic entry [0]:
      Vlan id:                               98
      First group ip:                       224.0.0.1
                                           239.255.255.255
      Last group ip:
...
  Veip:
    Multicast enable:                       false
    Multicast port settings:
      Upstream igmp vid:                    98
      Upstream igmp prio:                  0
      Upstream igmp tag control:           replace-tag
      Downstream multicast vid:            98
      Downstream multicast prio:          0
      Downstream multicast tag control:    replace-tag
      Max groups:                          0
      Max multicast bandwidth:            0
...

```

- **Step 12.** Configure a management profile. To do this, create a cross-connect profile and assign it with the management type.

```
LTP-8X(config)# profile cross-connect management
LTP-8X(config-cross-connect)("management")# outer vid 9
LTP-8X(config-cross-connect)("management")# type management
```

- **Step 13.** Check the changes made.

```
LTP-8X(config-cross-connect)("management")# do show profile cross-connect management
Name:                                     'management'
Description:                              'ONT Profile Cross Connect 4'
Model:                                     ont-rg
Bridge group:                             -
Tag mode:                                  single-tagged
Outer vid:                                 9
Outer cos:                                 unused
Inner vid:                                 -
U vid:                                     untagged
U cos:                                     unused
Mac table entry limit:                    unlimited
Type:                                      management
IP host index:                             0
Priority queue:                             0
```

- **Step 14.** Assign the created profiles in the ONT.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect Internet
LTP-8X(config)(if-ont-0/0)# service 1 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 1 profile cross-connect UC_IPTV
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# service 2 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 2 profile cross-connect management
LTP-8X(config)(if-ont-0/0)# service 3 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 3 profile cross-connect MC_IPTV
```

- **Step 15.** Check the changes made.

```
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
-----
[ONT0/0] configuration
-----

Description:                               ''
Enabled:                                    true
Serial:                                     ELTX5C00008C
Password:                                   '0000000000'
Fec up:                                     false
Easy mode:                                  false
Downstream broadcast:                       true
Downstream broadcast filter:                true
Ber interval:                               none
Ber update period:                          60
Rf port state:                              disabled
Omc error tolerant:                         false
Service [0]:
  Profile cross connect:                     Internet           ONT Profile Cross Connect 1
  Profile dba:                               AllServices          ONT Profile DBA 1
  Custom cross connect:                      disabled
```

```

Service [1]:
  Profile cross connect:      UC_IPTV           ONT Profile Cross Connect 2
  Profile dba:                AllServices       ONT Profile DBA 1
  Custom cross connect:      disabled
Service [2]:
  Profile cross connect:      management       ONT Profile Cross Connect 3
  Profile dba:                AllServices       ONT Profile DBA 1
  Custom cross connect:      disabled
Profile shaping:             shaping-00        ONT Profile Shaping 0
Profile ports:               Ports1           ONT Profile Ports 1
Profile management:          unassigned
Template:                    unassigned
Pppoe sessions unlimited:    false
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration

```

- **Step 16.** Configure VLAN 200, 201, 9 and 98 in the **switch view** (see [VLAN configuration](#)).

```

LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 200,201,98,9
LTP-8X(switch)(config-vlan-range)# tagged front-port 0
LTP-8X(switch)(config-vlan-range)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan-range)# exit
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit

```

- **Step 17.** Configure IGMP Proxy in the **switch view** for VLAN 98, enable the IGMP Snooping and IGMP Proxy mode globally, and set the range of allowed IGMP groups.

```

LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip igmp proxy report enable
LTP-8X(switch)(config)# ip igmp proxy report range 232.1.0.1 232.1.0.100 from all to 98
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit

```

Bridged mode

Configure the Internet (PPPoE), IPTV unicast, and management services via the TR-069 protocol. Set the VLAN ID to 200 for Internet, to 201 for UC_IPTV. Set U-VLAN to 200 for Internet. Multicast traffic will be transmitted to VLAN 98, management will be performed via VLAN 9.

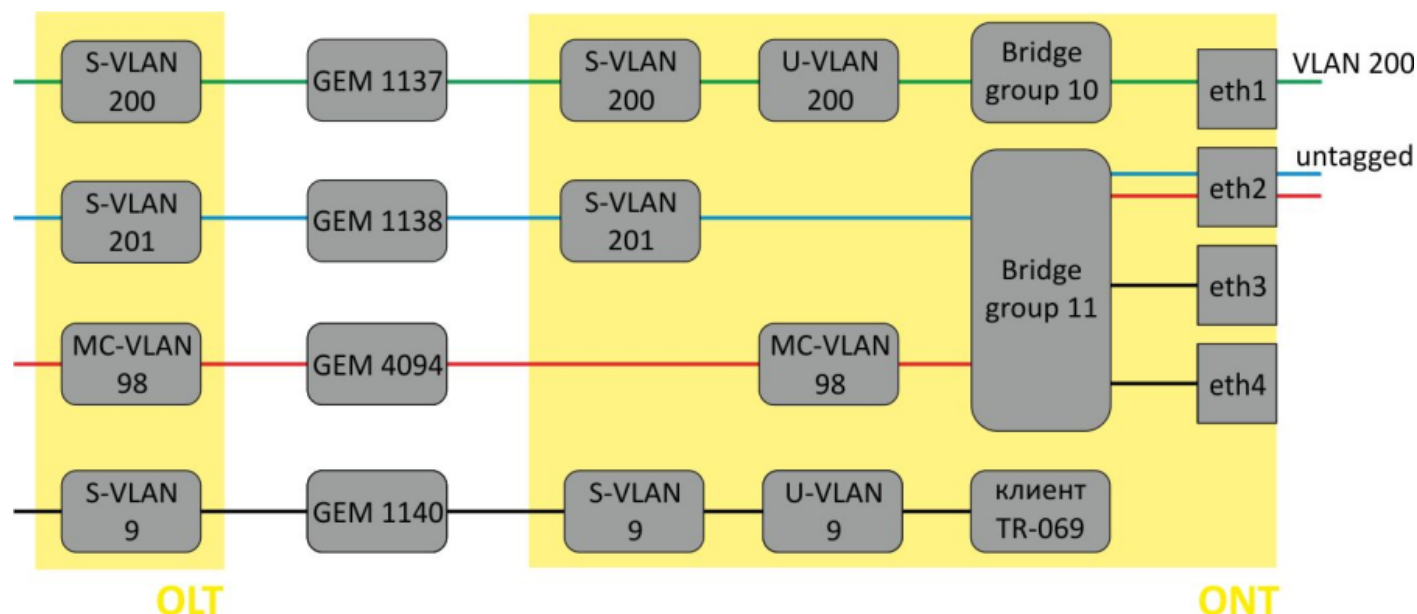


Figure 39 – Bridged service abstract representation for Model 3

- **Step 1.** Create an Internet cross-connect profile to configure PPPoE in the bridge. Configure the bridged service specifying the bridge group the ONT port will be connected to (in this case, it is equal to 10 for the first service).

```
LTP-8X(config)# profile cross-connect Internet
LTP-8X(config-cross-connect)("Internet")# bridge
LTP-8X(config-cross-connect)("Internet")# bridge group 10
```

- **Step 2.** To assign an S-VLAN, use the **outer vid 200** command: The LAN port of the ONT will send tagged traffic. To enable this, set U-VLAN equal to S-VLAN.

```
LTP-8X(config-cross-connect)("Internet")# outer vid 200
LTP-8X(config-cross-connect)("Internet")# user vid 200
```

- **Step 3.** Check the changes made.

```
LTP-8X(config-cross-connect)("Internet")# do show profile cross-connect Internet
Name:                                     'Internet'
Description:                             'ONT Profile Cross Connect 1'
Model:                                    ont
Bridge group:                             10
Tag mode:                                 single-tagged
Outer vid:                                 200
Outer cos:                                 unused
```

```

Inner vid:          -
U vid:             200
U cos:             unused
Mac table entry limit: unlimited
Type:              general
IP host index:     0
Priority queue:     0

```

- **Step 4.** By analogy with the described above, create another cross-connect profile (UC_IPTV) for the second service and configure it with bridge group 11 and S-VLAN 201.

```

LTP-8X(config)# profile cross-connect UC_IPTV
LTP-8X(config-cross-connect)("UC_IPTV")# bridge
LTP-8X(config-cross-connect)("UC_IPTV")# bridge group 11
LTP-8X(config-cross-connect)("UC_IPTV")# outer vid 201

```

- **Step 5.** Set U-VID to **untagged** to have untagged traffic outgoing from the ONT port.

```

LTP-8X(config-cross-connect)("UC_IPTV")# user vid untagged

```

- **Step 6.** Check the changes made.

```

LTP-8X(config-cross-connect)("UC_IPTV")# do show profile cross-connect UC_IPTV
Name:                               'UC_IPTV'
Description:                         'ONT Profile Cross Connect 2'
Model:                               ont
Bridge group:                        10
Tag mode:                            single-tagged
Outer vid:                           201
Outer cos:                           unused
Inner vid:                           -
U vid:                               untagged
U cos:                               unused
Mac table entry limit:              unlimited
Type:                                general
IP host index:                      0
Priority queue:                      0

```

- **Step 7.** Specify DBA parameters. To do this, create a **dba** profile and adjust the corresponding settings. We set a value of a guaranteed bandwidth in this example.

```

LTP-8X(config)# profile dba AllServices
LTP-8X(config-dba)("AllServices")# bandwidth guaranteed 500

```

- **Step 8.** Check the changes made.

```
LTP-8X(config-dba)("AllServices")# do show profile dba AllServices
Name:                                     'AllServices'
Description:                              'ONT Profile DBA 1'
Dba:
  Sla data:
```

```
Service class:                            type5
Status reporting:                          nsr
Alloc size:                                0
Alloc period:                              0
Fixed bandwidth:                           0
Guaranteed bandwidth:                      500
Besteffort bandwidth:                      1244000
T-CONT allocation scheme:                  share T-CONT with same profile
```

- **Step 9.** Associate the **bridge group** with an ONT port. To do this, create a **ports** profile and set the **bridge group** parameter to 10 for the eth0 port and to 11 for the eth1 port. Set the rules of multicast traffic processing for port 1.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# port 0 bridge group 10
LTP-8X(config-ports)("Ports1")# port 1 bridge group 11
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.1
239.255.255.255
LTP-8X(config-ports)("Ports1")# port 1 multicast
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream vid 98
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream tag-control remove-tag
```

- **Step 10.** Check the changes made.

```
LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
...
  Igmp settings:
...
    Multicast dynamic entry [0]:
      Vlan id:                98
      First group ip:         224.0.0.1
      Last group ip:          239.255.255.255
...
    Port [0]:
      Speed:                  auto
      Duplex:                 auto
      Bridge group:           10
      Spanning tree for bridge group: false
      Multicast enable:       true
      Multicast port settings:
        Upstream igmp vid:    1
        Upstream igmp prio:   0
        Upstream igmp tag control: pass
        Downstream multicast vid: 1
        Downstream multicast prio: 0
        Downstream multicast tag control: pass
        Max groups:           0
        Max multicast bandwidth: 0
      Shaper downstream:
        Enable:               false
        Committed rate:       1000000
      Shaper upstream:
        Enable:               false
        Committed rate:       1000000
```

```
Port [1]:
  Speed:                  auto
  Duplex:                 auto
  Bridge group:           11
  Spanning tree for bridge group: false
  Multicast enable:       false
  Multicast port settings:
    Upstream igmp vid:    1
    Upstream igmp prio:   0
    Upstream igmp tag control: pass
    Downstream multicast vid: 98
    Downstream multicast prio: 0
    Downstream multicast tag control: remove-tag
    Max groups:           0
    Max multicast bandwidth: 0
  Shaper downstream:
    Enable:               false
    Committed rate:       1000000
  Shaper upstream:
    Enable:               false
    Committed rate:       1000000
...
```


- **Step 11.** Configure a management profile. To do this, create a cross-connect profile and assign it with the **management** type and the **bridge** model.

```
LTP-8X(config)# profile cross-connect management
LTP-8X(config-cross-connect)("management")# bridge
LTP-8X(config-cross-connect)("management")# outer vid 9
LTP-8X(config-cross-connect)("management")# type management
```

- **Step 12.** Check the changes made.

```
LTP-8X(config-cross-connect)("management")# do show profile cross-connect management
  Name:                               'management'
  Description:                          'ONT Profile Cross Connect 3'
  Model:                                 ont
  Bridge group:                          255
  Tag mode:                               single-tagged
  Outer vid:                              9
  Outer cos:                              unused
  Inner vid:                              -
  U vid:                                  untagged
  U cos:                                  unused
  Mac table entry limit:                  unlimited
  Type:                                   management
  IP host index:                          0
  Priority queue:                          0
```

- **Step 13.** Assign the created profiles in the ONT.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect Internet
LTP-8X(config)(if-ont-0/0)# service 1 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 1 profile cross-connect UC_IPTV
LTP-8X(config)(if-ont-0/0)# service 2 profile dba AllServices
LTP-8X(config)(if-ont-0/0)# service 2 profile cross-connect management
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
-----
[ONT0/0] configuration
-----
Description:                               ''
Enabled:                                     true
Serial:                                     ELTX5C00008C
Password:                                   '0000000000'
Fec up:                                     false
Easy mode:                                 false
Downstream broadcast:                     true
Downstream broadcast filter:              true
Ber interval:                              none
Ber update period:                        60
Rf port state:                             disabled
Omc error tolerant:                       false
Service [0]:
  Profile cross connect:                   Internet           ONT Profile Cross
Connect 1
  Profile dba:                             AllServices         ONT Profile DBA 1
  Custom cross connect:                    disabled
Service [1]:
  Profile cross connect:                   UC_IPTV            ONT Profile Cross
Connect 2
  Profile dba:                             AllServices         ONT Profile DBA 1
  Custom cross connect:                    disabled
Service [2]:
  Profile cross connect:                   management         ONT Profile Cross
Connect 3
  Profile dba:                             AllServices         ONT Profile DBA 1
  Custom cross connect:                    disabled
Profile shaping:                           shaping-00         ONT Profile Shaping 0
Profile ports:                             Ports1             ONT Profile Ports 1
Profile management:                       unassigned
Template:                                  unassigned
Pppoe sessions unlimited:                 false
```

- **Step 14.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/1)# do commit
```

- **Step 15.** Configure VLAN 200, 201, 9 and 98 in the **switch view** (see [VLAN configuration](#)).

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 200,201,98,9
LTP-8X(switch)(config-vlan-range)# tagged front-port 0
LTP-8X(switch)(config-vlan-range)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan-range)# exit
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
```

- **Step 16.** Configure IGMP Proxy in the **switch view** for VLAN 98, enable the IGMP Snooping and IGMP Proxy mode globally, and set the range of allowed IGMP groups.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# ip igmp proxy report enable
LTP-8X(switch)(config)# ip igmp proxy report range 232.1.0.1 232.1.0.100 from all to 98
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# commit
LTP-8X(switch)(config)# exit
```

5.5.4.4 Tunnelling configuration

Usual profiles in the tag-mode, single-tag or double-tag modes are aimed at mapping the traffic, which is transmitted to the gem port and tagged as **user vid** or **untagged**, into the traffic tagged outer vid or outer:inner vid respectively.

Models 2 and 3 allow traffic tunnelling configuration, which extends the range of possible GPON applications in operator's network.

Using the profiles tagged as selective-tunnel allows a tag to be **added** to incoming packets with a certain set of user vid tags. The profiles tagged as tunnel allow a tag to be **added** to incoming packets with any user-vid tags.

Consider the following diagram and its configuration as an example.

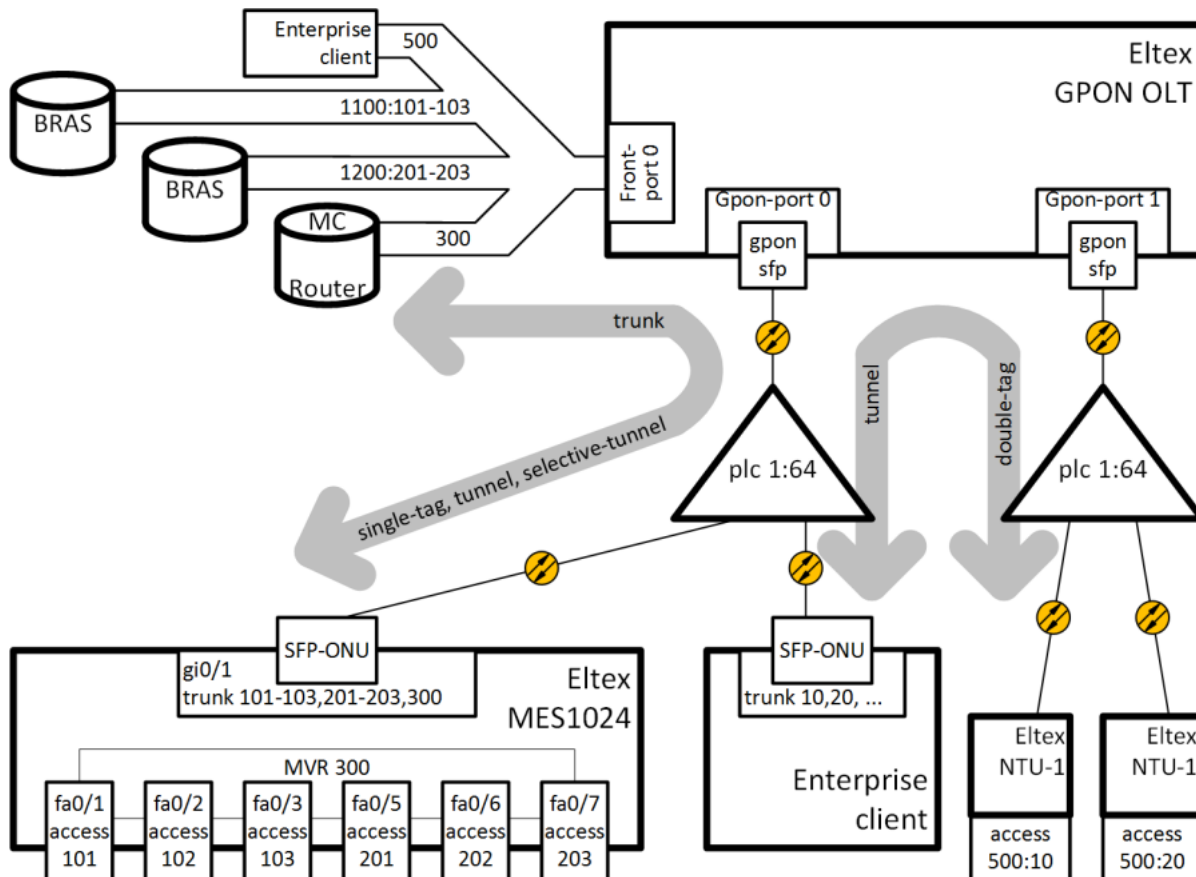


Figure 40 – Communication diagram

VLAN 300 (multicast) and Q-in-Q VLAN 1100 and 1200 (Internet) come to the uplink OLT. It is necessary to let them pass to the switch integrated in the OLT via SFP-ONU. In addition, a corporate client is connected to the splitter via SFP-ONU that sends a random set of VLANs to be passed to remote devices after removing tags of these VLANs at the ONT LAN port. To organise a tunnel for this client, VLAN 500 is selected in the operator's network.

Consider the procedure of OLT configuration for the above diagram.

- **Step 1. Configure the switch.**

```
interface pon-port 0
  bridging to pon-port 1
exit
interface pon-port 1
  bridging to pon-port 0
exit
vlan 300
  name VLAN0300
  tagged pon-port 0 , front-port 0
exit
vlan 500
  name VLAN0500
  tagged pon-port 0 , pon-port 1 , front-port 0
exit
vlan 1100
  name VLAN1100
  tagged pon-port 0 , front-port 0
exit
```

```
vlan 1200
  name VLAN1200
  tagged pon-port 0 , front-port 0
exit
```

- **Step 2. Configure cross-connect profiles.**

```
profile cross-connect "cc-tunnel"
  bridge
  bridge group "10"
  tag-mode tunnel
  exit
profile cross-connect "cc-selecttunnel"
  bridge
  bridge group "10"
  tag-mode selective-tunnel
  exit
profile cross-connect "cc-single"
  bridge
  bridge group "10"
  user vid "300"
  exit
profile cross-connect "cc-double"
  bridge
  bridge group "10"
  tag-mode double-tagged
  exit
```

- **Step 3.** Configure **ports** profiles.

```
profile ports "bridge-10"
port 0 bridge group "10"
exit
```

- **Step 4.** Configure the **address-table** profile by specifying the VLANs used for tunnels and assign the profile to GPON ports.

```
profile address-table "at-tunnel"
s-vlan 1100 use c-vlan
s-vlan 1200 use c-vlan
s-vlan 500 use c-vlan
exit interface gpon-port 0
profile address-table "at-tunnel"
exit
interface gpon-port 1
profile address-table "at-tunnel"
exit
```

- **Step 5.** Configure the SFP-ONU to be used for switch connection.

```
interface ont 0/0
serial "454C545300000001"
password "default"
service 0 profile cross-connect "cc-tunnel"
service 0 profile dba "dba-00"
```

```
service 1 profile cross-connect "cc-selecttunnel"
service 1 profile dba "dba-00"
service 2 profile cross-connect "cc-single"
service 2 profile dba "dba-00"
profile ports "bridge-10"
service 0 custom svid "1100"
service 1 custom svid "1200"
service 1 selective-tunnel uvid 201-203
service 2 custom svid "300"
```

- **Step 6.** Configure the SFP-ONU to be used for connection of the corporate client.

```
interface ont 0/1
serial "454C545300000002"
service 0 profile cross-connect "cc-tunnel"
service 0 profile dba "dba-00"
profile ports "bridge-10"
service 0 custom svid "500"
```

- **Step 7.** Configure the ONTs to be used for connection of remote offices.

```

interface ont 1/0
serial "454C545800000002"
service 0 profile cross-connect "cc-double"
service 0 profile dba "dba-00"
profile ports "bridge-10"
service 0 custom cvid "10"
service 0 custom svid "500"
exit
interface ont 1/1
serial "454C545800000003"
service 0 profile cross-connect "cc-double"
service 0 profile dba "dba-00"
profile ports "bridge-10"
service 0 custom cvid "20"
service 0 custom svid "500"

```

- ⚠** The number of UVIDs processed in all selective-tunnel services on one ONT should not exceed 42. The VLANs used for tunnel services cannot be used for other types of services within one GPON channel.
- The tunnel service is the last one to be configured on the ONT, therefore the user-vid used by other services will not be processed by the tunnel service.
- The traffic with a random user-vid tag should not contain additional 802.1q tags. Otherwise, it will be declined by any service provided for this user-vid.
- It is impossible to use double-tagged and tunnel services simultaneously on one terminal.
- You can create up to 12 services on a single interface using tunnel or selective tunnel.
- It is not recommended to use untagged traffic for tunnelling.

5.6 DBA configuration

This chapter considers DBA configuration for ONT.

GPON technology implies that all ONTs of one GPON channel use common communication medium (fibre). It is necessary to provide a mechanism that will ensure data transfer from all ONTs without collisions. The mechanism is called **dynamic bandwidth allocation (DBA)** and ensures allocation of time intervals in OLT for data transfer to ONTs.

A logical unit of the DBA algorithm is **Alloc-ID** (allocation) with a corresponding **T-CONT** (traffic counter) on the ONT side. Data transfer parameters (frequency, transmission window) are separately configured for every Alloc-ID (T-CONT) and are referred to as **service level agreement (SLA)**.

G.984.3 provides several SLA combinations called T-CONT type. There are the following T-CONT types:

- T-CONT type 1 with a fixed bandwidth only. It is suitable for traffic, which is transferred at a constant speed (or with very low variations) and is sensitive to delays and jitter.
- T-CONT type 2 with a guaranteed bandwidth only. This type is suitable for bursty traffic with a well defined upper bound, without strict delay and jitter restrictions.
- T-CONT type 3 is a counter with a guaranteed bandwidth and a possibility to allocate a best-effort bandwidth. This type is suitable for bursty traffic with peak values that requires a certain throughput to be guaranteed.
- T-CONT type 4 allows allocation of a best-effort bandwidth without fixed or guaranteed bandwidths. This type is suitable for bursty traffic with peak values that does not require any guaranteed throughput.
- T-CONT type 5 is a counter with fixed and guaranteed bandwidths and a possibility to allocate a best-effort bandwidth. This type summarises all other types and is suitable for most types of traffic.

The terminal allows configuration of up to 256 default allocations per channel. When one ONT is connected, at least one default allocation will be provided. Thus, when 128 subscribers are connected to a channel, 128 service allocations will be provided. The remaining 128 allocations will be enough to process data, but not enough to process more than one service in its own allocation. You need to follow the rule: $A_{max} = 256/N - 1$, where A_{max} – the maximum quantity of allocations for user data of an ONT, N – the quantity of ONTs on a channel. If the calculated amount of services exceeds ONT A_{max} , configure a combination of multiple services into a single allocation. For more detailed information, see [Services in one T-CONT](#).

DBA parameters are configured in the dba profile. These parameters allow specification of any T-CONT type described in G.984.3. First of all, choose service-class to define the basic DBA algorithm. After that, configure status-reporting to define the type of ONT queues status report. The fixed-bandwidth, guaranteed-bandwidth, and besteffort-bandwidth parameters define the fixed, guaranteed, and best-effort bandwidth correspondingly. Table 28 shows the correspondence between the dba profile settings and T-CONT types.

Table 28 – DBA profile configuration and T-CONT types

	T-CONT type 1	T-CONT type 2	T-CONT type 3	T-CONT type 4	T-CONT type 5
service-class	cbr	voip	type5	type5	type5
status-reporting	-	+	+	+	+
fixed-bandwidth	+	-	-	-	+
guaranteed-bandwidth	-	+	+	-	+
besteffort-bandwidth	-	-	+	+	+

The following rules apply to dba profile assignment:

- when an ONT service is assigned a dba profile, an Alloc-ID is created for the ONT on the OLT side, and a corresponding T-CONT is configured on the ONT side.
- if different ONTs are assigned the same profile, they will each have a separate Alloc-ID created with the same allocation parameters.
- if the same dba profiles are assigned to different services of the same ONT with allocation-scheme share-t-cont, these services will work in the same allocation and have the same allocation parameters.
- if the same dba profiles are assigned to different services of the same ONT with allocation-new-t-cont, these services will work in different allocations, and the number of Alloc-IDs created for the ONT equals the number of assigned dba profiles.

5.6.1 DBA global settings

5.6.1.1 Latency reduction mode

Enabling DBA latency reduction mode corrects the procedure of polling active allocations and activates redistribution of the fixed bandwidth between connected ONTs. The function is available for use on trees with any number of ONTs.

There are two modes of DBA operation: Most demanding – the mode of the most demanding ONTs and Fair allocations – the mode of fair distribution. Most demanding mode splits the bandwidth in such a way that the ONT sending the most traffic to the upstream is a priority for DBA algorithms. In the case of Fair allocations, the bandwidth tends to be evenly distributed among all ONTs on the channel.

To enable this mode, use the following command.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt dba-reduced-latency allocation-mode (most-demanding/fair-
allocations)
LTP-8X(config)# do commit
LTP-8X(config)# do save
```

After applying the configuration, the OLT will be automatically reconfigured.

To disable latency reduction mode use the **no** command.

```
LTP-8X# configure terminal
LTP-8X(config)# no gpon olt dba-reduced-latency
LTP-8X(config)# do commit
LTP-8X(config)# do save
```

⚠ Enabling this mode can lead to GPON port bandwidth reduction to 5–10 %.

5.6.1.2 DBA short cycle mode

Enabling this mode reduces DBA cycle for the indicated interfaces, which allows to optimize bandwidth allocation for trees with a small number of connected ONTs.

Below is a command for enabling DBA short cycle on 0,1 GPON ports. The mode is available on GPON ports pairs: 0–1, 2–3, 4–5, 6–7. For maximum effect, it is recommended to assign DBA profiles with the status-reporting type 0 parameter set to ONTs connected to gpon-ports with the dba-short-cycle function enabled. For more details on DBA profiles forming procedure, see [DBA parameters configuration](#).

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt dba-short-cycle gpon-port 0-1
LTP-8X(config)# do commit
LTP-8X(config)# do save
```

After applying the configuration, the OLT will be automatically reconfigured.

To disable DBA short cycle mode use the **no** command.

```
LTP-8X# configure terminal
LTP-8X(config)# no gpon olt dba-short-cycle gpon-port 0-1
LTP-8X(config)# do commit
LTP-8X(config)# do save
```

⚠ Enabling this mode is not recommended for trees with more than 32 connected ONTs.

5.6.2 DBA profiles assignment

5.6.2.1 Services in different T-CONTs

Two Alloc-IDs will be allocated for ONTs in the OLT. Each service will operate in its allocation. There will be two T-CONTs on the ONT side corresponding to the allocations.

- **Step 1.** Each ONT should have two services in different T-CONTs. To do this, assign two dba profiles by using the **profile dba** command.

```
LTP-8X(config)# profile dba ServiceInternet
LTP-8X(config-dba)("ServiceInternet")# exit
LTP-8X(config)# profile dba ServiceVoIP
LTP-8X(config-dba)("ServiceVoIP")# exit
```

- **Step 2.** Specify an individual allocations distribution scheme by using the **allocation-scheme** command.

```
LTP-8X(config)# profile dba ServiceInternet
LTP-8X(config-dba)("ServiceInternet")#allocation-scheme allocate-new-t-cont
LTP-8X(config-dba)("ServiceInternet")# exit
LTP-8X(config)# profile dba ServiceVoIP
LTP-8X(config-dba)("ServiceVoIP")# allocation-scheme allocate-new-t-cont
LTP-8X(config-dba)("ServiceVoIP")# exit
```

- **Step 3.** Assign the profiles to services by using the **service <id> profile dba** command.

```
LTP-8X(config)(if-ont-0/0)# service 0 profile dba ServiceInternet
LTP-8X(config)(if-ont-0/0)# service 1 profile dba ServiceVoIP
```

The configuration will be as follows:

```
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
    Profile dba:                AllServices          ONT Profile DBA 3
    Custom cross connect:      disabled
  Service [1]:
    Profile cross connect:      ServiceVoIP          ONT Profile Cross Connect
1
    Profile dba:                AllServices          ONT Profile DBA 3
    Custom cross connect:      disabled
...
```

- **Step 4.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0)# do commit
```

5.6.2.2 Services in one T-CONT

One Alloc-ID will be allocated for ONTs in the OLT. Each ONT will have one T-CONT configured. The T-CONT will be used to transfer traffic from multiple services. Traffic priority will be based on the value of the priority queue field of the corresponding cross-connect profiles.

- **Step 1.** Each ONT should have three services in one T-CONT. To do this, assign a dba profile by using the **profile dba** command.

```
LTP-8X(config)# profile dba AllServices
```

- **Step 2.** Each ONT should have all services in one T-CONT. To do this, specify an allocation scheme by using the **allocation-scheme** command.

```
LTP-8X(config-dba)("AllServices")# allocation-scheme share-t-cont
```

- **Step 3.** Assign the profile to three services by using the **service <id> profile dba** command.

```
LTP-8X(config)(if-ont-0/1)# service 0 profile dba AllServices
LTP-8X(config)(if-ont-0/1)# service 1 profile dba AllServices
LTP-8X(config)(if-ont-0/1)# service 2 profile dba AllServices
```

The configuration will be as follows:

```
LTP-8X(config)(if-ont-0/1)# do show interface ont 0/1 configuration
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
```

```

    Profile dba:                AllServices                ONT Profile DBA 3
    Custom cross connect:       disabled
  Service [1]:
    Profile cross connect:      ServiceVoIP                ONT Profile Cross Connect
1
    Profile dba:                AllServices                ONT Profile DBA 3
    Custom cross connect:       disabled
  Service [2]:
    Profile cross connect:      ServiceIPTV                ONT Profile Cross Connect
2
    Profile dba:                AllServices                ONT Profile DBA 3
    Custom cross connect:       disabled
...

```

- **Step 4.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/1)# do commit
```

5.6.2.3 One profile for multiple ONTs

This is a typical scenario in most cases, when similar services require the same DBA parameters on different ONTs.

- **Step 1.** Define a dba profile by using the **profile dba** command.

```
LTP-8X(config)# profile dba ServiceInternet
```

- **Step 2.** Assign the profile to the corresponding service of every ONT by using the **service <id> profile dba** command.

```
LTP-8X(config)# interface ont 0/0-1
LTP-8X(config)(if-ont-0/0-1)# service 0 profile dba ServiceInternet
```

ONT configurations will be as follows:

```
LTP-8X(config)(if-ont-0/0-1)# do show interface ont 0/0-1 configuration
LTP-8X(config)(if-ont-0/0-1)# do show interface ont 0/0-1 configuration
-----
[ONT0/0] configuration
-----
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
    Profile dba:                ServiceInternet      ONT Profile DBA 1
    Custom cross connect:      disabled
...
-----
[ONT0/1] configuration
-----
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
    Profile dba:                ServiceInternet      ONT Profile DBA 1
    Custom cross connect:      disabled
...

```

- **Step 3.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0-1)# do commit
```

Profiles assignment example

Consider two ONTs, which need to have the following three services: Internet, VoIP, SecurityAlarm. The VoIP service should operate in a separate allocation (a definite throughput should be ensured). The Internet and SecurityAlarm services may operate in one allocation.

This configuration implies that the OLT allocates two Alloc-IDs to each ONT. The Internet and SecurityAlarm services operate in one allocation, the VoIP service uses another one. Each ONT has two T-CONTs configured, which correspond to the Alloc-IDs of the ONT. Traffic priority between the Internet and SecurityAlarm services on the ONT side is based on the "priority-queue" value of the ServiceInternet and ServiceAlarm cross-connect profiles, which were assigned to the services.

The Internet and SecurityAlarm services require calculation of SLA parameters. This is done by adding the appropriate parameters for both services. Below is an example of SLA parameters calculation.

Table 29 – SLA parameters

SLA parameters	Internet	SecurityAlarm	Sum
bandwidth fixed	0	0	0
bandwidth guaranteed	10048	1024	11072
bandwidth besteffort	329984	20096	350080

For more information about SLA parameters, see [DBA parameters configuration](#).

- **Step 1.** Define two dba profiles by using the **profile dba** command.

```
LTP-8X(config)# profile dba ServiceVoIP
LTP-8X(config-dba)("ServiceVoIP")# exit
LTP-8X(config)# profile dba OtherServices
```

- **Step 2.** Specify an individual allocations distribution scheme by using the **allocation-scheme** command.

```
LTP-8X(config)# profile dba ServiceVoIP
LTP-8X(config-dba)("ServiceVoIP")# allocation-scheme allocate-new-t-cont
LTP-8X(config-dba)("ServiceVoIP")# exit
LTP-8X(config)# profile dba OtherServices
LTP-8X(config-dba)("OtherServices")# exit
```

- **Step 3.** Assign the profiles to the corresponding services of every ONT by using the **service <id> profile dba** command.

```
LTP-8X(config)# interface ont 0/0-1
LTP-8X(config)(if-ont-0/0-1)# service 0 profile dba OtherServices
LTP-8X(config)(if-ont-0/0-1)# service 1 profile dba ServiceVoIP
LTP-8X(config)(if-ont-0/0-1)# service 2 profile dba OtherServices
```

ONT configurations will be as follows:

```
LTP-8X(config)(if-ont-0/0-1)# do show interface ont 0/0-1 configuration
-----
[ONT0/0] configuration
-----
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
    Profile dba:                OtherServices        ONT Profile DBA 4
    Custom cross connect:      disabled
  Service [1]:
    Profile cross connect:      ServiceVoIP          ONT Profile Cross Connect
0
    Profile dba:                ServiceVoIP          ONT Profile DBA 2
    Custom cross connect:      disabled
  Service [2]:
    Profile cross connect:      SecurityiAlarm       ONT Profile Cross Connect
0
    Profile dba:                OtherServices        ONT Profile DBA 4
    Custom cross connect:      disabled
...
-----
[ONT0/1] configuration
-----
...
  Service [0]:
    Profile cross connect:      ServiceInternet      ONT Profile Cross Connect
0
    Profile dba:                OtherServices        ONT Profile DBA 4
    Custom cross connect:      disabled
  Service [1]:
    Profile cross connect:      ServiceVoIP          ONT Profile Cross Connect
0
    Profile dba:                ServiceVoIP          ONT Profile DBA 2
    Custom cross connect:      disabled
  Service [2]:
    Profile cross connect:      SecurityiAlarm       ONT Profile Cross Connect
0
    Profile dba:                OtherServices        ONT Profile DBA 4
    Custom cross connect:      disabled
```

- **Step 4.** Apply the changes by using the **commit** command.

```
LTP-8X(config)(if-ont-0/0-1)# do commit
```

5.6.3 DBA parameters configuration

5.6.3.1 T-CONT type 1 configuration

Consider configuration of a 100 Mbps fixed bandwidth.


- **Step 1.** Specify a T-CONT type by using the **sla class** command.

```
LTP-8X(config)# profile dba dba-00
LTP-8X(config-dba)("dba-00")# sla class cbr
```

- **Step 2.** Specify a type of status reports for ONT queues by using the **sla status-reporting** command.

```
LTP-8X(config-dba)("dba-00")# sla status-reporting nsr
```

- **Step 3.** Set fixed bandwidth parameters by using the **bandwidth fixed** command. Set other bandwidth parameters to 0.

 The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps.

```
LTP-8X(config-dba)("dba-00")# bandwidth fixed 100000
LTP-8X(config-dba)("dba-00")# bandwidth guaranteed 0
LTP-8X(config-dba)("dba-00")# bandwidth besteffort 0
```

- **Step 4.** Check the set parameters.

```
LTP-8X(config-dba)("dba-00")# do show profile dba dba-00
Name:                               'dba-00'
Description:                         'ONT Profile DBA 0'
Dba:
  Sla data:
    Service class:                    cbr
    Status reporting:                 nsr
    Alloc size:                       0
    Alloc period:                     0
    Fixed bandwidth:                  100000
    Guaranteed bandwidth:             0
    Besteffort bandwidth:             0
  T-CONT allocation scheme:          share T-CONT with same profile
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dba)("dba-00")# do commit
```


5.6.3.2 T-CONT type 2 configuration

Consider configuration of a 100 Mbps guaranteed bandwidth.


- **Step 1.** Specify a T-CONT type by using the **sla class** command.

```
LTP-8X(config)# profile dba dba-00
LTP-8X(config-dba)("dba-00")# sla class voip
```

- **Step 2.** Specify a type of status reports for ONT queues by using the **sla status-reporting** command.

```
LTP-8X(config-dba)("dba-00")# sla status-reporting nsr
```

- **Step 3.** Set guaranteed bandwidth parameters by using the **bandwidth guaranteed** command. Set other bandwidth parameters to 0.

 The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps.

```
LTP-8X(config-dba)("dba-00")# bandwidth guaranteed 100000
LTP-8X(config-dba)("dba-00")# bandwidth fixed 0
LTP-8X(config-dba)("dba-00")# bandwidth besteffort 0
```

- **Step 4.** Check the set parameters.

```
LTP-8X(config-dba)("dba-00")# do show profile dba dba-00
Name:                               'dba-00'
Description:                         'ONT Profile DBA 0'
Dba:
  Sla data:
    Service class:                    voip
    Status reporting:                 nsr
    Alloc size:                       0
    Alloc period:                     0
    Fixed bandwidth:                  100000
    Guaranteed bandwidth:             0
    Besteffort bandwidth:             0
  T-CONT allocation scheme:          share T-CONT with same profile
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dba)("dba-00")# do commit
```

5.6.3.3 T-CONT type 3 configuration

Consider configuration of a 100 Mbps guaranteed bandwidth with a possibility of allocation of a 200 Mbps best-effort bandwidth.


- **Step 1.** Specify a T-CONT type by using the **sla class** command.

```
LTP-8X(config)# profile dba dba-00
LTP-8X(config-dba)("dba-00")# sla class type5
```

- **Step 2.** Specify a type of status reports for ONT queues by using the **sla status-reporting** command.

```
LTP-8X(config-dba)("dba-00")# sla status-reporting nsr
```

- **Step 3.** Set guaranteed bandwidth parameters by using the **bandwidth guaranteed** command. Set best-effort bandwidth parameters by using the **bandwidth besteffort** command. Set other bandwidth parameters to 0.

 The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps.

```
LTP-8X(config-dba)("dba-00")# bandwidth fixed 0
LTP-8X(config-dba)("dba-00")# bandwidth guaranteed 100000
LTP-8X(config-dba)("dba-00")# bandwidth besteffort 200000
```

- **Step 4.** Check the set parameters.

```
LTP-8X(config-dba)("dba-00")# do show profile dba dba-00
Name:                               'dba-00'
Description:                         'ONT Profile DBA 0'
Dba:
  Sla data:
    Service class:                    type5
    Status reporting:                 nsr
    Alloc size:                       0
    Alloc period:                    0
    Fixed bandwidth:                  100000
    Guaranteed bandwidth:             0
    Besteffort bandwidth:             200000
  T-CONT allocation scheme:          share T-CONT with same profile
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dba)("dba-00")# do commit
```

5.6.3.4 T-CONT type 4 configuration

Consider configuration of a 200 Mbps best-effort bandwidth without allocation of a guaranteed bandwidth.


- **Step 1.** Specify a T-CONT type by using the **sla class** command.

```
LTP-8X(config)# profile dba dba-00
LTP-8X(config-dba)("dba-00")# sla class type5
```

- **Step 2.** Specify a type of status reports for ONT queues by using the **sla status-reporting** command.

```
LTP-8X(config-dba)("dba-00")# sla status-reporting nsr
```

- **Step 3.** Set best-effort bandwidth parameters by using the **bandwidth besteffort** command. Set other bandwidth parameters to 0.

 The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps.

```
LTP-8X(config-dba)("dba-00")# bandwidth fixed 0
LTP-8X(config-dba)("dba-00")# bandwidth guaranteed 0
LTP-8X(config-dba)("dba-00")# bandwidth besteffort 200000
```

- **Step 4.** Check the set parameters.

```
LTP-8X(config-dba)("dba-00")# do show profile dba dba-00
Name:                               'dba-00'
Description:                         'ONT Profile DBA 0'
Dba:
  Sla data:
    Service class:                    type5
    Status reporting:                 nsr
    Alloc size:                       0
    Alloc period:                     0
    Fixed bandwidth:                  0
    Guaranteed bandwidth:             0
    Besteffort bandwidth:              200000
  T-CONT allocation scheme:           share T-CONT with same profile
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dba)("dba-00")# do commit
```

5.6.3.5 T-CONT type 5 configuration

Consider configuration of a 100 Mbps fixed bandwidth and a 200 Mbps guaranteed bandwidth with a possibility of allocation of a 1244 Mbps best-effort bandwidth.


- **Step 1.** Specify a T-CONT type by using the **sla class** command.

```
LTP-8X(config)# profile dba dba-00
LTP-8X(config-dba)("dba-00")# sla class type5
```

- **Step 2.** Specify a type of status reports for ONT queues by using the **sla status-reporting** command.

```
LTP-8X(config-dba)("dba-00")# sla status-reporting nsr
```

- **Step 3.** Specify the parameters of the fixed bandwidth by using the **bandwidth fixed** command, the parameters of the guaranteed bandwidth by the **bandwidth guaranteed** command, and the parameters of the additional bandwidth by the **bandwidth besteffort** command.

 The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps.

```
LTP-8X(config-dba)("dba-00")# bandwidth fixed 100000
LTP-8X(config-dba)("dba-00")# bandwidth guaranteed 200000
LTP-8X(config-dba)("dba-00")# bandwidth besteffort 1244000
```

- **Step 4.** Check the set parameters.

```
LTP-8X(config-dba)("dba-00")# do show profile dba dba-00
Name:                               'dba-00'
Description:                         'ONT Profile DBA 0'
Dba:
  Sla data:
    Service class:                    type5
    Status reporting:                 nsr
    Alloc size:                       0
    Alloc period:                     0
    Fixed bandwidth:                  100000
    Guaranteed bandwidth:             200000
    Besteffort bandwidth:             1244000
  T-CONT allocation scheme:          share T-CONT with same profile
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-dba)("dba-00")# do commit
```

5.7 Shaping configuration

This chapter describes how to configure Shaping profile for an ONT.

A shaping profile allows limiting a downstream and upstream bandwidth for a specified ONT.

Downstream restriction in OLT uses the **downstream policer** algorithm. The restriction can either use one policer for all services or individual policers for each separate service.

Upstream restriction in ONT uses the **upstream shaping** algorithm. It is possible to use either a single policer for all services simultaneously or different policers for each service separately.

5.7.1 Shaping parameters configuration

5.7.1.1 Downstream policer configuration

You need to configure a bandwidth limit of 100 Mbps for all services.

The total bandwidth for all services is limited by the value set for **0 service**.

- **Step 1.** Enable **one-policer**.


```
LTP-8X(config)# profile shaping shaping-00
LTP-8X(config-shaping)("shaping-00")# downstream one-policer
```

- **Step 2.** Enable policer for necessary services.

```
LTP-8X(config-shaping)("shaping-00")# downstream policer 0 enable
LTP-8X(config-shaping)("shaping-00")# downstream policer 1 enable
LTP-8X(config-shaping)("shaping-00")# downstream policer 2 enable
LTP-8X(config-shaping)("shaping-00")# downstream policer 3 enable
```

- **Step 3.** Specify parameters of a fixed band for **service 0**.

```
LTP-8X(config-shaping)("shaping-00")# downstream policer 0 peak-rate 100000
```

 For disabling limiting of bandwidth for all services and enable limiting separately, disable **downstream one-police** and set **downstream policer peak-rate** for required services.

5.7.1.2 Upstream shaping configuration

Shaping allows limiting all types of traffic for services by bandwidth or set different values of bandwidth for each type separately.

There is an opportunity to limit bandwidth for multicast and broadcast traffic separately. In this case unicast traffic will be limited by the global value. If you set the limit for unicast traffic, you should set limits for multicast and broadcast traffic as well. Otherwise, multicast and broadcast traffic will not be limited at all.

For the correct bandwidth limiting, different DBA profiles should be assigned for each service.

- **Step 1.** Enable **shaping** for required services and set committed-rate and peak-rate values for global limiting.

```
LTP-8X(config-shaping)("shaping-00")# upstream 0 enable
LTP-8X(config-shaping)("shaping-00")# upstream 0 committed-rate 100000
LTP-8X(config-shaping)("shaping-00")# upstream 0 peak-rate 110000
```

If you stop configuring on this step, all the traffic of service 0 will be limited by the committed-rate value.

- **Step 2.** Enable **shaping** for different traffic types.

```
LTP-8X(config-shaping)("shaping-00")# upstream multicast 0 enable
LTP-8X(config-shaping)("shaping-00")# upstream broadcast 0 enable
LTP-8X(config-shaping)("shaping-00")# upstream unicast 0 enable
```

- **Step 3.** Specify parameters of fixed bandwidth for each traffic type for service 0.

```
LTP-8X(config-shaping)("shaping-00")# upstream multicast 0 committed-rate 500
LTP-8X(config-shaping)("shaping-00")# upstream multicast 0 peak-rate 600
LTP-8X(config-shaping)("shaping-00")# upstream broadcast 0 committed-rate 500
LTP-8X(config-shaping)("shaping-00")# upstream broadcast 0 peak-rate 600
LTP-8X(config-shaping)("shaping-00")# upstream unicast 0 committed-rate 100000
LTP-8X(config-shaping)("shaping-00")# upstream unicast 0 peak-rate 100000
```

- ⚠** The bandwidth has a throughput in Kbps (1000 bps), which is rounded down to 64 Kbps. For NTU-1, the algorithm of bandwidth limiting in upstream is different:
- traffic types are independent: if the limit of unicast traffic is set, multicast and broadcast traffic will be limited by the global value;
 - in case the global value is specified as well as values for different traffic types, the limit for different traffic types will be implemented first, then limiting by the global value;
 - the traffic for all services is limited by the value set for service 0. Similarly, you can configure the bandwidth for other services.

5.7.1.3 Configuration of Storm-control in the upstera direction

To protect against «storms» arising in the pon part of the OLT, you can use the advanced functionality of the shaping profile.

Configuration example to limit bc and mc traffic is given below. The limit is set in the number of packets per second. If necessary, you can provide event logging when the threshold is exceeded, perform ONT blocking*, or do both.

```
LTP-8X(config-shaping)("shaping-00")# upstream broadcast storm-control rate-limit 100 logging shutdown
LTP-8X(config-shaping)("shaping-00")# upstream multicast storm-control rate-limit 100 logging shutdown
```

*The blocking time is set in the global configuration with the following command.

```
LTP-8X(config)# gpon olt ont-block-time 1
```

The time is specified in minutes.

5.8 RG ONT

This chapter considers issues related to configuration of Residential Gateway (RG) ONTs. The chapter introduces the notion of Bridged and Routed services.

Consider the concept of OMCI and RG management domains. These terms are determined in TR-142 Issue 2. In terms of management domains, an ONT is considered as a device, which operates in the OMCI domain only. The devices, which operate in both management domains (i. e. have an integrated router), are denoted as ONT/RG. Everything that refers to the OMCI domain can be applied to both ONT and ONT/RG devices. For this reason, we will further denote ONT/RG as ONT. If an ONT is configured without the RG domain (without a router), skip all steps concerning RG.

Figure below shows an ONT/RG scheme and its management domains.

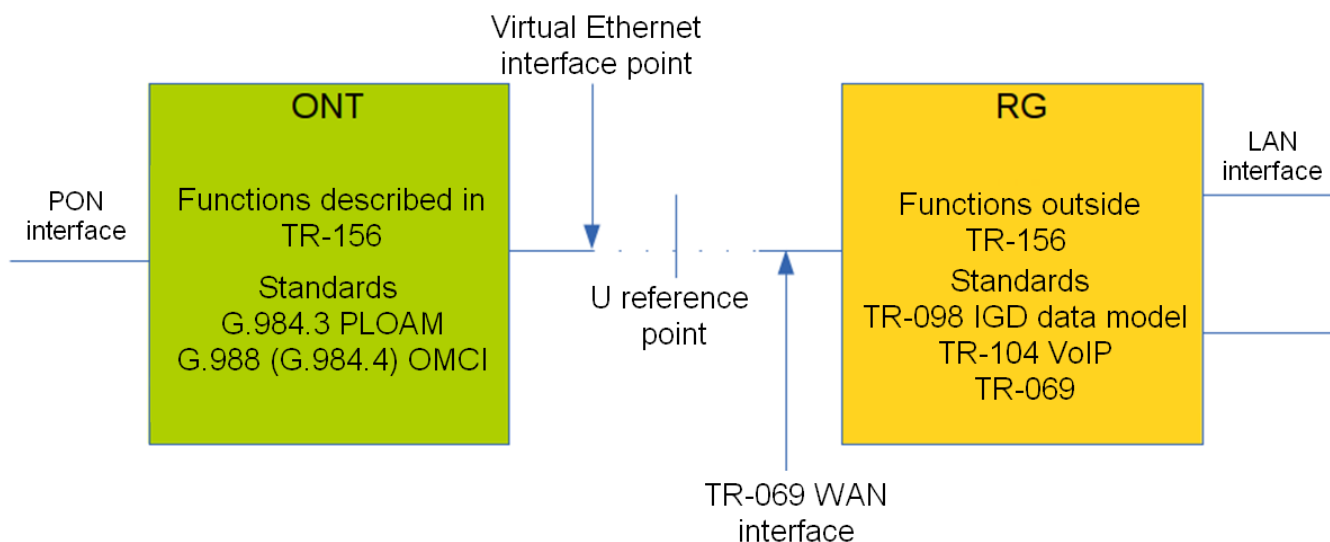


Figure 41 – ONT/RG management domains

- ⚠ **Bridged service** is a service, which configuration requires the OMCI management domain only, i. e. it can be completely configured with the help of the OMCI protocol in ONT.
- Routed service** is a service, which configuration requires both the OMCI and RG management domains.

In addition to configuration in terminal, a routed service requires the RG domain to be configured by using one of the following methods:

1. Pre-defined configuration – subscriber is provided with an ONT having fixed configuration.
2. Local ONT configuration using WEB interface.
3. ONT configuration using the TR-069 protocol and auto configuration server (ACS).

- ⚠ Contact ONT vendor for information about RG domain configuration.

ONT is connected to RG using a Virtual Ethernet interface point (VEIP), which corresponds to the TR-069 WAN interface (described in TR-098) on the RG side. VEIP is represented by a virtual port in terminal parameters. The port has the same configuration procedure as Ethernet ports in the ports profile.

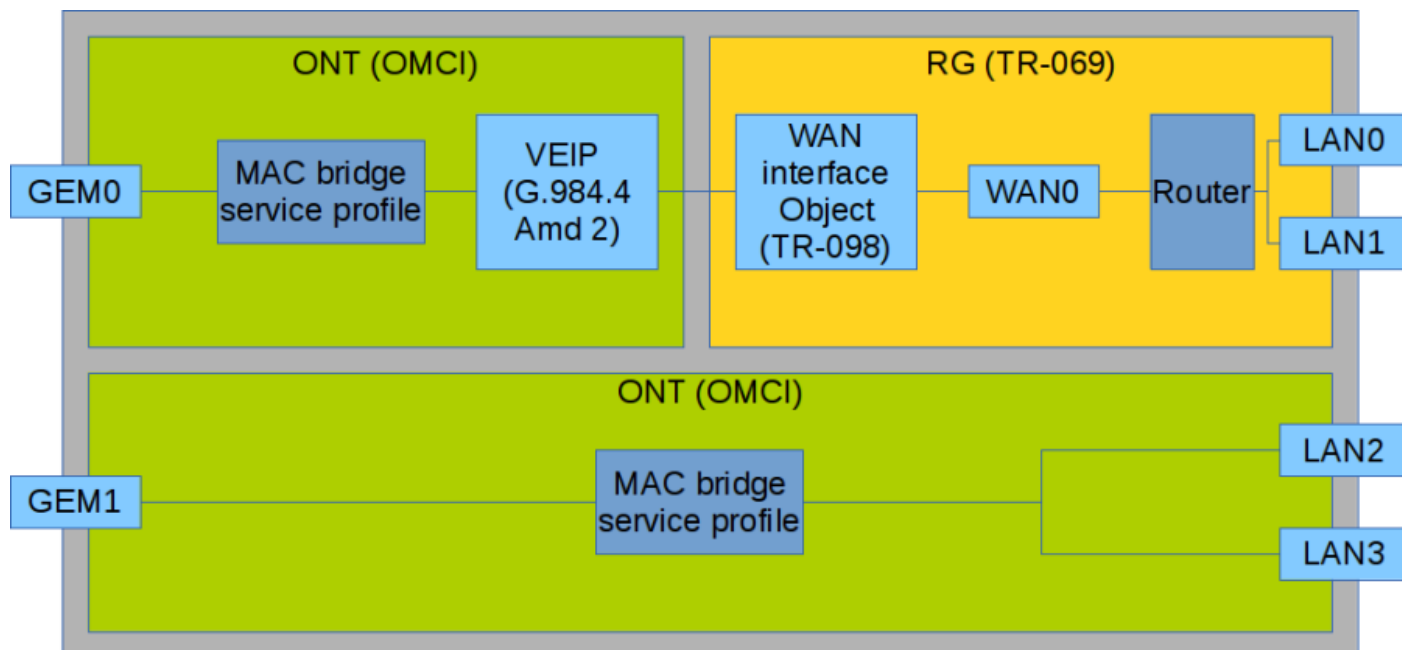


Figure 42 – Services configuration in ONT and RG domains

Figure above shows two services (each with a corresponding GEM port on the ONT side), with one of them being routed and using both the OMCI and RG management domains and the other one being bridged and using only OMCI for configuration. Terminal configuration includes configuration of bridge interfaces (green areas in the figure) and distribution of LAN ports between the management domains.

The bridge parameter of the cross-connect profile is responsible for association of a service with a management domain. Being set, the bridge parameter creates a bridged service (the bridge group parameter is the bridge number in this case). When no bridge is set, a routed service is created (there is only one bridge associated with RG; it has a special bridge number–0).

5.8.1 Mixed configuration

Consider an example of ONT configuration, which simultaneously uses both management domains. Port numbers and the internal structure are shown in [Figure 42](#).

- **Step 1.** Create a VLAN for services on the switch. VLAN configuration is described in detail in [VLAN configuration](#).

```
LTP-8X(switch)(config)# vlan 20
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 1
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# vlan 30
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 1
```

- **Step 2.** Specify 3 as a service model value corresponding to the «VLAN for Service» model by using the **gpon olt model** command.

```
LTP-8X# configure terminal
LTP-8X(config)# gpon olt model 3
```

- **Step 3.** Define cross-connect profiles for services.

```
LTP-8X(config)# profile cross-connect RG-service
LTP-8X(config-cross-connect)("RG-service")# exit
LTP-8X(config)# profile cross-connect OMCI-service
```

- **Step 4.** Define a dba profile. DBA parameters are not important for the purposes of this chapter. Thus, we will not configure these parameters, just use the default values. We will also assign one profile to both services that means that upstream services will operate with one T-CONT. DBA configuration is described in detail in [DBA configuration](#).

```
LTP-8X(config)# profile dba basic
LTP-8X(config-dba)("basic")# exit
```

- **Step 5.** Create ports profile.

```
LTP-8X(config)# profile ports 2RG-2OMCI
LTP-8X(config-ports)("2RG-2OMCI")# exit
```

- **Step 6.** Configure a routed service. Use one VLAN 20 on both the OLT and ONT sides. Specify a routed service by using the **no bridge** command. Configure a cross-connect profile for the routed service.

```
LTP-8X(config)# profile cross-connect RG-service
LTP-8X(config-cross-connect)("RG-service")# no bridge
LTP-8X(config-cross-connect)("RG-service")# type general
LTP-8X(config-cross-connect)("RG-service")# tag-mode single-tagged
LTP-8X(config-cross-connect)("RG-service")# outer vid 20
LTP-8X(config-cross-connect)("RG-service")# outer cos unused
LTP-8X(config-cross-connect)("RG-service")# user vid untagged
LTP-8X(config-cross-connect)("RG-service")# mac-table-limit unlimited
LTP-8X(config-cross-connect)("RG-service")# priority 0
```

- **Step 7.** Configure a bridged service. Use one VLAN 30 on both the OLT and ONT sides. Specify a bridged service by using the **bridge** command. Set 1 as the OMCI bridge number. Configure a cross-connect profile for the bridged service.

```
LTP-8X(config)# profile cross-connect OMCI-service
LTP-8X(config-cross-connect)("OMCI-service")# bridge
LTP-8X(config-cross-connect)("OMCI-service")# bridge group 1
LTP-8X(config-cross-connect)("OMCI-service")# type general
LTP-8X(config-cross-connect)("OMCI-service")# tag-mode single-tagged
LTP-8X(config-cross-connect)("OMCI-service")# outer vid 30
LTP-8X(config-cross-connect)("OMCI-service")# outer cos unused
LTP-8X(config-cross-connect)("OMCI-service")# user vid untagged
LTP-8X(config-cross-connect)("OMCI-service")# mac-table-limit unlimited
LTP-8X(config-cross-connect)("OMCI-service")# priority 1
```

You specified different **priority queue** values for the services. The routed service will have a higher priority than the bridged service as they work with one T-CONT.

- **Step 8.** Configure a ports profile. According to [Figure 41](#), we need to associate the first two LAN ports with the RG management domain, while the other two should be associated with the OMCI domain and bound to bridge 1.

```
LTP-8X(config)# profile ports 2RG-2OMCI
LTP-8X(config-ports)("2RG-2OMCI")# port 0 bridge group 0
LTP-8X(config-ports)("2RG-2OMCI")# port 1 bridge group 0
LTP-8X(config-ports)("2RG-2OMCI")# port 2 bridge group 1
LTP-8X(config-ports)("2RG-2OMCI")# port 3 bridge group 1
```

- **Step 9.** Set the ONT configuration. ONT management is described in detail in [Service Models](#).

```
LTP-8X(config)# interface ont 0/0
```

- **Step 10.** Assign the created profiles. Assign the cross-connect RG-service profile to service 0 and the cross-connect OMCI-service profile to service 1.

```
LTP-8X(config)# serial ELTX10203040
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect RG-service
LTP-8X(config)(if-ont-0/0)# service 0 profile dba basic
LTP-8X(config)(if-ont-0/0)# service 1 profile cross-connect OMCI-service
LTP-8X(config)(if-ont-0/0)# service 1 profile dba basic
LTP-8X(config)(if-ont-0/0)# profile ports 2RG-2OMCI
```

- **Step 11.** Use the **show interface ont <id> configuration** command to check the created configuration.

```
LTP-8X(config)(if-ont-0/0-1)# do show interface ont 0/0-1 configuration
-----
[ONT0/0] configuration
-----

Description:          ''
Enabled:              true
Serial:               ELTX10203040
...
Service [0]:
  Profile cross connect:  RG-service          ONT Profile Cross Connect 1
  Profile dba:           basic              ONT Profile DBA 2
  Custom cross connect:  disabled
Service [1]:
  Profile cross connect:  RG-service          ONT Profile Cross Connect 0
  Profile dba:           basic              ONT Profile DBA 2
  Custom cross connect:  disabled
Service [2]:
  Profile cross connect:  SecurityAlarm      ONT Profile Cross Connect 0
  Profile dba:           OtherServices      ONT Profile DBA 4
  Custom cross connect:  disabled
Profile ports:        2RG-2OMCI          ONT Profile Ports 1
```

- **Step 12.** Apply changes by the **commit** command.

```
LTP-8X(config)(if-ont-0/0)# do commit
```

As a result, you will have the mixed configuration of the ONT. One of the services is managed completely by the OMCI domain (the bridged service), LAN2 and LAN3 ports on the ONT are connected as bridges. The second service is managed by both OMCI and RG (the routed service; the RG domain can be configured, for instance, through the WEB interface on the ONT). LAN0 and LAN1 ports are connected to RG ONT.

5.9 High Speed Internet configuration

Configuration of High Speed Internet (HSI) does not have any peculiarities and can be easily performed as described in [Service Models](#).

Correct operation of IPv6 requires to do the following:

- specify the multicast type when creating a cross-connect profile;
- enable multicast passing on the necessary port (0-4 and/or veip) in the ports profile.

Example of a routed configuration:

```
LTP-8X(config)# profile cross-connect ipv6
LTP-8X(config-cross-connect)("ipv6")# outer vid 300
LTP-8X(config-cross-connect)("ipv6")# user vid 300
LTP-8X(config-cross-connect)("ipv6")# type multicast
LTP-8X(config-cross-connect)("ipv6")# exit
LTP-8X(config)# profile ports ipv6
LTP-8X(config-ports)("ipv6")# veip multicast
LTP-8X(config-ports)("ipv6")# exit
LTP-8X(config)# exit
LTP-8X# commit
```

Example of a bridged configuration:

```
LTP-8X(config)# profile cross-connect ipv6_br
LTP-8X(config-cross-connect)("ipv6_br")# bridge
LTP-8X(config-cross-connect)("ipv6_br")# bridge group 10
LTP-8X(config-cross-connect)("ipv6_br")# outer vid 300
LTP-8X(config-cross-connect)("ipv6_br")# user vid 300
LTP-8X(config-cross-connect)("ipv6_br")# type multicast
LTP-8X(config-cross-connect)("ipv6_br")# exit
LTP-8X(config)# profile ports ipv6_br
LTP-8X(config-ports)("ipv6_br")# port 0 multicast
LTP-8X(config-ports)("ipv6_br")# port 0 bridge group 10
LTP-8X(config-ports)("ipv6_br")# exit
LTP-8X(config)# exit
LTP-8X# commit
```

5.10 Multicast configuration

The chapter describes peculiarities of IPTV service configuration.

Hosts and routers use the Internet Group Management Protocol (IGMP) to support multicasting. It provides all systems of a physical network with relevant information: which hosts are included in groups and which group corresponds to a host.

IGMP snooping is a technique that allows network devices of the channel level (switches) to snoop IGMP requests from hosts to a group router in order to decide whether group traffic transmission to the corresponding interfaces should be started or stopped. When a switch snoops a host's IGMP request for connection to a multicast group, it adds the port the host is connected to into the group (for group traffic retransmission). Having snooped a leave_group request, the switch removes the corresponding port from the group.

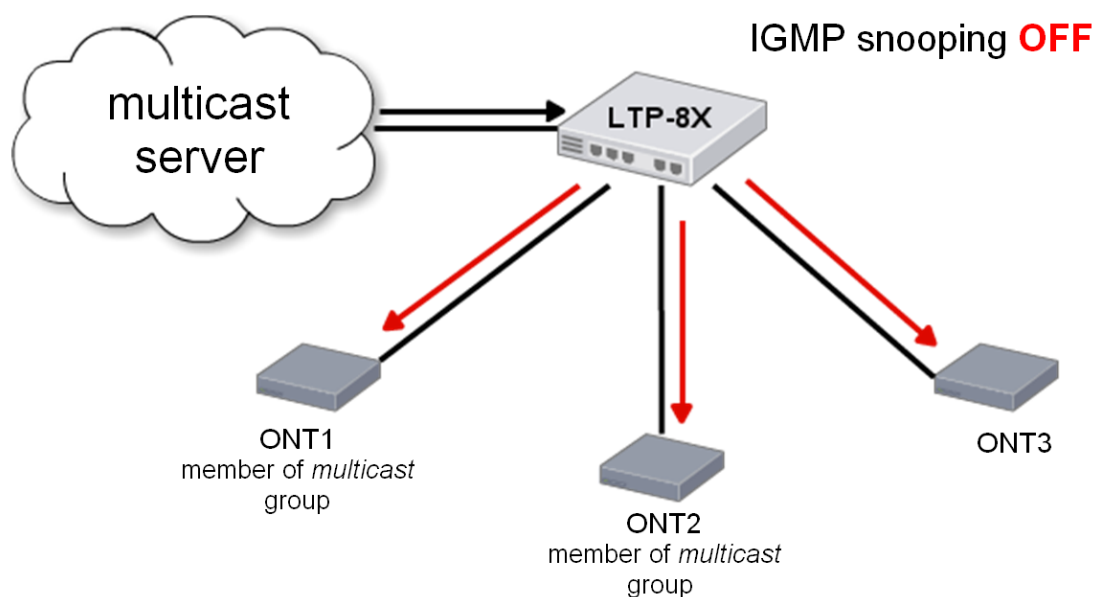


Figure 43 – IGMP snooping is disabled

Figure above shows traffic multicasting regardless of whether an end host needs the traffic or not. When IGMP snooping is enabled, the multicasting situation changes as follows: the switch will analyse all IGMP packets between connected devices and the routers the multicast traffic comes from. When the switch receives a consumer's IGMP request for connection to a multicast group, it adds the port the consumer is connected to into the group. And vice versa, having received a request for leaving a group, the switch removes the corresponding port from the group.

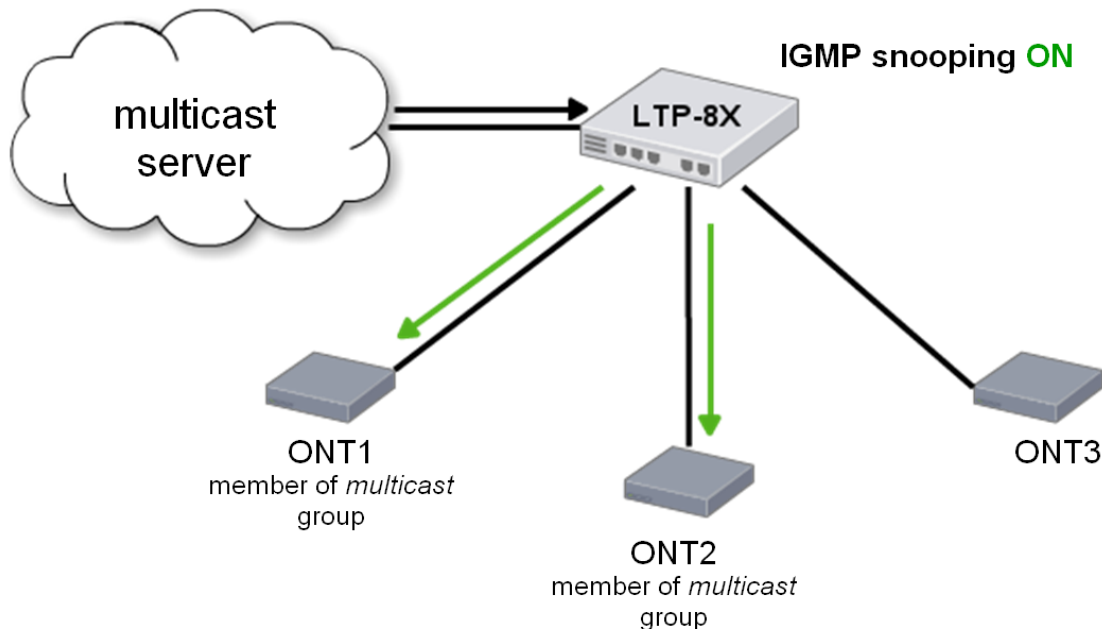


Figure 44 – IGMP snooping is enabled

As you can see from the Figure 44, LTP-8X with enabled IGMP snooping translates multicast traffic only to the hosts, which are members of the IGMP group.

IGMP proxy is an IGMP client and group router at the same time (IGMP router). On the one hand, proxy requests an upstream router for group channels; on the other hand, it receives join/leave requests from hosts and replicates upstream traffic to the corresponding interfaces.

5.10.1 Model 1 Multicast configuration

Consider configuration of a multicast service for Model 1.

An STB, which works in VLAN 14, is connected to an ONT port in this example. Upstream IGMP packets arrive to VLAN 14 through a GEM port and the OLT changes VLAN 14 to subscriber's VLAN 200.

As we have a multicast server in VLAN 98 in our example, we need to configure a proxy on the switch to translate IGMP packets from VLAN 200 to VLAN 98 (for more information, see [VLAN configuration](#)). The multicast service comes downstream to the ONT port in VLAN 98 and changes to VLAN 14.

For more information on general configuration principles of data communication channels, see [Service Models](#).

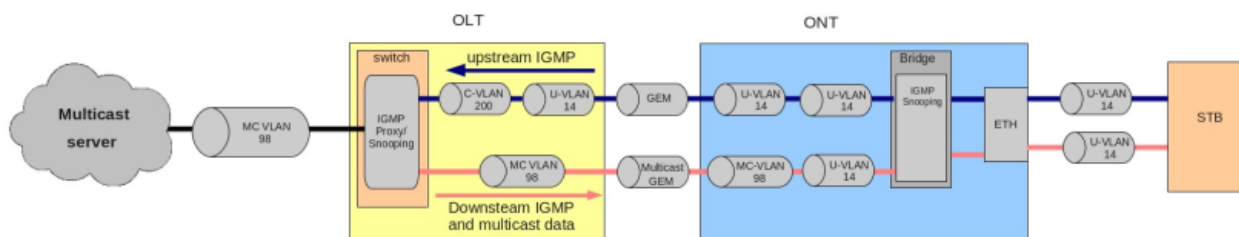


Figure 45 – Model 1 Multicast

- **Step 1.** Specify the ONT serial number in the configuration.

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config-if-ont-0/0)# serial ELTX01234567
LTP-8X(config-if-ont-0/0)# exit
```

- **Step 2.** Assign a service model.

```
LTP-8X(config)# gpon olt model 1
```

- **Step 3.** Create an UsIGMP cross-connect profile to configure the service, which will be used to send IGMP requests upstream. Configure a bridged service and specify the bridge group (it equals 1 in our example) the ONT port will be associated with; specify U-VLAN 14.

```
LTP-8X(config)# profile cross-connect UsIGMP
LTP-8X(config-cross-connect)("UsIGMP")# bridge
LTP-8X(config-cross-connect)("UsIGMP")# bridge group 1
LTP-8X(config-cross-connect)("UsIGMP")# user vid 14
LTP-8X(config-cross-connect)("UsIGMP")# do show profile cross-connect UsIGMP
  Name:                               'UsIGMP'
  Description:                         'ONT Profile Cross Connect 1'
  Model:                               ont
  Bridge group:                        1
  Tag mode:                            single-tagged
  Outer vid:                           1
  Outer cos:                           unused
  Inner vid:                           -
  U vid:                               14
  U cos:                               unused
  Mac table entry limit:               unlimited
  Type:                                general
  IP host index:                       0
  Priority queue:                       0
```

- **Step 4.** Associate the bridge group with an ONT port. To do this, create a **ports** profile and assign value 1 to the **bridge group** parameter for the LAN1 port.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# port 1 bridge group 1
```

- **Step 5.** Enable multicasting and configure VLAN replacement rules for the ONT port.

```
LTP-8X(config-ports)("Ports1")# port 1 multicast
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream vid 14
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream tag-control replace-vid
LTP-8X(config-ports)("Ports1")# port 1 igmp upstream vid 14
LTP-8X(config-ports)("Ports1")# port 1 igmp upstream tag-control replace-vid
```

- **Step 6.** You also need to configure VLAN 98 multicasting and specify the group range.

```

LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.0
239.255.255.255
LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
  Name:                               'Ports1'
  Description:                         'ONT Profile Ports 7'
  Multicast IP version:                IPv4
  Igmp settings:
    Version:                           IGMP v3
    Mode:                               snooping
    Immediate leave:                   false
    Robustness:                         2
    Querier ip:                         0.0.0.0
    Query interval:                     125
    Query response interval:            100
    Last member query interval:         10
  Mld settings:
    Version:                           MLD v2
    Mode:                               snooping
    Immediate leave:                   false
    Robustness:                         2
    Querier ipv6:                       ::
    Query interval:                     125
    Query response interval:            100
    Last member query interval:         10
  ...
  Port [1]:
    Speed:                              auto
    Duplex:                              auto
    Bridge group:                        1
    Spanning tree for bridge group:      false
    Multicast enable:                    true
    Multicast port settings:
      Upstream igmp vid:                 14
      Upstream igmp prio:                 0
      Upstream igmp tag control:          replace vid
      Downstream multicast vid:           14
      Downstream multicast prio:          0
      Downstream multicast tag control:    replace vid
      Max groups:                         0
      Max multicast bandwidth:            0
    Shaper downstream:
      Enable:                             false
      Committed rate:                     1000000
    Shaper upstream:
      Enable:                              false
      Committed rate:                     1000000
  ...

```


- **Step 7.** Assign the created profiles in the ONT. Configure a **custom cross-connect** profile, specify S-VLAN 200, and apply the configuration.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect UsIGMP
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# service 0 custom svid 200
LTP-8X(config)(if-ont-0/0)# do commit
```

- **Step 8.** Add VLAN 98 and VLAN 200 in the **switch view**. Enable IGMP snooping.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 200
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan)# ip igmp snooping enable
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# vlan 98
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan)# ip igmp snooping enable
LTP-8X(switch)(config-vlan)# exit
```

- **Step 9.** Configure IGMP proxy for IGMP packets transmission from VLAN 200 to VLAN 98. Apply the configuration.

```
LTP-8X(switch)(config)# ip igmp proxy report enable
LTP-8X(switch)(config)# ip igmp proxy report range 224.0.0.0 239.255.255.255 from 200
to 98
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# commit
```

5.10.2 Model 3 Multicast configuration

Consider configuration of a multicast service for Model 3.

The multicast service operates in VLAN 98 in the example below, an STB operating in VLAN 14 is connected to an ONT port. Upstream IGMP packets come to VLAN 14 in the ONT, where VLAN 14 is replaced with the service VLAN 98, and then the data is further transferred upstream through the GEM port. The multicast service comes downstream to the ONT port in VLAN 98 and changes to VLAN 14. For more information on general configuration principles of data communication channels, see [Service Models](#).

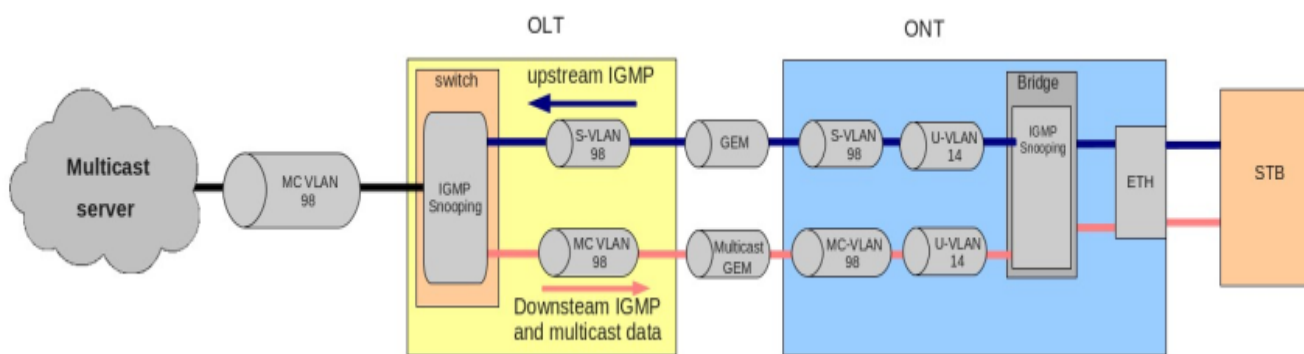


Figure 46 – Model 3 Multicast

- **Step 1.** Specify the ONT serial number in the configuration.

```
LTP-8X# configure terminal
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# serial ELTX01234567
LTP-8X(config)(if-ont-0/0)# exit
```

- **Step 2.** Assign a service model.

```
LTP-8X(config)# gpon olt model 3
```

- **Step 3.** Create an UsIGMP cross-connect profile to transfer IGMP requests upstream. Configure a bridged service and specify the bridged group (it equals 1 in the example below) the ONT port will be associated with. Specify U-VLAN 14 and S-VLAN 98.

```
LTP-8X(config)# profile cross-connect UsIGMP
LTP-8X(config-cross-connect)("UsIGMP")# bridge
LTP-8X(config-cross-connect)("UsIGMP")# bridge group 1
LTP-8X(config-cross-connect)("UsIGMP")# outer vid 98
LTP-8X(config-cross-connect)("UsIGMP")# user vid 14
LTP-8X(config-cross-connect)("UsIGMP")# do show profile cross-connect UsIGMP
Name:                               'UsIGMP'
Description:                         'ONT Profile Cross Connect 1'
Model:                               ont
Bridge group:                        1
Tag mode:                            single-tagged
Outer vid:                           98
Outer cos:                            unused
Inner vid:                           -
U vid:                                14
U cos:                                unused
Mac table entry limit:               unlimited
Type:                                general
IP host index:                       0
Priority queue:                       0
```

- **Step 4.** Associate the bridge group with an ONT port. To do this, create a **ports** profile and assign value 1 to the **bridge group** parameter for the LAN1 port.

```
LTP-8X(config)# profile ports Ports1
LTP-8X(config-ports)("Ports1")# port 1 bridge group 1
```

- **Step 5.** Enable multicasting and configure VLAN replacement rules for the ONT port.

```
LTP-8X(config-ports)("Ports1")# port 1 multicast
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream vid 14
LTP-8X(config-ports)("Ports1")# port 1 igmp downstream tag-control replace-vid
LTP-8X(config-ports)("Ports1")# port 1 igmp upstream vid 98
LTP-8X(config-ports)("Ports1")# port 1 igmp upstream tag-control replace-vid
```

- **Step 6.** You also need to configure VLAN 98 multicasting and specify the group range.

```
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# igmp multicast dynamic-entry 0 group 224.0.0.0
239.255.255.255
LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
...
  Igmp settings:
...
  Multicast dynamic entry [0]:
    Vlan id:                98
    First group ip:         224.0.0.1
    Last group ip:          239.255.255.255
...
  Port [1]:
    Speed:                  auto
    Duplex:                  auto
    Bridge group:           0
    Spanning tree for bridge group: false
    Multicast enable:       false
    Multicast port settings:
      Upstream igmp vid:    98
      Upstream igmp prio:  0
      Upstream igmp tag control: replace-vid
      Downstream multicast vid: 14
      Downstream multicast prio: 0
      Downstream multicast tag control: replace-vid
      Max groups:           0
      Max multicast bandwidth: 0
    Shaper downstream:
      Enable:                false
      Committed rate:        1000000
    Shaper upstream:
      Enable:                false
      Committed rate:        1000000
...

```

- **Step 7.** Assign the created profiles in the ONT and apply the configuration.

```
LTP-8X(config)# interface ont 0/0
LTP-8X(config)(if-ont-0/0)# service 0 profile cross-connect UsIGMP
LTP-8X(config)(if-ont-0/0)# profile ports Ports1
LTP-8X(config)(if-ont-0/0)# do commit
```

- **Step 8.** Add VLAN 98 in the **switch view** and enable IGMP snooping.

```
LTP-8X# switch
LTP-8X(switch)# configure terminal
LTP-8X(switch)(config)# vlan 98
LTP-8X(switch)(config-vlan)# tagged front-port 0
LTP-8X(switch)(config-vlan)# tagged pon-port 0 - 7
LTP-8X(switch)(config-vlan)# ip igmp snooping enable
LTP-8X(switch)(config-vlan)# exit
LTP-8X(switch)(config)# ip igmp snooping
LTP-8X(switch)(config)# commit
```

5.10.3 IPv6 Multicast configuration

IPv6 multicast is configured the same way as shown above. However, there are some differences in configuration.

- **Step 1.** Change the IP protocol to IPv6, Configure VLAN 98 multicast, and specify the group range.


```
LTP-8X(config-ports)("Ports1")# multicast ip version ipv6
LTP-8X(config-ports)("Ports1")# mld multicast dynamic-entry 0 vid 98
LTP-8X(config-ports)("Ports1")# mld multicast dynamic-entry 0 group ff15:0::1
ff15:0::ffff
LTP-8X(config-ports)("Ports1")# do show profile ports Ports1
  Name:                               'Ports1'
  Description:                         'ONT Profile Ports 7'
  Multicast IP version:                IPv6
  Igmp settings:
    Version:                           IGMP v3
    Mode:                               snooping
    Immediate leave:                   false
    Robustness:                         2
    Querier ip:                        0.0.0.0
    Query interval:                    125
    Query response interval:           100
    Last member query interval:        10
  Mld settings:
    Version:                           MLD v2
    Mode:                               snooping
    Immediate leave:                   false
    Robustness:                         2
    Querier ipv6:                      ::
    Query interval:                    30
    Query response interval:           100
    Last member query interval:        10
  Multicast dynamic entry v6 [0]:
```

```

Vlan id: 98
First group ip: ff15:0::1
Last group ip: ff15:0::ffff
Preview length: 55
Preview repeat time: 60
Preview repeat count: 0
Preview reset time: 3
...
Port [1]:
Speed: auto
Duplex: auto
Bridge group: 1
Spanning tree for bridge group: false
Multicast enable: true
Multicast port settings:
Upstream igmp vid: 14
Upstream igmp prio: 0
Upstream igmp tag control: replace vid
Downstream multicast vid: 14
Downstream multicast prio: 0
Downstream multicast tag control: replace vid
Max groups: 0
Max multicast bandwidth: 0
Shaper downstream:
Enable: false
Committed rate: 1000000
Shaper upstream:
Enable: false
Committed rate: 1000000

```

- **Step 2.** Add VLAN 98 in the **switch view** and enable MLD snooping.

 MLD snooping is not supported for Model 1.

5.11 VoIP configuration

The chapter describes peculiarities of VoIP service configuration. The terminal supports several methods of VoIP configuration:

- VoIP Configuration in OMCI management domain;
- VoIP configuration in the RG management domain.

A method is chosen based on service model and ONT functionality.

5.11.1 VoIP Configuration in OMCI management domain

VoIP is a special bridged service. It has all general properties of a bridged service. Operator's actions required for services configuration are described in detail in [ONT configuration](#).

As opposed to other bridge services, VoIP requires the iphost type in the cross-connect profile to terminate traffic in internal virtual IP interface. That also requires the lphost eid parameter to be specified. As a rule, it should equal 1. Contact your ONT vendor for information about the lphost eid value for the VoIP.

- **Step 1.** Configure a cross-connect profile to be used as VoIP.

```
LTP-8X(config)# profile cross-connect VoIP
LTP-8X(config-cross-connect)("VoIP")# bridge
LTP-8X(config-cross-connect)("VoIP")# type iphost
LTP-8X(config-cross-connect)("VoIP")# bridge group 2
LTP-8X(config-cross-connect)("VoIP")# iphost eid 1
```

- **Step 2.** Check the changes made.

```
LTP-8X(config-cross-connect)("VoIP")# do show profile cross-connect VoIP
...
  Type:                iphost
  IP host index:       1
  Priority queue:      0
```

- **Step 3.** Apply the changes by using the **commit** command.

```
LTP-8X(config-cross-connect)("VoIP")# do commit
```

5.11.2 VoIP configuration in RG management domain

In case the VoIP client is located after the U point (i. e. in the RG management domain), the VoIP service has the same configuration procedure as all other routed services. The procedure is described in detail in [ONT configuration](#). All the general steps of service configuration are applied to VoIP as well.

5.12 Configuration of management via TR-069

This chapter describes configuration of a data communication channel for the CPE management service via the TR-069 protocol.

An ONT management channel can be established in one of the two modes: Inband and OutOfBand. Inband is the preferred mode as it is simpler. Contact your ONT vendor for information about operation capabilities of both modes.

ONT management via TR-069 is a special service. All general steps of service configuration apply to TR-069 management. Operator's actions required for services configuration are described in detail in [ONT configuration](#).

As opposed to other services, the management service requires the management type in the cross-connect profile. You also need to specify the lphost eid parameter. As a rule, it should equal 0.

5.12.1 Configuration of a TR-069 Inband management

This mode is characterised by its simple implementation. Management traffic goes through the same bridge as user traffic. Figure below shows a part of the OMCI layout. Arrows show the traffic flow.

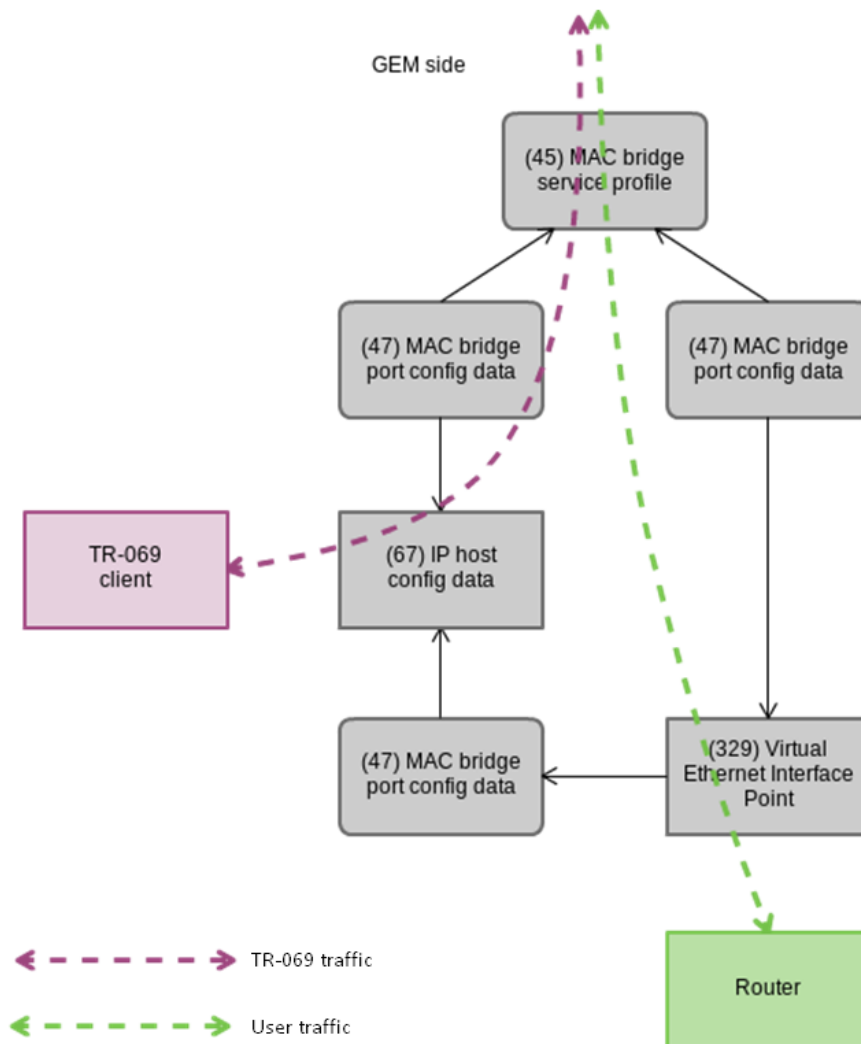


Figure 47 – TR-069 Inband management channel

- **Step 1.** Set the **management** type in the cross-connect profile.

```
LTP-8X(config)# profile cross-connect TR069
LTP-8X(config-cross-connect)("TR069")# type management
```

- **Step 2.** Set the **ont-rg** model in the cross-connect profile.

```
LTP-8X(config-cross-connect)("TR069")# no bridge
```

- **Step 3.** Set the **IP Host** identifier to 0.

```
LTP-8X(config-cross-connect)("TR069")# iphost eid 0
```

- **Step 4.** Check the changes made with the **show profile cross-connect** command.

```
LTP-8X(config-cross-connect)("TR069")# do show profile cross-connect TR069
  Name:                               'TR069'
  Description:                         'ONT Profile Cross Connect 1'
  Model:                               ont-rg
  Bridge group:                       -
  Tag mode:                            single-tagged
  Outer vid:                           1
  Outer cos:                           unused
  Inner vid:                           -
  U vid:                               untagged
  U cos:                               unused
  Mac table entry limit:               unlimited
  Type:                                management
  IP host index:                      0
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-cross-connect)("TR069")# do commit
```


5.12.2 Configuration of a TR-069 OOB management channel

Not all ONT vendors support creation of Inband management channels via TR-069. To solve this, a capability to create an OutOfBand management channel was developed as an alternative. The main peculiarity of the mode is the use of a separate bridge for management. See a part of the OMCI layout below. Arrows show the traffic flow.

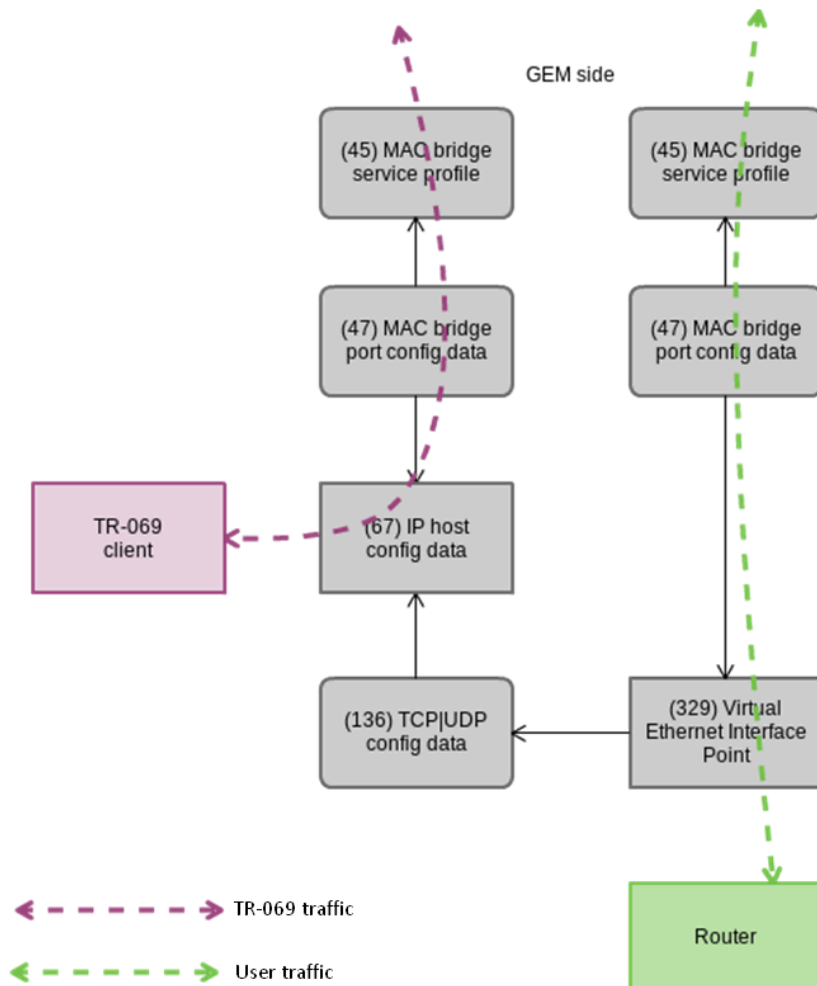


Figure 48 – TR-069 OutOfband management channel

- **Step 1.** Set the **management** type in the cross-connect profile.

```
LTP-8X(config)# profile cross-connect TR069
LTP-8X(config-cross-connect)("TR069")# type management
```

- **Step 2.** Set the **ont** model in the cross-connect profile. Specify a separate **bridge-group**.

```
LTP-8X(config-cross-connect)("TR069")# bridge
LTP-8X(config-cross-connect)("TR069")# bridge group 20
```

- **Step 3.** Set the **IP Host** identifier to 0.

```
LTP-8X(config-cross-connect)("TR069")# iphost eid 0
```

- **Step 4.** Check the changes by using the **show profile cross-connect** command.

```
LTP-8X(config-cross-connect)("TR069")# do show profile cross-connect TR069
Name: 'TR069'
Description: 'ONT Profile Cross Connect 1'
Model: ont
Bridge group: 20
Tag mode: single-tagged
Outer vid: 1
Outer cos: unused
Inner vid: -
U vid: untagged
U cos: unused
Mac table entry limit: unlimited
Type: management
Iphost eid: 0
Priority queue: 0
LTP-8X(pon/profiles-ont/cross-connect-6)
```

- **Step 5.** Apply the changes by using the **commit** command.

```
LTP-8X(config-cross-connect)("TR069")# do commit
```

5.12.3 TR-069 client parameters configuration

To configure TR-069 client parameters, use the **management** profile.

```
LTP-8X# show profile management management-00
Name: 'management-00'
Description: 'ONT Profile Management 0'
Enable omci configuration: true
Url: ''
Username: ''
Password: ''
```

In case when the DHCP server transmits the TR-069 parameters via option 43, there is no need to transfer them via OMCI. Disable this phase with the **no omci-configuration** command.

Otherwise, specify TR-069 client parameters explicitly.

- **Step 1.** Enable TR-069 configuration.

```
LTP-8X(config)# profile management management-00
LTP-8X(config-management)("management-00")# omci-configuration
```

- **Step 2.** Specify the connection parameters.

```
LTP-8X(config-management)("management-00")# url http://acs.tele.com:9595/acs
LTP-8X(config-management)("management-00")# username acs
LTP-8X(config-management)("management-00")# password acsacs
```

- **Step 3.** Check the changes made.

```
LTP-8X(config-management)("management-00")# do show profile management management-00
Name:                                     'management-00'
Description:                             'ONT Profile Management 0'
Enable omci configuration:               true
Url:                                     'http://acs.tele.com:9595/acs'
Username:                                'acs'
Password:                                'acsacs'
```

- **Step 4.** Apply the changes by using the **commit** command.

```
LTP-8X(config-management)("management-00")# do commit
```

5.13 ONT configuration templates

It is not always convenient, especially for large-scale operators, to build ONT configuration from separate profiles for each subscriber. This process is painstaking and risky in a certain sense, as it is highly prone to operator error.

As a rule, such companies employ at least one service plan with pre-defined ONT profiles. This section describes ONT templates, an effective solution to simplify the work of subscriber service specialists.

The essence of configuration templates is simple. Network administrator prepares required quantity of templates for the quantity of service plans. Configuration template contains detailed profile list and a set of ONT parameters. Subscriber service specialist or OSS/BSS system assigns the template to an ONT and identifies additional configuration parameters if necessary. As a rule, configuration assignment is performed in "one click" or by using one command.

5.13.1 Preparing ONT configuration template

- **Step 1.** Define an ONT configuration template.

```
LTP-8X(config)# template HSI-100-CaTV
LTP-8X(ont-template)("HSI-100-CaTV")#
```

- **Step 2.** Set the ONT configuration. Template configuration does not have any peculiarities and exactly follows the ONT configuration process described in [ONT configuration](#).

```
LTP-8X(ont-template)("HSI-100-CaTV")# service 0 profile dba AllServices
LTP-8X(ont-template)("HSI-100-CaTV")# service 0 profile cross-connect Service1
LTP-8X(ont-template)("HSI-100-CaTV")# service 1 profile dba AllServices
LTP-8X(ont-template)("HSI-100-CaTV")# service 1 profile cross-connect Service2
LTP-8X(ont-template)("HSI-100-CaTV")# profile ports Ports1
```

- **Step 3.** Disable all configuration parameters that should be specified explicitly for the ONT with the **undefine** command, if necessary.

```
LTP-8X(ont-template)("HSI-100-CaTV"># undefine rf-port-state
```

- **Step 4.** Apply the changes.

```
LTP-8X(ont-template)("HSI-100-CaTV"># do commit
```

5.13.2 ONT configuration template assignment

- **Step 1.** Switch to the **ONT view**. You can use a range of ONT IDs for group operations if necessary.

```
LTP-8X(config)# interface ont 0/0-10  
LTP-8X(config)(if-ont-0/0-10)#
```

- **Step 2.** Assign an ONT configuration template by using the **template** command.

```
LTP-8X(config)(if-ont-0/0-10)# template HSI-100-CaTV
```

- **Step 3.** Define individual ONT parameters not specified in the template if necessary.

```
LTP-8X(config)(if-ont-0/0-10)# rf-port-state enabled
```

- **Step 4.** Apply the changes.

```
LTP-8X(config)(if-ont-0/0-10)# do commit
```

5.13.3 ONT configuration preview with templates

You can view the ONT configuration using the same command: **show interface ont <id> configuration**. You can distinguish the template parameters from the general ones by **[T]**(Template) markers. In this example, **Rf port state** is the only general parameter.

```
LTP-8X(config)(if-ont-0/0-10)# do show interface ont 0/0 configuration
```

```
-----  
[ONT0/0] configuration  
-----
```

```

Description:          ''
Enabled:              true
Serial:               ELTX5C00008C
Password:             '0000000000'
[T] Fec up:           false
[T] Easy mode:        false
[T] Downstream broadcast: true
[T] Downstream broadcast filter: true
[T] Ber interval:     none
[T] Ber update period: 60
Rf port state:        disabled

```

```

[T] Omci error tolerant:      false
  Service [0]:
[T]   Profile cross connect:  Service1      NT Profile Cross Connect 1
[T]   Profile dba:            dba-00      ONT Profile DBA 0
   Custom cross connect:     disabled
  Service [1]:
[T]   Profile cross connect:  Service2      NT Profile Cross Connect 2
[T]   Profile dba:            dba-00      ONT Profile DBA 0
   Custom cross connect:     disabled
[T] Profile shaping:         shaping-00   ONT Profile Shaping 0
[T] Profile ports:           ports-00    ONT Profile Ports 0
[T] Profile management:      unassigned
  Template:                  test          ONT Template 1

```

5.14 ONT ports management

This chapter describes Ethernet ports management via OMCI.

The ability to enable/disable Ethernet ports on connected ONT was implemented, as well as ability to manage and control Poe on ONT as power supply.

In case of PoE support from ONT side, it is possible to control ports:

- enabling/disabling PoE on ports;
- power classes control;
- priority configuration.

All these attributes are transmitted via OMCI (ITU-T G.988 ME 11 "PPTP Ethernet UNI").

5.14.1 Ethernet ports management on ONT

Ethernet ports management on ONT means enabling/disabling the port and performed by **[no] port <port number> shutdown** command, where **<port number>** is the number of "0-3" port.

Step 1. To disable Ethernet port, do the following commands.

```
LTP-8X(config)(if-ont-0/0)# port 0 shutdown
LTP-8X(config)(if-ont-0/0)# do commit
```

Step 2. Make sure that changes has been applied, to do that, run the command.

```
LTP-8X(config)(if-ont-0/0)# do show interface ont 0/0 configuration
...
  Ports:
    Port [0]:
      shutdown: true
      PoE:
        Enable: false
        Pse class control: 0
        Power priority: high
    Port [1]:
      shutdown: false
      PoE:
        Enable: true
        Pse class control: 0
        Power priority: high
...
```

Step 3. To enable Ethernet port, do the following commands.

```
LTP-8X(config)(if-ont-0/0)# no port 0 shutdown
LTP-8X(config)(if-ont-0/0)# do commit
```

5.14.2 PoE management on ONT ports

PoE management on ONT ports is performed using **port <port number> poe enable pseclass-control <class> power-priority <level>** command, where

- **<port number>** – "0–3" port number,
- **<class>** – "0–5" power class,
- **<level>** – "critical/high/low" priority level.

5.14.2.1 Enabling PoE on ONT ports

To enable PoE on ONT ports, do the following:

```
LTP-8X(config)(if-ont-0/0)# port 0 poe enable
LTP-8X(config)(if-ont-0/0)# do commit
```

5.14.2.2 Power class control

This attribute can be used to set specific limits on the power class.

Valid values for this attribute:

- 0 – power is on at the default level for this port;
- 1 – power supply is permitted at power class level 0;
- 2 – power supply is permitted at power class level 1;
- 3 – power supply is permitted at power class level 2;
- 4 – power supply is permitted at power class level 3;
- 5 – power supply is permitted at power class level 4;

To change PoE on ONT ports, do the following:

```
LTP-8X(config)(if-ont-0/0)# port 0 poe pse-class-control 0
LTP-8X(config)(if-ont-0/0)# do commit
```

5.14.2.3 PoE priority settings

This attribute controls port priority in terms of the power management algorithm. Priority set by this attribute can be used by control mechanism which prevents overcurrent situations by disabling ports with lower power priority.

Valid values for this attribute:

- **critical;**
- **high;**
- **low.**

To change PoE priority on ONT ports, do the following:

```
LTP-8X(config)(if-ont-0/0)# port 0 poe power-priority low
LTP-8X(config)(if-ont-0/0)# do commit
```

6 Terminal monitoring

6.1 General information

6.1.1 Information on current terminal firmware version

To view information on the current version of terminal firmware, use the **show version** command.

```
LTP-8X# show version
Eltex LTP-8X:rev.C software version 3.40.0 build XXXX on XX.XX.2020 XX:XX
```

6.1.2 Terminal information preview

To view information about the terminal, use the **show system environment** command.

```
LTP-8X# show system environment
System information:
  CPU load average (1m, 5m, 15m):  4.23  2.89  2.53
  Free RAM/Total RAM (Mbytes):      260/495
  Temperature (sensor1/sensor2):    35C/50C
  Reset button:                      disabled

  Fan configured speed, %:           15
  Fan minimum speed, %:              15
  Fan speed levels, %:               16 27 39 51 64 76 88 100

  Fan state (fan0/fan1):             4620rpm 4620rpm

  PLD FW version:                    14

  TYPE:                              LTP-8X:rev.C
  HW_revision:                       1v4
  SN:                                 GP2B000304
  MAC:                                A8:F9:4B:8B:79:D0

Power supply information:
  Module 1: PM160 220/12 1vX
    Type: Alternate current(AC)
    Intact: 1
  Module 2: PM160 220/12 1vX
    Type: Alternate current(AC)
    Intact: 1
```


Table 30 – Terminal parameters

Parameter	Description
CPU load average	Average processor load
Free RAM/Total RAM	Free/total RAM
Temperature	Temperature from sensors 1 and 2
Reset button	The action depends on the reset button configuration
Fan configured speed	Set fan rotation speed
Fan minimum speed	Minimum fan rotation speed
Fan speed levels	Set fan rotation speed for each level
Fan state	Fans state and rpm value
PLD FW Version	PLD firmware version
Power supply information	Information about installed power modules

6.1.3 Information on terminal operation time

To view terminal operating time, use the **show uptime** command.

```
LTP-8X# show uptime
up 7 days, 20:11
```

6.1.4 Network connection check

To check network connection, use the **ping** command. As a parameter, pass the IP address of the node to be checked.

```
LTP-8X# ping 192.168.1.254
PING 192.168.1.254 (192.168.1.254): 56 data bytes

64 bytes from 192.168.1.254: seq=0 ttl=64 time=0.422 ms
64 bytes from 192.168.1.254: seq=1 ttl=64 time=0.426 ms
64 bytes from 192.168.1.254: seq=2 ttl=64 time=0.360 ms
64 bytes from 192.168.1.254: seq=3 ttl=64 time=0.397 ms
64 bytes from 192.168.1.254: seq=4 ttl=64 time=0.404 ms

--- 192.168.1.254 ping statistics ---
5 packets transmitted, 5 packets received, 0% packet loss round-trip min/avg/max =
0.360/0.401/0.426 ms
```

6.2 Terminal operation log

Use **show log** command to view log files.

```
LTP-8X# show log
  ##      Name      Size in bytes      Date of last modification
  1       ltp        994625             Thu Aug 31 13:51:20 2017
  2       ltp.1.gz     41784              Thu Aug 29 12:42:25 2017
  3       ltp.2.gz     59829              Thu Aug 29 00:13:10 2017
Total files: 3
AntonLTP-8X#
```

Use the **show log buffer** command to view a local terminal operation log buffer.

```
LTP-8X# show log buffer
...
Jan 1 00:00:49 LTP-8X pmchal: notice: [OLT] OLT reset successfully
Jan 1 00:01:05 LTP-8X pmchal: notice: [PPPOEIA] PPPoE IA initialized successfully
Jan 1 00:01:05 LTP-8X pmchal: notice: [DHCPRA] DHCP RA initialized successfully
Jan 1 00:01:11 LTP-8X pmchal: notice: [OLT] OLT initialized successfully
Jan 1 00:01:11 LTP-8X pmchal: notice: [OLT] OLT0 FW version 2.3.37.1008
Jan 1 00:01:11 LTP-8X pmchal: notice: [OLT] OLT0 FW is up to date
Jan 1 00:01:11 LTP-8X pmchal: notice: [OLT] OLT1 FW version 2.3.37.1008
Jan 1 00:01:11 LTP-8X pmchal: notice: [OLT] OLT1 FW is up to date
...
```

The log messages can be filtered. To do this, use the **show log buffer grep** command. The command takes a string as a parameter that is used for search in the log. Only the messages containing the string will be displayed on the screen.

```
LTP-8X# show log buffer grep pmchal
```

If console output or output to CLI sessions is configured for log messages, the messages will be output to these devices automatically as soon as they are generated. User does not need to perform any additional operations.

When a remote syslog server is used, use the log display tools provided by the SYSLOG server. Enter **show log <filename>** command to view the files.

```
LTP-8X# show log ltp.1.gz
```

6.3 Active alarms log

To view the active alarms log, use the **show alarms** command. Pass an event type as a parameter (see [Table 14](#)) and/or their severity (see [Table 15](#)). You can view all active alarms by using the **show alarm active all** command.

```
LTP-8X# show alarm active all
Active alarms (1):
  ##      Type          Severity      Description
  0       Fan             Critical      FAN1 0 rpm
LTP-8X#
```

6.4 GPON monitoring

6.4.1 GPON OLT state

- **Step 1.** To view the state of GPON OLT, use the **show gpon olt state** command.

```
LTP-8X# show gpon olt state
Device count:          2
Gpon-ports per device: 4
Driver version:       1.2.119
Device 0:
  Firmware version:   2.3.37.1036
  Hardware version:   5211.2
Device 1:
  Firmware version:   2.3.37.1036
  Hardware version:   5211.2
LTP-8X#
```

GPON OLT parameters are listed and described in table below.

Table 31 – GPON OLT parameters

Parameter	Description
Device count	The number of OLT chips
Gpon-ports per device	The number of channels in one OLT chip
Firmware version	OLT chip firmware version
Hardware version	OLT chip hardware version

6.4.2 GPON interface state

- **Step 1.** To view the state of GPON interfaces, use the **show interface gpon-port <ID> state** command.

```
LTP-8X# show interface gpon-port 0-3 state
Reading: ....
Gpon-ports status information:
Gpon-port:                0            1            2            3
State:                    OK            OK            OK            OK
ONT count:                1            0            29           0
Force-mode:               enabled    disabled    disabled    disabled
ONT autofind:             enabled    enabled     enabled     enabled
SFP vendor:               Ligent     n/a         Ligent     n/a
SFP product number:      LTE3680M-BC n/a         LTE3680M-BC n/a
SFP vendor revision:     1.0       n/a         1.0       n/a
SFP temperature [C]:     71        n/a         74        n/a
SFP voltage [V]:         3.19     n/a         3.23     n/a
SFP tx bias current [mA]: 17.61    n/a         21.16    n/a
SFP tx power [dBm]:     3.54     n/a         3.75     n/a
```

Table 32 – GPON interface parameters

Parameter	Description
Gpon-port	Channel number
State	Channel state
ONT count	The number of ONTs in the channel
SFP vendor	SFP vendor
SFP product number	SFP model
SFP vendor revision	SFP revision
SFP temperature	SFP temperature in Celsius degrees
SFP voltage	SFP voltage in Volts
SFP tx bias current	Bias current in mA
SFP tx power	Transmission power in dBm

Table 33 – GPON interface states

Value	Description
INITED	The channel is initialised
CFGINPROGRESS	The channel configuration is in progress
CFGFAILED	The channel configuration completed with error
OK	The channel is in operation
FAILED	The channel is out of operation
DISABLED	The channel is disabled

- **Step 2.** To view the state of only one GPON interface, use the **show interface gpon-port <ID> state** command. That means you need to specify the interface number.

```
LTP-8X# show interface gpon-port 0 state
Reading: .
Gpon-port status information:
  Gpon-port:                0
  State:                    OK
  ONT count:                1
  Force-mode:               enabled
  ONT autofind:             enabled
  SFP vendor:               Ligent
  SFP product number:       LTE3680M-BC
  SFP vendor revision:      1.0
  SFP temperature [C]:      71
  SFP voltage [V]:          3.19
  SFP tx bias current [mA]: 17.61
  SFP tx power [dBm]:       3.54
```

6.4.3 MAC table preview

- **Step 1.** To view the table of MAC addresses on the fourth port of the GPON interface, use the **show mac interface gpon-port 4** command.

```
LTP-8X# show mac interface gpon-port 4
##      ONT Serial  ONT ID  GPON-port  GEM UVID  CVID  SVID          MAC
  1  ELTX06000022   74      4          912      1214  A8:F9:4B:40:05:1B
  2  ELTX06000060   86      4         1008      1214  A8:F9:4B:40:07:0B
  3  ELTX06001B70   88      4         1024      1214  A8:F9:4B:41:1F:9B
Total records: 3 of 3
```

6.4.4 Statistics for GPON interfaces

- **Step 1.** To view statistics on GPON interfaces, use the **show interface gpon-port <ID> counters** command. ID means the GPON interface number. You can specify several interfaces at once.

```
LTP-8X# show interface gpon-port 0-3 counters
```

##	Downstream counters for channels:	0	1	2	3
2	RX DS octets	128548	128548	128548	128548
3	RX DS packets	1867	1867	1867	1867
5	RX DS octets for channel	128548	18556	18556	18556
6	RX DS packets for channel	1867	202	202	202
8	TX DS octets	128548	18556	18556	18556
9	TX DS packets	1867	202	202	202
11	DS octets	28870	17596	17596	17596
12	DS packets	334	187	187	187
13	DS unicast packets	0	0	0	0
14	DS multicast packets	334	187	187	187
15	DS broadcast packets	0	0	0	0
16	DS packet dropped	1533	15	15	15
##	Upstream counters for channels:	0	1	2	3
2	TX US octets	0	0	0	0
3	TX US packets	0	0	0	0
5	US octets	0	0	0	0
6	US packets	0	0	0	0
7	US unicast packets	0	0	0	0
8	US multicast packets	0	0	0	0
9	US broadcast packets	0	0	0	0
10	US packed dropped	0	0	0	0
11	Packet dropped (CRC)	0	0	0	0
13	TX US octets reassembly	0	0	0	0
14	TX US packets reassembly	0	0	0	0

6.4.5 Statistics for OLT Ethernet interfaces

- **Step 1.** To view statistics on Ethernet interfaces of the OLT (connected to the terminal switch), use the **show interface gpon-port <ID> counters v-interface** command.

```
LTP-8X# show interface gpon-port 0 counters v-interface

##      Downstream counters for channels:          0

 1      RX Alignment errors                        0
 2      RX Pause frames                          0
 3      RX CRC-32 errors                         0
 4      RX Oversize errors                       0
 5      RX Bad FCS                              0
 6      RX Too long frames                      0
 7      RX Undersize errors                     0
 8      RX Range errors                         0
 9      RX Ok frames                            3965150
10      RX total frames                        3965150
11      RX 64 octets frames                    314
12      RX 65-127 octets frames                3964297
13      RX 128-255 octets frames              59
14      RX 256-511 octets frames              480
15      RX 512-1023 octets frames             0
16      RX 1024-1518 octets frames            0
17      RX 1519-MAX octets frames             0
18      RX Total unicast packets                83
19      RX Total multicast packets            3679683
20      RX Total broadcast packets            285384
22      RX Total octets                       269746879
24      RX Ok octets                          269746879
25      RX FIFO overflow errors                0
26      RX Bad FCS and <64 octets              0
27      RX Frame errors                       0

##      Upstream counters for channels:          0

 1      TX frames without errors                0
 2      TX valid pause frames                  0
 3      TX frames with errors                  0
 4      TX good unicast packets                0
 5      TX good multicast packets              0
 6      TX good broadcast packets              0
 8      TX octets                              0
```


6.4.6 Multicast statistics

- **Step 1.** To view statistics on MC streams, use the **show interface gpon-port <ID> igmp groups** command. As a parameter, pass the channel number or a range of channels.

```
LTP-8X# show interface gpon-port 0-7 igmp groups
All IGMP groups (104):
  ##  GPON-port      Serial  Multicast address          Start
Stop
  1      4  ELTX66000074      239.1.128.43  2017.11.21 09:58:02  2017.11.21
11:25:21
  2      4  ELTX67000050      239.1.128.43  2017.11.21 09:58:02  2017.11.21
11:25:21
  3      4  ELTX6700007C      239.1.128.43  2017.11.21 09:58:02
---
```

6.5 ONT monitoring

6.5.1 ONT configurations list

- **Step 1.** To view active ONT configurations, use the **show interface ont <ID> configured** command. As an ID, pass the GPON port number or a range of numbers.

```
LTP-8X# show interface gpon-port ont 2 configured
-----
GPON-port 0 ONT configured list
-----
  ##          Serial ONT ID GPON-PORT  Status  RSSI[dBm]  Version  EquipmentID
Description
  1  454C54581A000021      0        2  OFFLINE      n/a      n/a      n/a
  2  444C4E4B8713F000      1        2  OFFLINE      n/a      n/a      n/a
  3  48575443904D6425      2        2  OFFLINE      n/a      n/a      n/a
  4  454C545806000024      3        2  OFFLINE      n/a      n/a      n/a
  5  454C54585D000048      4        2  OFFLINE      n/a      n/a      n/a
  6  454C54585F00009E8     10        2    OK        -8.16    3.22.0.1669  NTU-2V
Total ONT count: 6
```

6.5.2 List of empty ONT configurations

- **Step 1.** To view empty ONT configurations (vacant ONT IDs), use the **show interface ont <ID> unconfigured** command.

```
LTP-8X# show interface ont 0-7 unconfigured
GPON-port 0 ONT unconfigured list: 3,5-49,51-127
GPON-port 1 ONT unconfigured list: 0-127
GPON-port 2 ONT unconfigured list: 5-9, 11-127
GPON-port 3 ONT unconfigured list: 0-127
GPON-port 4 ONT unconfigured list: 32-127
GPON-port 5 ONT unconfigured list: 0-127
GPON-port 6 ONT unconfigured list: 0,2-127
GPON-port 7 ONT unconfigured list: 3,22,35127
Total ONT count: 947
```

6.5.3 List of connected ONTs

- **Step 1.** To view the list of online ONTs, use the following command: **show interface ont <ID> online**. As an argument, specify the GPON interface number or a range of numbers.

```
LTP-8X# show interface ont 0 online
-----
GPON-port 0 ONT online list
-----
## Serial   ONT ID GPON-PORT Status RSSI[dBm] Version   EquipmentID
1 ELTX5C00008C 3  0      OK      -23.19   3.50.2.1157 NTU-RG-1402G-W
2 ELTX1A00001A 2  0      OK      -24.44   3.21.1.1928 NTP-RG-1402G-W:rev.C
GPON-port 1 has no online ONTs
GPON-port 2 has no online ONTs
GPON-port 3 has no online ONTs
```

```
GPON-port 4 has no online ONTs
GPON-port 5 has no online ONTs
GPON-port 6 has no online ONTs
GPON-port 7 has no online ONTs
Total ONT count: 2
```

Table 34 – ONT status description

ONT status	Description
UNACTIVATED	ONT has no configurations
ALLOCATED	ONT detected
AUTHINPROGRESS	ONT authentication is in progress

ONT status	Description
AUTHFAILED	Authentication failed
AUTHOK	Authentication successfully completed
PRECONFIG	Preparing ONT for configuration
CFGINPROGRESS	ONT configuration is in progress
CFGFAILED	Configuration failed
OK	ONT is in operation
BLOCKED	ONT is blocked
MIBRESET	ONT MIB reset
FAILED	ONT has a critical failure
FWUPDATING	ONT firmware update is in progress
DISABLED	ONT is disabled (technically blocked)

```
## Serial   ONT ID GPON-PORT Status RSSI[dBm] Version      EquipmentID
1 ELTX5C00008C 3   0         OK      -23.19  3.50.2.1157 NTU-RG-1402G-W
2 ELTX1A00001A 2   0         OK      -24.44  3.21.1.1928 NTP-RG-1402G-W:rev.C
GPON-port 1 has no online ONTs
GPON-port 2 has no online ONTs
GPON-port 3 has no online ONTs
```

6.5.4 List of disconnected ONTs

- **Step 1.** To view the list of offline ONTs, use the **show interface ont <ID> offline** command. As an argument, specify the GPON interface number or a range of numbers.

```
LTP-8X# show interface ont 0-7 offline

-----
GPON-port 0 ONT offline list
-----
##          Serial          ONT ID      GPON-port   Description
1          454C54585C0908B4    0           0
GPON-port 1 has no offline ONTs
GPON-port 2 has no offline ONTs
```

```

GPON-port 3 has no offline ONTs
GPON-port 4 has no offline ONTs
GPON-port 5 has no offline ONTs
GPON-port 6 has no offline ONTs
GPON-port 7 has no offline ONTs
Total ONT count: 1

```

6.5.5 ONT statistics

To view ONT statistics, use the **show interface ont <ID> counters <type>** command. As an argument, pass the ONT ID and the type of requested statistics (see Table 35).

```

LTP-8X# show interface ont 4/0 counters gem-port-nctp-performance-monitoring
-----
[ONT4/0] counters
-----

  ##      Downstream counters for cross-connects: 0      ...      7      MC      BC
  1      Finished intervals                202      ...      ---      ---      ---
  2      Received GEM frames                 54       ...      ---      ---      ---
  4      Received payload bytes             11576    ...      ---      ---      ---

  ##      Upstream counters for cross-connects: 0      ...      7      MC      BC
  1      Finished intervals                202      ...      ---      ---      ---
  2      Transmitted GEM frames             54       ...      ---      ---      ---
  4      Transmitted payload bytes         10448    ...      ---      ---      ---

```

Table 35 – ONT statistics types

Statistics type
gem-port-performance-monitoring
gem-port-nctp-performance-monitoring
ethernet-performance-monitoring-history-data
ethernet-performance-monitoring-history-data2
ethernet-performance-monitoring-history-data3
gal-ethernet-performance-monitoring-history-data
fec-performance-monitoring-history-data

Statistics type

ethernet-frame-extended-performance-monitoring

multicast-subscriber-monitor

6.5.6 ONT bit error rate

Bit error rate (BER) is the rate of errors in data transmission.

To view BER on reception at the ONT, use the **show interface gpon-port <id> downstream-ber** command. As an argument, pass the number of the GPON interface.

```
LTP-8X# show interface gpon-port 0 downstream-ber
-----
GPON-port 0 BER table
-----
##      Ch/ Id   Errors   Intervals  BER Interval   BER
1       0/ 2     0        0          100000         0
2       0/ 3     0        0          100000         0
```

6.5.7 Viewing the status of ONT ports

To view the status of the ONT ports, run the **show interface ont <ID> ports** command. Pass the ONT identifier as an argument.

```
LTP-8X# show interface ont 0/0 ports
-----
[ONT0/0] ports state
-----

UNI ##                0                1

Link:                 up                up
Speed:                100M             100M
Duplex:               full              full

PoE:
  State:               enable            enable
  Power detection status: Delivering power  Delivering power
  Power classification status: Class 3          Class 3
  PsE class control:   Default          Default
  Power priority:      high             high
  Consumption:         1600 mW         1600 mW
```

Table 36 – Description of PSE statuses

PSE status	Description
Disabled	PoE connectivity on the port is disabled
Searching	PoE connectivity on the port is enabled, waiting for device connection
Delivering power	PoE device is connected, power is supplied
Test mode	Test mode
Fault	Error is detected
Specific fault	Implementation error is detected

6.6 System environment configuration

You can adjust fans and configure reset button of the device.

Enter **show system environment** to view the system status.

```
LTP-8X# show system environment
System information:
  CPU load average (1m, 5m, 15m):  1.39  3.97  4.11
  Free RAM/Total RAM (Mbytes):      253/495
  Temperature (sensor1/sensor2):    36C/50C
  Reset button:                      disabled

  Fan configured speed, %:           15
  Fan minimum speed, %:              15
  Fan speed levels, %:               16 27 39 51 64 76 88 100

  Fan state (fan0/fan1):             4620rpm 4620rpm

  PLD FW version:                    14

  TYPE:                              LTP-8X:rev.C
  HW_revision:                       1v4
  SN:                                 GP2B000304
  MAC:                                A8:F9:4B:8B:79:D0

Power supply information:
  Module 1: PM160 220/12 1vX
    Type: Alternate current(AC)
    Intact: 1
  Module 2: PM160 220/12 1vX
    Type: Alternate current(AC)
    Intact: 1
```

Fans configuration

- **Step 1.** Set the minimal rotation rate.

```
LTP-8X(config)# system fan min-speed 30
```

- **Step 2.** Set the table of rate levels starting from 0.

```
LTP-8X(config)# system fan speed-table 16 27 39 51 64 76 88 100
```

- **Step 3.** If you need to change the level, use the following command.

```
LTP-8X(config)# system fan speed-level 4 70
```

- **Step 4.** You may set the level forcibly.

```
LTP-8X(config)# system fan speed 50
```

Reset button configuration

<Reset> button has 3 operating modes.

disabled	disabled
reset-only	only reboot
enabled	reset to factory settings and reboot

```
LTP-8X(config)# system reset-button disabled
```

7 Terminal maintenance

7.1 SFP transceivers replacement

SFP transceivers can be installed when the terminal is turned on or off. The front panel has pairs of slots: even slots in the upper line, odd slots at the bottom. SFP transceivers are symmetrically installed for each pair of slots.

- **Step 1.** Insert an SFP transceiver into a slot with its open side down (open side up for the bottom line of slots).

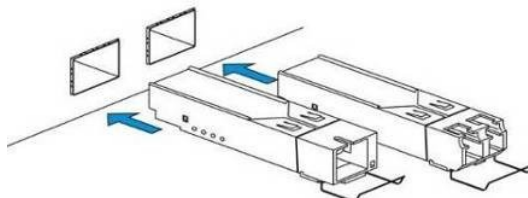


Figure 49 – SFP transceivers installation

- **Step 2.** Push the module. When it is in place, you should hear a distinctive 'click'.

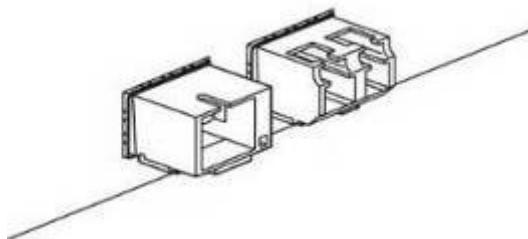


Figure 50 – SFP transceivers installation

To remove a transceiver:

- **Step 1.** Unlock the module latch.

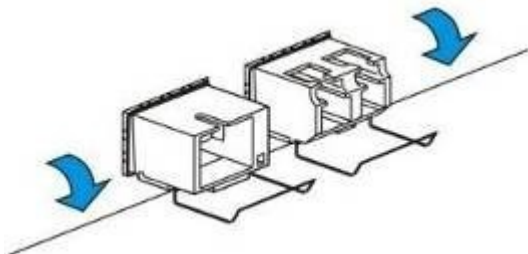


Figure 51 – Opening SFP transceiver latch

- **Step 2.** Remove the module from the slot.

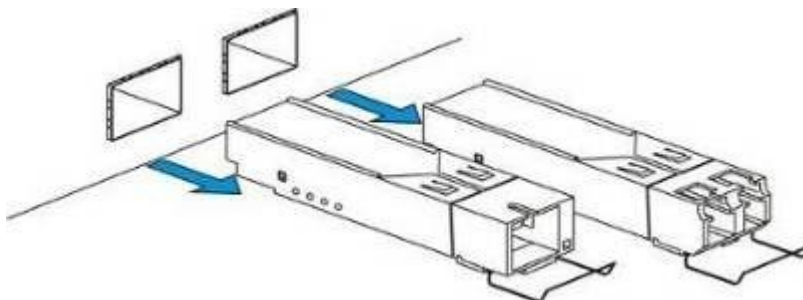
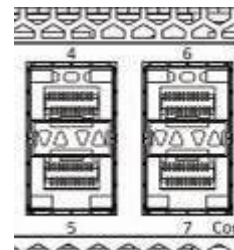


Figure 52 – SFP transceivers removal



7.2 Ventilation units replacement

The terminal design allows ventilation units replacement even when the terminal is on.

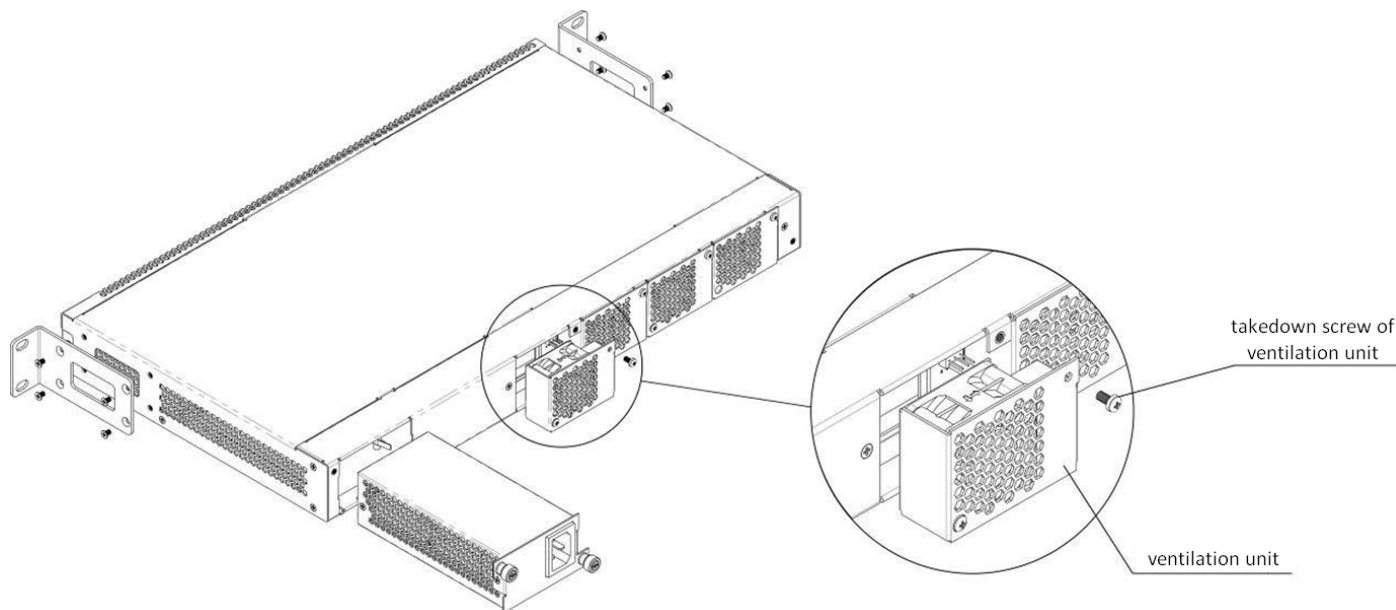


Figure 53 – Ventilation unit. Installation to the case

To remove a ventilation unit:

- **Step 1.** Use a screwdriver to remove the right screw fixing the ventilation unit to the rear panel (see Figure 53).
- **Step 2.** Carefully pull the unit until it is removed from the case.
- **Step 3.** Disengage the pins of the unit from the connector in the device (see Figure 54).

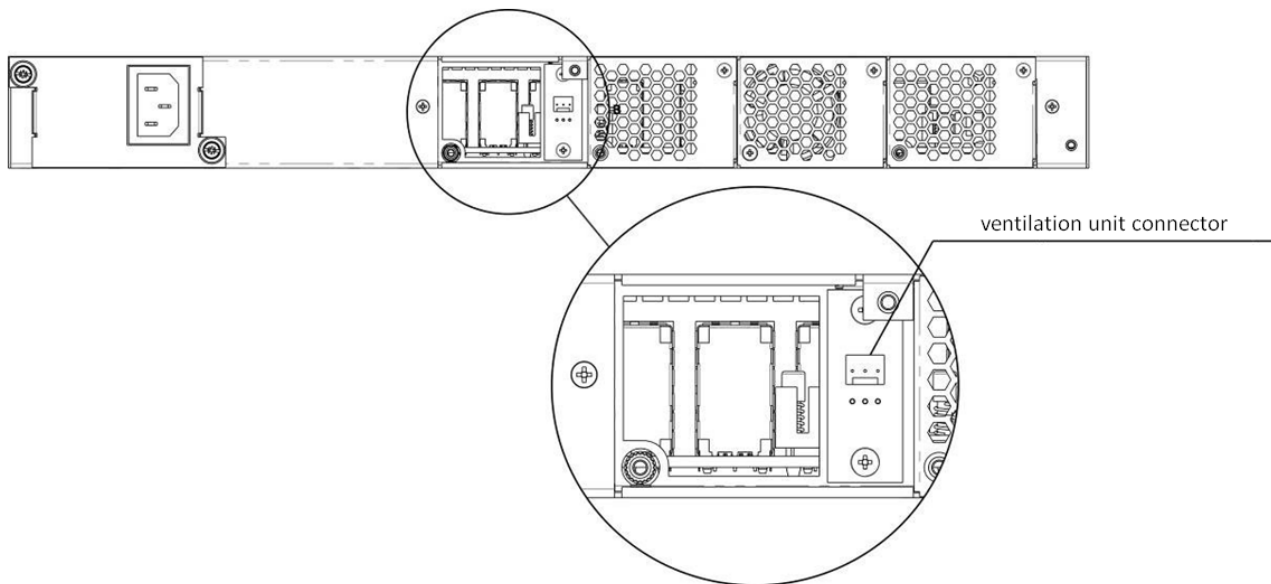


Figure 54 – Ventilation unit socket

To install a ventilation unit, perform the following actions:

- **Step 1.** Connect the pins of the unit with the connector in the device (see Figure 54).
- **Step 2.** Lay the connection cable in a special tray on the inner side of the unit.
- **Step 3.** Insert the unit into the terminal case.
- **Step 4.** Screw the ventilation unit to the rear panel (see Figure 53).

7.3 OLT firmware update

This chapter describes the terminal firmware update procedure. To download a firmware file, use the TFTP server available in the terminal management network.

- **Step 1.** Copy the firmware file into the root folder (or any other known folder) of the TFTP server.
- **Step 2.** Update the firmware by using the **copy** command.

```
LTP-8X# copy ftp://user:pass@10.54.16.1/ltp-8x-revc-revd-3.40.0-buildXXXX.fw.bin fs://
firmware
Downloading system
firmware.. .....
.....
.....

Download successfully - speed: 3160145.000 bytes/sec during 5.027 seconds, total size
15885504
System firmware successfully downloaded
Updating system firmware..
Current board version:      6
Current firmware version:  3.26.1.1349
New firmware version:      3.32.0.XXXX
Update device mtd7
Erase flash...
Done.
Write data...
Done.
Done.
Success
Update device mtd5
Erase flash...Done.
Write data...
Done.
Done.
Success
System firmware successfully updated
```

- **Step 3.** Reboot the terminal to start the new firmware.

```
LTP-8X# reboot
Do you really want to reboot the system now? (y/n)  y
```

7.4 ONT firmware update

This chapter describes different methods of ONT firmware update using the OMCI protocol.

7.4.1 ONT firmware update download

ONT firmware update can run automatically for all ONTs or for a specified ONT. To start the update, download a firmware update file to the line terminal. To download the file, use the **copy** command and specify the file name and the address of the TFTP server as arguments.

```
LTP-8X# copy ftp://user:pass@10.54.16.1/ntp-rg-r3.24.1.854.fw.bin bin fs://ont-firmware
Download file from FTP-server
Download successfully - speed: 2906533.000 bytes/sec during 1.008 seconds, total size 2929684
.....
.....
ONT firmware vendor is Eltex Corporation, version 3.24.1.854 Write downloaded file to flash
memory.
.....
.....
```

7.4.2 ONT firmware custom update

To update firmware of a specified ONT, you need to create a corresponding task and specify the ONT ID and the firmware file name. There are two types of ONT firmware update tasks: single try or multiple tries.

To create a single try update task, use the **update ont** command and specify the ONT ID and the file name of the firmware.

```
LTP-8X# update ont 0/0 filename ntp-rg-r3.24.1.854.fw.bin
Task for updated successfully created. ONT firmware will be updated in 20 minutes or more
```

As a result, the single try update task will be created for the ONT having the specified serial number. This method is used to update the ONTs, which are in the OLT channel at the time of update. The task will end with an error for the ONTs, which are not connected.

To create a multiple tries update task, use a scheduler. This method is generally used to update the ONTs, which are not in the OLT channel at the time of the update. The tasks you create in the scheduler will be executed as soon as the corresponding ONT connects to the channel. To create, delete, or view tasks in the scheduler, use the **schedule ont** command. To create an ONT firmware update task, use the **schedule ont update** command and specify the ONT ID and the firmware update file.

```
LTP-8X# schedule ont update 0/0 ntp-rg-r3.24.1.854.fw.bin
Task created for [ONT0/0]
```

To view scheduled tasks, use the **show schedule ont update** command.

```
LTP-8X# show schedule ont update Existing tasks (1):
## Serial Ch/ Id Operation Status Tries remained
0 --- 0/ 0 ont_update scheduled 5
```

You can delete some of the created tasks by using the **no schedule ont update** command and specifying the ONTs ID.

```
LTP-8X# no schedule ont update 0/0
Task deleted for [ONT0/0]
```

To clear the scheduler, use the **clear schedule ont update** command.

```
LTP-8X# clear schedule ont update
All tasks cleared
```

The tasks created in the scheduler will continue running until the update completes successfully or the number of tries is reached (the Tries remained parameter).

7.4.3 ONT firmware autoupdate

To enable firmware autoupdate for all ONTs, use the **auto-update ont** command and specify the update mode (**immediate** or **postpone**).

- **Step 1.** Specify the FW ONT autoupdate mode. The **immediate** mode enables immediate firmware autoupdate for all connected ONTs. In the **postpone** mode, ONT firmware update will be performed only upon ONT connection.

```
LTP-8X# config
LTP-8X(config)# auto-update ont postpone
Parameter was applied successfully
```

You can view the set parameter by using the **show auto-update ont** command.

```
LTP-8X(config)# do show auto-update ont
Auto-update ONT:postpone
```

- **Step 2.** To enable ONT firmware autoupdate, specify update rules. Specify the ONT model, its current firmware version and the name of the firmware file to be flashed. To do this, use the **auto-update ont record** command.

Create the update1 autoupdate rule. Pass the ONT type **XXX**, the current FW version **YYY**, and the file name **ZZZ.bin** as parameters.


```
LTP-8X(config)# auto-update ont record update1 equipment-id TYPE fw-version match V1
filename V2.bin
Record was added successfully
```

The match keyword indicates that the ONT version number should match the specified number, in this case YYY.

To simplify the process and make it more convenient, you can create records to perform firmware autoupdate on ONTs, even when their firmware versions differ from the specified one. Use the **non-match** parameter when creating the rule.

```
LTP-8X(config)# auto-update ont record update2 equipment-id TYPE fw-version not-match
V2 filename V2.bin
Record was added successfully
```

As a result, the update2 record will be created in the table that will automatically update the ONT with the TYPE and the version not equal to V2 by installing the V2.bin file. This allows autoupdate of all ONTs to the required V2 version.

 If the table contains multiple records for one ONT type, autoupdate will be performed by the last rule for this ONT type.

- **Step 3.** You can view the created records by using the **show auto-update ont records** command.

```
LTP-8X(config)# do show auto-update ont records
Name EquipmentID FWVersion FileName Mode Downgrade
update1 TYPE V1 V2.bin global disable
update2 TYPE !V2 V2.bin postpone enable
```

- **Step 4.** You can delete a created record by using the **no auto-update ont record** command and specifying the record name.

```
LTP-8X(config)# no auto-update ont record update1
Record was deleted successfully
```

To clear the record table, use the **no auto-update ont records** command.

```
LTP-8X(config)# no auto-update ont records
Records cleared successfully
```


9 APPENDIX B. Configuring services on ONT Ericsson, Atron, CIG

Starting with version 3.36, ONT support has been added for Ericsson T063G, Ericsson T073G, Atron RFT620, Atron PSG590, CIG G-25A-J80. In service configuration on these ONTs, there are some features presented below.

9.1 VoIP configuration

To configure VoIP, you need to create two new profiles: cross-connect type voice, profile voice.

- **Step 1.** Create required profiles.

```
LTP-8X(config)# profile cross-connect "VOICE-ERCS"
LTP-8X(config-cross-connect)("VOICE-ERCS")# description "For VOICE ont Ericsson"
LTP-8X(config-cross-connect)("VOICE-ERCS")# bridge
LTP-8X(config-cross-connect)("VOICE-ERCS")# bridge group "5"
LTP-8X(config-cross-connect)("VOICE-ERCS")# outer vid 354
LTP-8X(config-cross-connect)("VOICE-ERCS")# user vid 354
LTP-8X(config-cross-connect)("VOICE-ERCS")# type "voice"
LTP-8X(config-cross-connect)("VOICE-ERCS")# exit
LTP-8X(config)# profile voice "voice-00-ERCS"
LTP-8X(config-voice)("voice-00-ERCS")# sip proxy "123.test.ru"
LTP-8X(config-voice)("voice-00-ERCS")# sip outbound-proxy "172.20.20.201"
LTP-8X(config-voice)("voice-00-ERCS")# sip domain "123.test.ru"
LTP-8X(config-voice)("voice-00-ERCS")# exit
```

- **Step 2.** Assign profiles to ONT and configure additional VoIP data.

```
LTP-8X(config)# interface ont 0/2
LTP-8X(config)(if-ont-0/2)# service 0 profile cross-connect "VOICE-ERCS" dba "dba-00"
LTP-8X(config)(if-ont-0/2)# profile voice "voice-00-ERCS"
LTP-8X(config)(if-ont-0/2)# voice port 0 number "402153"
LTP-8X(config)(if-ont-0/2)# voice port 0 authentication username "402153"
LTP-8X(config)(if-ont-0/2)# voice port 0 authentication password "QFxy2EzfvdrL1"
```

- **Step 3.** If necessary, configure Value Added Services for the ONT.

```
LTP-8X(config)(if-ont-0/2)# voice fax-mode t38
LTP-8X(config)(if-ont-0/2)# voice features call-presentation special-dialtone
LTP-8X(config)(if-ont-0/2)# voice features call-presentation visual
LTP-8X(config)(if-ont-0/2)# voice features call-presentation call-forward
LTP-8X(config)(if-ont-0/2)# voice features call-progress 3way
LTP-8X(config)(if-ont-0/2)# voice features call-progress transfer
LTP-8X(config)(if-ont-0/2)# voice features call-progress hold
LTP-8X(config)(if-ont-0/2)# voice features call-progress park
LTP-8X(config)(if-ont-0/2)# voice features call-progress emergency-hold
LTP-8X(config)(if-ont-0/2)# voice features call-progress 6way
LTP-8X(config)(if-ont-0/2)# voice features call-wait enable
LTP-8X(config)(if-ont-0/2)# voice features call-wait call-id-annonce
LTP-8X(config)(if-ont-0/2)# voice features cid call-number
LTP-8X(config)(if-ont-0/2)# voice features cid call-name
```

```
LTP-8X(config)(if-ont-0/2)# voice features cid cid-number  
LTP-8X(config)(if-ont-0/2)# voice features cid cid-name
```

- **Step 4.** Apply the changes.

```
LTP-8X(config)(if-ont-0/2)# do commit
```

9.2 Internet and IPTV services configuration

These services are configured similarly to ONT ELTEX.

10 The list of changes

Firmware version	Document version	Issue date	Revisions
Version 3.46.0	Issue 22	02.11.2022	Synchronization with firmware version 3.46.0.
Version 3.44.0	Issue 21	13.12.2021	Synchronization with firmware version 3.44.0.
Version 3.42.2	Issue 20	30.11.2021	Synchronization with firmware version 3.42.2.
Version 3.42.1	Issue 19	14.10.2021	Synchronization with firmware version 3.42.1.
Version 3.42.0	Issue 18	31.05.2021	<p>Added:</p> <ul style="list-style-type: none"> • Poe support for ONT; • Alarm PSE overload support; • PoE support for ONT in SNMP; • Ability to set timezone accurate to minutes; • OMCI alarm PSE overload support; • OMCI LAN port control; • NTU-MD500P support. <p>Added sections:</p> <ul style="list-style-type: none"> • ONT ports management; • Viewing the status of ONT ports. <p>Fixed:</p> <ul style="list-style-type: none"> • Application of backup-configuration when using ACLs; • Removal of ip source-guard database after LTP restart; • ONT hanging in CFGFAIL status.
Version 3.40.2	Issue 17	28.04.2021	Synchronization with firmware version 3.40.2.

Firmware version	Document version	Issue date	Revisions
Version 3.40.0	Issue 16	10.12.2020	<p>Added:</p> <ul style="list-style-type: none"> • Redundancy functionality for gpon ports; • CaTV signal level acquisition; • Option to disable VLAN filtering for multicast GEM; • Functionality for forced activation of GPON port, without taking into account the configuration; • A command to remove dynamic entries from the DHCP Snooping table; • Possibility to set ONT auto-activation by GPON ports; • Possibility to auto complete the list of log files; • Support for PM-DC12 power supply; • Alarms for exceeding the CaTV thresholds; • Support for LTP-X rev.D boards. <p>Sections added:</p> <ul style="list-style-type: none"> • GPON port redundancy. <p>Fixed:</p> <ul style="list-style-type: none"> • UNACTIVATED ONT reload; • ONT reloading in case of authorization error; • ONT activation bug after mass link crash; • ONT activation error after quick reconfiguration; • OLT chip reload, during mass ONT power off; • Multicast passing through broadcast GEM with unknown-multicast-forward enabled; • Supported EqID output for NTU-1 rev.B and NTU-RG-5440G-WZ; • pmchal crash when requesting ONT status; • Loss of private parameters when updating LTP; • Operation with configuration that contains null in the fields; • Saving LLDP settings for 10G-front-port; • Fixed bug when deleting entries from DHCP Snooping table; • Stabilized operation with broken blocks on NAND flash; • Possibility to re-prescribe ONT when auto-activation is enabled; • Loss of ip arp inspection configuration; • pmchal crash when using IPSG; • CLI crash when naming interfaces with capital letters; • ACL with ARP packets when filtering by ports; • Removed duplicate events of front-ports state changes; • Isolation for pon ports that related to different chips.
Version 3.38.2	Issue 15	20.05.2020	Synchronization with firmware version 3.38.2.
Version 3.38.1	Issue 14	07.02.2020	Synchronization with firmware version 3.38.1.

Firmware version	Document version	Issue date	Revisions
Version 3.38.0	Issue 13	13.12.2019	<p>Synchronization with firmware version 3.38.0.</p> <p>Sections added:</p> <ul style="list-style-type: none"> • CLI hotkeys; • Origin parameter configuration. <p>Changes:</p> <ul style="list-style-type: none"> • Compatible SFP transceivers; • User list preview; • SNMPD configuration; • GPON interface configuration; • DHCP Relay Agent profiles management; • IP Source Guard configuration; • Tunnelling configuration.
Version 3.36.2	Issue 12	08.10.2019	<p>Synchronization with firmware version 3.36.2.</p>
Version 3.36.0	Issue 11	07.02.2019	<p>Added:</p> <ul style="list-style-type: none"> • Manual supplemented by LTP R3.36.0 commands. <p>Sections added:</p> <ul style="list-style-type: none"> • Configuring multicast traffic between ONTs within the same tree; • APPENDIX B. Configuring services on ONT Ericsson, Atron, CIG. <p>Added description:</p> <ul style="list-style-type: none"> • Configuring DHCPD issuing static routes to the network on the ONT TR-interface (option 121).
Version 3.32.0	Issue 10	03.07.2018	<p>Added:</p> <ul style="list-style-type: none"> • Manual supplemented by LTP R3.32.0 commands. <p>Sections added:</p> <ul style="list-style-type: none"> • ERPS configuration; • Deleting a license file from OLT • Automatic ONT activation. <p>Added description:</p> <ul style="list-style-type: none"> • GPON interface configuration; <p>Changes:</p> <ul style="list-style-type: none"> • Active DHCP leases monitoring command; • IGMP Snooping enabling command.

Firmware version	Document version	Issue date	Revisions
Version 3.30.0	Issue 9	30.11.2017	<p>Added:</p> <ul style="list-style-type: none"> Manual supplemented by LTP R3.30.0 commands. <p>Sections added:</p> <ul style="list-style-type: none"> LLDP configuration; QoS WRR; ARP-Inspection; Storm Control in PON; Configuring Access List Control and policies. <p>Added description:</p> <ul style="list-style-type: none"> Collaboration of various types of cross-connect; Upstream shaping configuration; SNMPv3 users configuration; SNMPv3 encryption configuration; Additional RADIUS servers configuration; Configuration of syslog entries for entered commands; Updated logging system; Configuration of description for the interface in switch; Storm Control in switch; Fan configuration; Reset button configuration; MAC Notification trap configuration; %OLTMAC% parameter in option 82. <p>Changes:</p> <ul style="list-style-type: none"> PPPoE sessions view command; DHCP sessions view command.
Version 3.26.1	Issue 8	13.12.2016	<p>Added:</p> <ul style="list-style-type: none"> Manual supplemented by LTP R3.26.1 commands; AAA (radius/tacacs+) functionality description; Extended custom parameters description.
Version 3.26.0	Issue 7	09.07.2016	<p>Added:</p> <ul style="list-style-type: none"> Manual supplemented by LTP R3.26.0 commands; Information about LTP rev.C; IP Source Guard functionality description; DHCP Relay (broadcast-unicast relay) functionality description; Tunnel configuration description; ONT licensing description; Description of configuring services over IPv6; RS-232 null-modem cable pin designation. <p>Changes:</p> <ul style="list-style-type: none"> OLT. 6.3 firmware update command.
Version 3.24.3	Issue 6	25.04.2016	<p>Added:</p> <ul style="list-style-type: none"> Manual supplemented by LTP R3.24.3 commands.

Firmware version	Document version	Issue date	Revisions
Version 3.24.1	Issue 5	17.12.2015	Added: <ul style="list-style-type: none"> Manual supplemented by LTP R3.24.1 commands.
Version 3.24.0	Issue 4	02.09.2015	Added: <ul style="list-style-type: none"> Manual supplemented by LTP R3.24.0 commands.
Version 3.20.2	Issue 3	25.07.2014	Added: <ul style="list-style-type: none"> The manual is given to the LTP-8X R3.20.2 command system; Section 3.2.5 for group operations; 5.13, describing operation with ONT configuration templates.
	Issue 2	24.04.2014	Changes: <ul style="list-style-type: none"> Errors corrected.
	Issue 1	21.04.2014	Added: <ul style="list-style-type: none"> Section 4.1.2, describing the Configuration structure; Section 4.1.4, which describes the Configuration autosave; Step 7 in the MAC address lifetime configuration; Added an application with an example of setting up Triple Play in the VLAN for Subscriber model; Parameters of optical interfaces in table 4.1. Changes: <ul style="list-style-type: none"> Fixed table 24 name; Section 6.4.6 is renamed to Multicast statistics.

TECHNICAL SUPPORT

For technical assistance in issues related to handling Eltex Ltd. equipment, please, address to Service Center of the company:

Feedback form on the website: <https://eltex-co.com/support/>

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