Laserway Applications for offices and hotels

Compatible with the following OLT models:

OLT
3508

Important:

Before beginning configuration, it is important to have the logical project in hands. It will be the guide to executing all the configurations as planned and in a fast and efficient manner. A logical project well-executed guarantees an ease network management with greater availability and reliability avoiding future issues when changes or expansions are necessary. The logical project will also serve for reference in the future and will be a powerful tool for troubleshooting network performance issues, instability, or service unavailability.

SUMMARY

1 OBJECTIVE

The settings used in this document will serve as a guide to demonstrate the configuration for the main Laserway services for enterprise and hotel applications. This document can be applied to the OLT 3508 model.

2 BEST PRACTICES

In this topic, we will address the best network practices that should be applied to your GPON Laserway network, which are:

- It is recommended to certify the passive network before connecting the equipment;
- Do not use the VLAN 1. The VLAN 1 is the default VLAN for most part of equipment. As all GPON interfaces must be in trunk mode (tagged VLAN), the VLAN 1 must not be used. It is also not recommended as a good security practice;
- All VLANs set up in GPON interface must **ALWAYS** be in trunk mode (tagged);
- Do not use the 192.168.1.0/24 network (internal ONTs network);
- Use one VLAN per TCONT, limited to 8 VLAN/TCONT per ONT. If you need to pass more than 8 VLANs on a ONT, refer to point 13.3 of this guide;
- For a new Laserway network deployment, it is recommended to install the GPON equipment with the latest OLT(s) and ONT(s) firmware versions available on the Furukawa support portal;
- Set a password for the administrator user;
- Set a password to access “enable” mode on the OLT;
- Create a username and password for each person who needs to access the OLT, thus preventing everyone from accessing it as “admin”;
- Enable SSH and disable Telnet to ensure that access to the OLT is always encrypted.
- Configure the loop-detect on GPON Network so that, in the event of a network physical loop, it is possible to isolate the problem and identify which ONT it occurred on;
- Configure an NTP server to ensure constant synchronization of the OLT with the accurate time;
- Configure public and private SNMP communities;
- Configure the syslog forwarding to an external syslog server, allowing the possibility to retrieve OLT logs when needed;

3 TOPOLOGY

Following is the topology diagram featuring the OLT 3508:

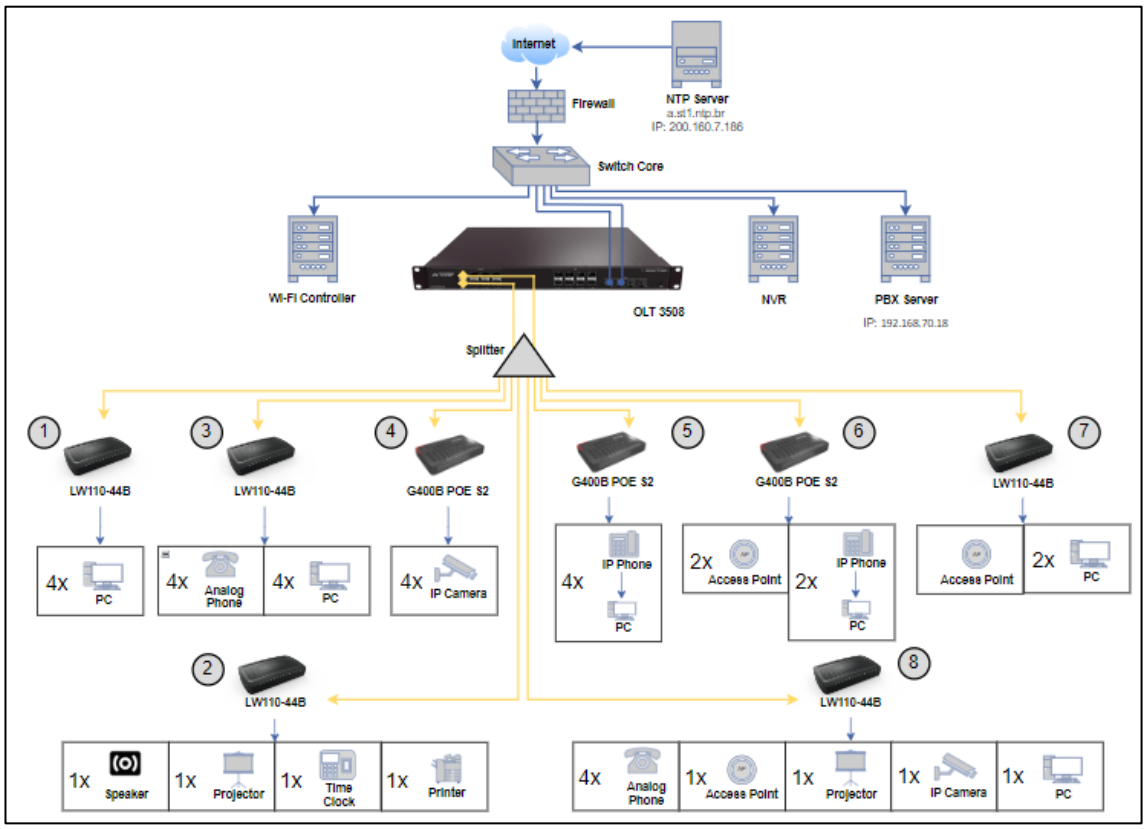

Figure 1: OLT 3508's Topology

3.1 Premises

Important information regarding the applications and topology of the demonstration scenario:

1) The scenario was planned to be a Laserway network with applications for an office/hotel;
2) No bandwidth control is performed within the GPON network;
3) The uplink ports of the OLT have aggregation, with the OLT 3508 having aggregation on ports XE1 and XE2;
4) The throughput of each uplink port will be 1 Gbps;
5) The ONUs will have the following functionalities for telephony:
   • CODECS: PCMA, PCMU, G729, and G723;
   • Features: call waiting, call transfer, conference, caller ID;
   • Dial plan with numbers 8XX, 3XX, and X.T;
   • DTMF Inband;
6) The DHCP for the telephony VLAN (70) will be configured on the OLT, while other VLANs will have external DHCP;
7) The G400B/PoE S2 model ONUs will be configured with PoE technology for powering cameras, APs, and IP phones;
8) Type B redundancy configuration will be implemented between GPON ports 1 and 2;
9) OLT management will be in-band via VLAN 90;

10) For the IPTV service will be used IGMP V2 with IP multicast range from 239.100.100.1 - 239.100.100.5;

3.2 Network definition

To provide detailed information about the applications used in this document, the following is a table indicating the VLANs and IP addresses associated to each service:

SERVICE	NETWORK	MASK	VLAN
PC	192.168.10.0	255.255.255.0	10
Speaker	192.168.20.0	255.255.255.0	20
Printer	192.168.30.0	255.255.255.0	30
Projector	192.168.40.0	255.255.255.0	40
Time Clock	192.168.50.0	255.255.255.0	50
IP Camera	192.168.60.0	255.255.255.0	60
Telephony	192.168.70.0	255.255.255.0	70
WiFi Management	192.168.80.0	255.255.255.0	80
Guest WiFi	192.168.81.0	255.255.255.0	81
Management WiFi	192.168.82.0	255.255.255.0	82
NOC WiFi	192.168.83.0	255.255.255.0	83
Network Administration	192.168.90.0	255.255.255.0	90
IPTV	192.168.100.0	255.255.255.0	100

3.3 Services definition

The following table provides information on the connections of each ONU, indicating which equipment is connected to each ETH and FXS port of the ONUs:

Scenario	ONT	Port 1	Port 2	Port 3	Port 4	FXS 1	FXS 2	FXS 3	FXS 4
1	FKW0001	PC	PC	PC	PC				
2	FKW0002	Projector	Printer	Time Clock	Speaker				
3	FKW0003	PC	PC	PC	PC	EXT 301	EXT 302	EXT 303	EXT 304
4	FKW0004	IP Camera	IP Camera	IP Camera	IP Camera				
5	FKW0005	IP Phone/ PC	IP Phone/ PC	IP Phone/ PC	IP Phone/ PC				
6	FKW0006	IP Phone/ PC	IP Phone/ PC	AP	AP				
7	FKW0007	IPTV	IPTV	AP	AP				
8	FKW0008	PC	Projector	IP Camera	AP	EXT 801	EXT 802	EXT 803	EXT 804

4 CONFIGURATIONS FOR THE OLT 3508

Show running-config	Descrição
service password-encryption	Enable password encryption.
service ssh enable	Enable the SSH service.
service telnet disable	Disable Telnet service.
service terminal-length 0	Eliminates the limit of lines to be displayed in the CLI.
hostname GPON3508	Name given to the equipment to identify it on the network.
logging console 3	System for logs and error messages that are displayed in the terminal/console: Logging console 3 - sets logging level via serial connection.
logging monitor 3	Logging monitor 3 - sets logs level via SSH/Telnet connection.
logging server 7 192.168.90.150	Logging server 7 - sets logging level that will be sent to an external Syslog server.
logging level all 2	Logging level all 2 - sets logging level to recommended default.
enable password 8 1Aw$osIo/VUhUhHHtsaVc10	Privileged mode password. In the running-config, it is displayed in encrypted form. The command to set the password is "enable password <password>".
clock timezone Sao_Paulo	Timezone configuration can be set via the interactive menu or manual configuration.
snmp-server community add public read	SNMP configuration.

snmp-server community add private write ip name-server 8.8.8.8 ip domain-lookup	Configures the DNS that the OLT will use. DNS: enables the translation of name into IP address. This setting is enabled by default.
igmp snooping igmp snooping report-suppression	Enables IGMP Snooping. Enables IGMP report suppression functionality.
vlan database vlan 10 bridge 1 name PC state enable vlan 20 bridge 1 name CaixaSom state enable vlan 30 bridge 1 name Impressora state enable vlan 40 bridge 1 name Projetor state enable vlan 50 bridge 1 name RelogioPonto state enable vlan 60 bridge 1 name CamerasIP state enable vlan 70 bridge 1 name Telefonia state enable vlan 80 bridge 1 name GerenciaWiFi state enable vlan 81 bridge 1 name WifiCONVIDADOS state enable vlan 82 bridge 1 name WifiGERENCIA state enable vlan 83 bridge 1 name WifiNOC state enable vlan 90 bridge 1 name Gerencia state enable vlan 100 bridge 1 name IPTV state enable	Enters VLAN configuration mode. Creation of the VLANs that will be used on the OLT.
interface gpon1	Accesses the GPON port configuration mode. Configures the GPON port as an L2 port.

switchport bridge-group 1 spanning-tree disable	Disables Spanning Tree on the GPON port. Recommended setting and comes as default.
switchport mode trunk switchport trunk allowed vlan add 10,20,30,40,50,60,70,80,81,82,83,90,100	Configures the GPON port as a trunk and adds the VLANs that will be used.
port-frame-return pon-link enable pon-link auto-discovery enable interval 60 keepalive 10	If there is a need for communication between two or more ONUs configured on the same PON link, it will be necessary to enable the port-frame-return functionality. Enables GPON link. Automatic ONU discover every 60 sec. Enables GPON port loop detection.
interface gpon2 switchport bridge-group 1 spanning-tree disable switchport mode trunk switchport trunk allowed vlan add 10,20,30,40,50,60,70,80,81,82,83,90,100 port-frame-return pon-link enable pon-link auto-discovery enable interval 60 keepalive 10	The settings for this port should be the same as for the "gpon1" port.
gpon redundancy single-homing main gpon1 backup gpon2 name red12	Creation of the GPON type B redundancy group, between ports GPON1 (main) and GPON2 (backup) named "red12".

interface xe1 switchport bridge-group 1 switchport mode trunk switchport trunk allowed vlan add 10,20,30,40,50,60,70,80,81,82,83,90,100 channel-group 232 mode active	Accesses the XE1 uplink port configuration mode. Configures the XE1 port as a switch port. Configures the XE1 port as trunk and adds the VLANs that will be used. Configures the port to be part of Channel Group 232 using LACP in active mode.
interface xe2 switchport bridge-group 1 switchport mode trunk switchport trunk allowed vlan add 10,20,30,40,50,60,70,80,81,82,83,90,100 channel-group 232 mode active	Accesses in XE2 uplink port configuration mode. Configures the XE2 port as a switch port. Configures the XE2 port as trunk and adds the VLANs that will be used. Configures the port to be part of Channel Group 232 using LACP in active mode.
interface po232 switchport bridge-group 1 switchport mode trunk switchport trunk allowed vlan add 10,20,30,40,50,60,70,80,81,82,83,90,100	Accesses in aggregate port po232 configuration mode. All these configurations will be done automatically after the LACP is created. All future configuration should be done on this port only and not on the LAG member ports.
interface vlan1.90	Configuration of the VLAN 90 interface. IP configuration.

ip address 192.168.90.10/24 dhcp server config range 192.168.90.50 192.168.90.100 gateway 192.168.90.10 dhcp server config optional dns 8.8.8.8 8.8.4.4 dhcp server enable	DHCP pool configuration. Defines the DNS server that will be delivered to DHCP clients. Enables the DHCP server on the interface.
ip route 0.0.0.0/0 192.168.90.1	Default Route Configuration.
ntp server 200.160.7.186 end	The NTP protocol allows you to keep the OLT's clock synchronized with the server's time.
write	Saves the settings made on the OLT.

5 ONU CONFIGURATION FOR SCENARIO 1

The following scenario will use the ONU LW110-44B, all ethernet ports will be dedicated for internet service (VLAN 10) access (untagged).

Note: The same settings are valid for the G400B PoE/S2 ONUs.

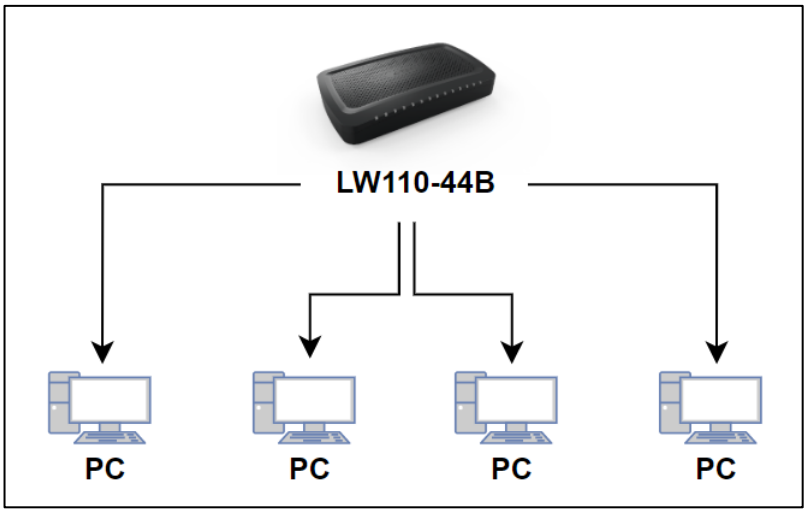

Figure 2: Topology of the scenario 1

onu-profile PC-PC-PC-PC tcont 1 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0 interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 1 interface ethernet 3 associate service ethernet 1 interface ethernet 4 associate service ethernet 1	It creates a profile that will use all the ONU ports as access in VLAN 10 (Internet service). Creation of one tcont per service is performed. Since in this case there is only one service, only tcont 1 was created. By recommendation of Furukawa, there is no bandwidth limitation. Then, the maximum allowed was used: 1000000 Kbps. Each tcont is related to an ethernet service, which will set up the profile's VLANs. The ethernet service is then allocated to the interfaces as indicated in the topology.

The following are the settings on the GPON port of the OLT to apply the profile to the ONU:

interface red12 onu profile PC-PC-PC-PC onu-index 1	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU.

6 ONU CONFIGURATION FOR SCENARIO 2

In the following scenario the LW110-44B ONU will be used, port 1 will be used for the projector (VLAN 40), port 2 for the printer (VLAN 30), port 3 for the time clock (VLAN 50) and port 4 for the speaker (VLAN 20). All ports will operate as access (untagged).

Note: The same settings are valid for the G400B PoE/S2 ONUs.

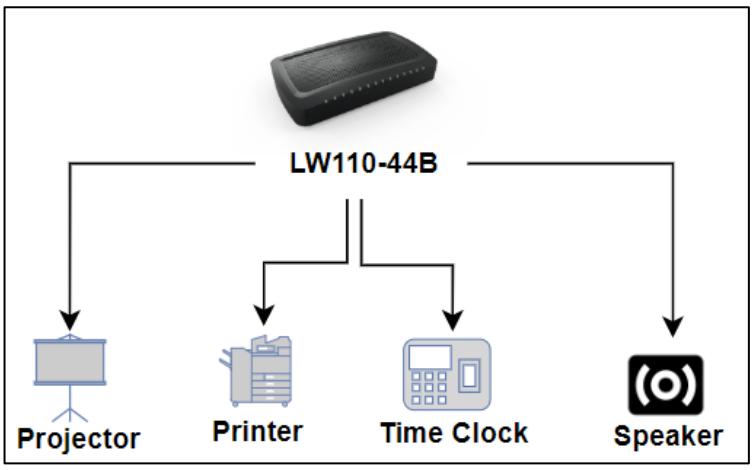

Figure 3: Topology of the scenario 2

onu-profile PROJ-IMP-REL-SOM tcont 1 dba cir 256 pir 1000000	

tcont 2 dba cir 256 pir 1000000 tcont 3 dba cir 256 pir 1000000 tcont 4 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 40 priority 0 service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type untagged insert inner vid 30 priority 0 service ethernet 3 upstream tcont 3 switchport mode extended extended-vlan-operation type untagged insert inner vid 50 priority 0 service ethernet 4 upstream tcont 4 switchport mode extended extended-vlan-operation type untagged insert inner vid 20 priority 0 interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 2 interface ethernet 3 associate service ethernet 3 interface ethernet 4 associate service ethernet 4	It creates a profile that will use all the ONU ports as access, but each ONU port will use a different VLAN according to the topology. Creation of one tcont per service is performed. As in this case there are 4 services, tconts 1, 2, 3 and 4 were created. By recommendation of Furukawa, there is no bandwidth limitation. Then, the maximum allowed was used: 1000000 Kbps. Each tcont is related to an ethernet service, which will set up the profile's VLANs. Each ethernet service is then allocated to the interfaces as indicated in the topology.

The following are the settings on the GPON port of the OLT to apply the profile to the ONU:

interface red12 onu profile PROJ-IMP-REL-SOM onu-index 2	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU.

7 ONU CONFIGURATION FOR SCENARIO 3

The following scenario will use the ONU LW110-44B, all ethernet ports will be dedicated for internet service (VLAN 10) access (untagged). All FXS/POTS/RJ11 ports will be used for analog telephony (VLAN 70).

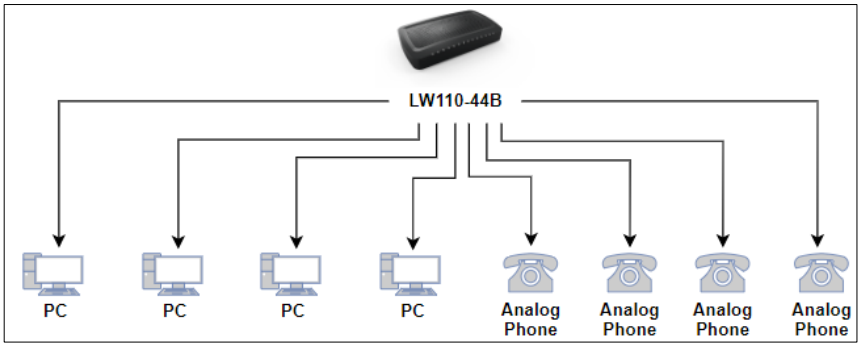

Figure 4: Topology of the scenario 3

Following are the profile settings:

voip-profile FXS codec 1 type pcma packet-period 10 silence-suppression enable codec 2 type pcmu packet-period 20 silence-suppression enable codec 3 type g729 packet-period 30 silence-suppression enable codec 4 type g723 packet-period 30 silence-suppression enable proxy-server 192.168.70.18 outbound-proxy-server 192.168.70.18 register-server 192.168.70.18 dial-plan table 1 8XX.T dial-plan table 2 3XX.T dial-plan table 3 X.T	Creation of the voip-profile, a profile responsible for analog telephony settings. In this profile the CODECs, IP of the PABX and dial-plan are configured. The telephony settings must be in accordance with the PABX because a misalignment of these parameters will cause problems in operation. The dial-plan is responsible for creating telephony features. For example, creating a key for call transfer, setting codes for internal or external calls. To work properly it must be configured the same way in the PABX. In this voip-profile we are using 3 dial-plan rules. If other dial-plan rules are used, always the last one must be X.T, according to Furukawa's best practices.
onu-profile PC-PC-PC-PC-FXS-FXS-FXS-FXS tcont 1 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0 service voip 1	It creates a profile that will use all the ONU ethernet ports as VLAN 10 access (internet service) and all the FXS ports for analog telephony. One tcont is created per service (not necessary for analog telephony), therefore only the tcont for the Internet service was created. By recommendation of Furukawa, there is no bandwidth limitation. Then, the maximum allowed was used: 1000000 Kbps.

associate voip-profile FXS service ip-host vlan 70 dynamic upstream cir 1000 pir 1125 interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 1 interface ethernet 3 associate service ethernet 1 interface ethernet 4 associate service ethernet 1 interface pots 1 associate service voip 1 interface pots 2 associate service voip 1 interface pots 3 associate service voip 1 interface pots 4 associate service voip 1	Each tcont is related to an ethernet service, which will set up the profile's VLANs. Each ethernet service is then allocated to the interfaces as indicated in the topology. For the analog telephony service it is not necessary the creation of a tcont. It is only necessary to create an service ip-host that in this case is receiving IP dynamically in VLAN 70. Then the voip service is created and the voip-profile is added to it. Finally, the voip service is configured on all analog telephony interfaces (POTS).

Following are the settings of the extensions on the GPON port of the OLT:

interface red12 onu profile PC-PC-PC-PC-FXS-FXS-FXS-FXS onu-index 3 onu sip 301 display 301 user 301 passwd senha301 onu-index 3 pots 1 onu sip 302 display 302 user 302 passwd senha302 onu-index 3 pots 2 onu sip 303 display 303 user 303 passwd senha303 onu-index 3 pots 3 onu sip 304 display 304 user 304 passwd senha304 onu-index 3 pots 4	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU. It is necessary to set up the extension numbers and define a password for activation of the phone. The configured extensions are the following: • Configuration of 301 extension on FXS port 1 • Configuration of 302 extension on FXS port 2 • Configuration of 303 extension on FXS port 3 • Configuration of 304 extension on FXS port 4

8 ONU CONFIGURATION FOR SCENARIO 4

The following scenario will use the G400B POE/S2 ONU, all ethernet ports will be dedicated for CCTV service (VLAN 60) access (untagged). The cameras will be powered by the PoE of the ONU.

Note: The profile settings are valid for ONU LW110-44B, but the power supply to the devices must be external.

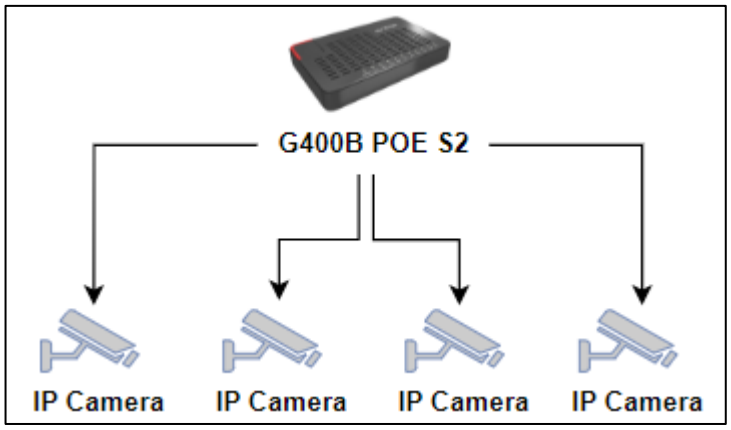

Figure 5: Topology of the scenario 4

Following are the profile settings:

onu-profile CFTV-CFTV-CFTV-CFTV tcont 1 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 60 priority 0 interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 1 interface ethernet 3 associate service ethernet 1 interface ethernet 4 associate service ethernet 1	It creates a profile that will use all ONU ports as access on VLAN 60 (CCTV service). One tcont per service is created. As in this case there is only one service, only tcont 1 was created. By recommendation of Furukawa, there is no bandwidth limitation. So it was used the maximum allowed: 1000000 Kbps. Each tcont is related to a service ethernet, which will set up the profile's VLANs. Then the service ethernet is assigned to the interfaces as indicated in the topology.

Following are the settings on the OLT GPON port to apply the profile and enable PoE on the ONU port:

interface red12 onu profile CFTV-CFTV-CFTV-CFTV onu-index 4 onu poe enable onu-index 4 port 1 onu poe enable onu-index 4 port 2 onu poe enable onu-index 4 port 3 onu poe enable onu-index 4 port 4	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU. Activation of PoE on LAN ports 1, 2, 3 and 4 of the ONU to power the devices.

9 ONU CONFIGURATION FOR SCENARIO 5

The following scenario will use the ONU G400B POE/S2, all ethernet ports will be dedicated to internet services (VLAN 10) + IP telephony (VLAN 70). VLAN 10 will be access (untagged) and VLAN 70 will be trunk (tagged). The phones will be powered by PoE from the ONU.

Note: The profile settings are valid for the ONU LW110-44B, but the power supply of the devices must be external.

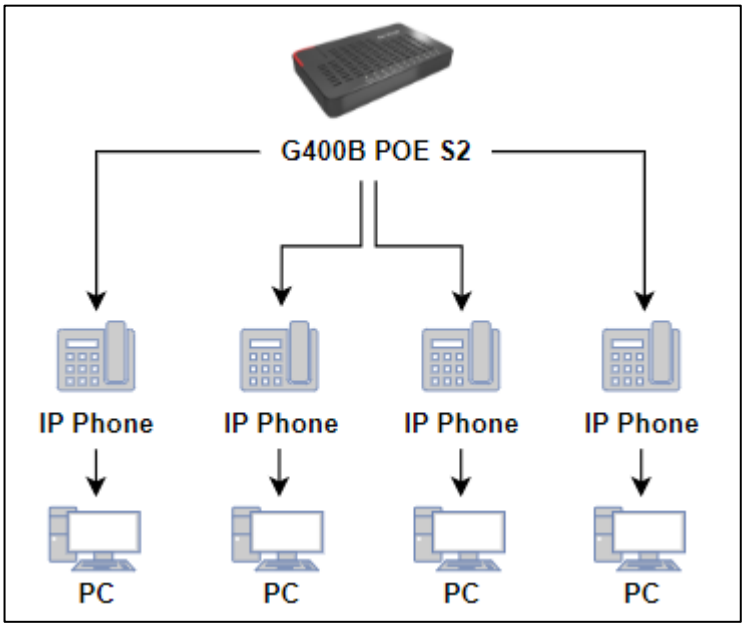

Figure 6: Topology of the scenario 5

Following are the profile settings:

onu-profile TEL-PC--TEL-PC--TEL-PC--TEL-PC tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0 service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 70 priority any remove single insert inner vid 70 priority copy-inner interface ethernet 1 associate service ethernet 1 associate service ethernet 2 interface ethernet 2 associate service ethernet 1 associate service ethernet 2	It creates a profile that will use all ONU ports as access in VLAN 10 (Internet service) and trunk in VLAN 70 (telephony service). One tcont per service is created. As in this case there are two services, tconts 1 and 2 were created. By recommendation of Furukawa, there is no bandwidth limitation. So the maximum allowed was used: 1000000 Kbps. Each tcont is related to a service ethernet, which will set up the profile VLANs. Service ethernet 1 configures the untagged VLAN and service ethernet 2 configures the tagged VLAN. Em seguida os service ethernet são alocados nas interfaces conforme indicado na topologia.

interface ethernet 3 associate service ethernet 1 associate service ethernet 2 interface ethernet 4 associate service ethernet 1 associate service ethernet 2	

Following are the settings on the OLT GPON port to apply the profile and enable PoE on the ONU port:

interface red12 onu profile TEL-PC--TEL-PC--TEL-PC--TEL-PC onu-index 5 onu poe enable onu-index 5 port 1 onu poe enable onu-index 5 port 2 onu poe enable onu-index 5 port 3 onu poe enable onu-index 5 port 4	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU. Activation of PoE on LAN ports 1, 2, 3 and 4 of the ONU to power the devices.

10 ONU CONFIGURATION FOR SCENARIO 6

The following scenario will use the ONU G400B POE/S2, ports 1 and 2 will be dedicated for internet services (VLAN 10) + IP telephony (VLAN 70). VLAN 10 will be access (untagged) and VLAN 70 will be trunk (tagged). The telephones will be powered by PoE from the ONU.

Ports 3 and 4 will be dedicated for the APs, which will have WiFi Management (VLAN 80 - untagged), WiFi Guest SSID (VLAN 81 - trunk (tagged)), WiFi Management SSID (VLAN 82 - trunk (tagged)) and WiFi NOC SSID (VLAN 83 - trunk (tagged)). The APs will be powered by the ONU PoE.

Note: The profile settings are valid for the ONU LW110-44B, but the power supply of the devices must be external.

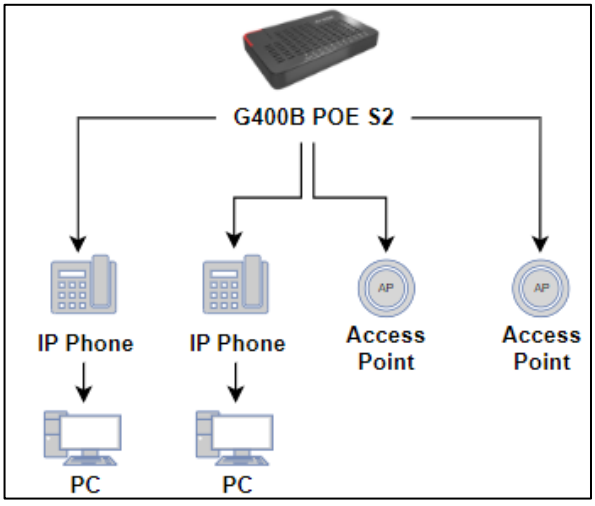

Figure 7: Topology of the scenario 6

Following are the profile settings:

onu-profile (VOIP-PC)-(VOIP-PC)-WIFI-WIFI tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000 tcont 3 dba cir 256 pir 1000000 tcont 4 dba cir 256 pir 1000000 tcont 5 dba cir 256 pir 1000000 tcont 6 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0 service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 70 priority any remove single insert inner vid 70 priority copy-inner service ethernet 3 upstream tcont 3 switchport mode extended extended-vlan-operation type untagged insert inner vid 80 priority 0 service ethernet 4 upstream tcont 4 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 81 priority any remove single insert inner vid 81 priority copy-inner service ethernet 5 upstream tcont 5 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 82 priority any remove single insert inner vid 82 priority copy-inner service ethernet 6 upstream tcont 6 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 83 priority any remove single insert inner vid 83 priority copy-inner interface ethernet 1 associate service ethernet 1 associate service ethernet 2	It creates a profile that will use two ONU ports as access on VLAN 10 (internet service) and trunk on VLAN 70 (telephony service). The other two ONU ports will be dedicated to the WiFi service. One tcont per service is created. As in this case there are six services (internet, VoIP, 1 WiFi management VLAN and 3 SSIDs), tconts 1, 2, 3, 4, 5 and 6 were created. By recommendation of Furukawa, there is no bandwidth limitation. So the maximum allowed was used: 1000000 Kbps. Each tcont is related to a service ethernet, which will set up the profile VLANs. Service ethernet 1 configures the Internet VLAN. Service ethernet 2 configures the telephony VLAN. Service ethernet 3 configures the WiFi management VLAN. Service ethernet 4, 5 and 6 configure the SSID VLANs. Then the service ethernet are assigned to the interfaces as indicated in the topology.

interface ethernet 2 associate service ethernet 1 associate service ethernet 2 interface ethernet 3 associate service ethernet 3 associate service ethernet 4 associate service ethernet 5 associate service ethernet 6 interface ethernet 4 associate service ethernet 3 associate service ethernet 4 associate service ethernet 5 associate service ethernet 6	

Following are the settings on the OLT GPON port to apply the profile and enable PoE on the ONU port:

interface red12 onu profile (VOIP-PC)-(VOIP-PC)-WIFI-WIFI onu-index 6 onu poe enable onu-index 6 port 1 onu poe enable onu-index 6 port 2 onu poe enable onu-index 6 port 3 onu poe enable onu-index 6 port 4	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU. Activation of PoE on LAN ports 1, 2, 3 and 4 of the ONU to power the devices.

11 ONU CONFIGURATION FOR SCENARIO 7

The following scenario will use the ONU LW110-44B, ports 1 and 2 will be used for IPTV (VLAN 100) and ports 3 and 4 for APs, which will have WiFi management (VLAN 80 - access (untagged)), WiFi Guest SSID (VLAN 81 - trunk (tagged)), WiFi Management SSID (VLAN 82 - trunk (tagged)) and WiFi NOC SSID (VLAN 83 - trunk (tagged)).

Note: The same settings are valid for the ONU G400B PoE/S2.

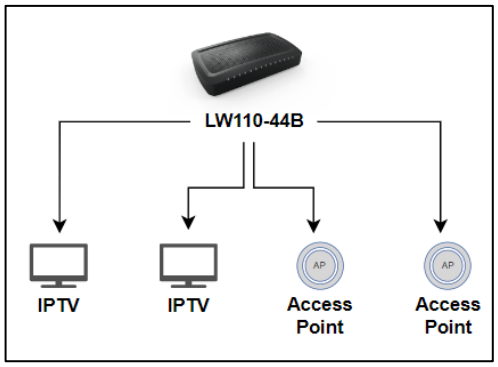

Figure 8: Topology of the scenario 7

onu-profile IPTV-IPTV-WIFI-WIFI tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000 tcont 3 dba cir 256 pir 1000000 tcont 4 dba cir 256 pir 1000000 tcont 5 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 100 priority 0 service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type untagged insert inner vid 80 priority 0 service ethernet 3 upstream tcont 3 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 81 priority any remove single insert inner vid 81 priority copy-inner service ethernet 4 upstream tcont 4 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 82 priority any remove single insert inner vid 82 priority copy-inner service ethernet 5 upstream tcont 5 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 83 priority any remove single insert inner vid 83 priority copy-inner interface ethernet 1	It creates a profile that will use two ONU ports as access on VLAN 100 (IPTV service). The other two ONU ports will be dedicated to the WiFi service. One tcont per service is created. As in this case there are 5 services (IPTV, 1 WiFi management VLAN and 3 SSIDs), tconts 1, 2, 3, 4 and 5 were created. By recommendation of Furukawa, there is no bandwidth limitation. So the maximum allowed was used: 1000000 Kbps. Each tcont is related to a service ethernet, which will set up the profile VLANs. Service ethernet 1 configures the IPTV VLAN. Service ethernet 2 configures the WiFi management VLAN. Service ethernet 3, 4 and 5 configure the SSID VLANs. Then the service ethernet are assigned to the interfaces as indicated in the topology.

associate service ethernet 1 interface ethernet 2 associate service ethernet 1 interface ethernet 3 associate service ethernet 2 associate service ethernet 3 associate service ethernet 4 associate service ethernet 5 interface ethernet 4 associate service ethernet 2 associate service ethernet 3 associate service ethernet 4 associate service ethernet 5	

The following are the settings on the GPON port of the OLT to apply the profile to the ONU:

interface red12 onu profile IPTV-IPTV-WIFI-WIFI onu-index 7	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU.

12 ONU CONFIGURATION FOR SCENARIO 8

The following scenario will use the ONU LW110-44B, port 1 will use the internet service (VLAN 10 - access (untagged)), port 2 will use the projector service (VLAN 40 - access (untagged)), port 3 will use the IP camera service (VLAN 60 - access (untagged)), port 4 will use the WiFi service (VLAN 80 - access (untagged) and VLANs 81,82 and 83 - trunk (tagged)).

All FXS/POTS/RJ11 ports will be used for analog telephony (VLAN 70).

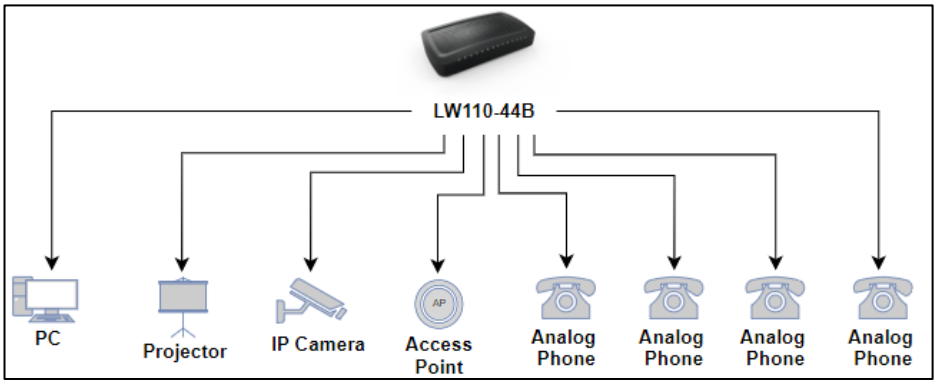

Figure 9: Topology of the scenario 8

Following are the profile settings:

voip-profile FXS codec 1 type pcma packet-period 10 silence-suppression enable codec 2 type pcmu packet-period 20 silence-suppression enable codec 3 type g729 packet-period 30 silence-suppression enable	Creation of the voip-profile, profile responsible for analog telephony settings. In this profile, the CODECs, IP of the telephone exchange and dial-plan are configured.

codec 4 type g723 packet-period 30 silence-suppression enable proxy-server 192.168.70.18 outbound-proxy-server 192.168.70.18 register-server 192.168.70.18 dial-plan table 1 8XX.T dial-plan table 2 3XX.T dial-plan table 3 X.T	The telephony settings must be in accordance with the PABX because a misalignment of these parameters will cause problems in the operation. The dial-plan is responsible for creating telephony features. For example, creating a key for call transfer, setting codes for internal or external calls. To work properly it must be configured the same way in the central office. In this voip-profile is being used 3 dial-plan rules. If other dial-plan rules are used, the last one must always be X.T, according to Furukawa best practices.
onu-profile PC-PROJ-CFTV-WIFI-FXS tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000 tcont 3 dba cir 256 pir 1000000 tcont 4 dba cir 256 pir 1000000 tcont 5 dba cir 256 pir 1000000 tcont 6 dba cir 256 pir 1000000 tcont 7 dba cir 256 pir 1000000 service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0 service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type untagged insert inner vid 40 priority 0 service ethernet 3 upstream tcont 3 switchport mode extended extended-vlan-operation type untagged insert inner vid 60 priority 0 service ethernet 4 upstream tcont 4 switchport mode extended	It creates a profile that will use 3 ONU ports as access, each of which will use a different VLAN according to topology. One port will be used for WiFi service. In addition, the ONU will have analog telephony on all FXS ports. A tcont is created per service (it is not necessary to create a tcont for analog telephony). As in this case there are 7 services, tconts 1, 2, 3, 4, 5, 6 and 7 were created. By recommendation of Furukawa, there is no bandwidth limitation. So the maximum allowed was used: 1000000 Kbps. Each tcont is related to a service ethernet, which will set up the profile VLANs. Then the service ethernet are assigned to the interfaces as indicated in the topology. For the analog telephony service it is not necessary to create a tcont. It is only necessary to create an ip-host service that in this case is receiving IP dynamically in VLAN 70. Em seguida é criado o service voip, nele é alocado o perfil voip-profile.

extended-vlan-operation type untagged insert inner vid 80 priority 0 service ethernet 5 upstream tcont 5 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 81 priority any remove single insert inner vid 81 priority copy-inner service ethernet 6 upstream tcont 6 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 82 priority any remove single insert inner vid 82 priority copy-inner service ethernet 7 upstream tcont 7 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 83 priority any remove single insert inner vid 83 priority copy-inner service voip 1 associate voip-profile FXS service ip-host vlan 70 dynamic upstream cir 1000 pir 1125 interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 2 interface ethernet 3 associate service ethernet 3 interface ethernet 4 associate service ethernet 4 associate service ethernet 5 associate service ethernet 6 associate service ethernet 7 interface pots 1 associate service voip 1 interface pots 2 associate service voip 1 interface pots 3 associate service voip 1 interface pots 4 associate service voip 1	Finally, the voip service was configured on all analog telephony interfaces (POTS).

Segue abaixo as configurações na porta GPON da OLT para aplicar o perfil na ONU e configurar os ramais:

interface red12 onu profile PC-PROJ-CFTV-WIFI-FXS onu-index 8 onu sip 801 display 801 user 801 passwd senha801 onu-index 8 pots 1 onu sip 802 display 802 user 802 passwd senha802 onu-index 8 pots 2 onu sip 803 display 803 user 803 passwd senha803 onu-index 8 pots 3 onu sip 804 display 804 user 804 passwd senha804 onu-index 8 pots 4	Accesses the redundancy interface configuration mode "red12". Applies the profile created in the ONU. It is necessary to set up the extension numbers and define a password for activation of the phone. The configured extensions are the following:: • Configuration of 801 extension on FXS port 1 • Configuration of 802 extension on FXS port 2 • Configuration of 803 extension on FXS port 3 • Configuration of 804 extension on FXS port 4

13 SPECIAL CASES

We have some special topologies that differ a little from the normal use of the equipment, so we separated 3 different scenarios with specific configurations for these scenarios.

13.1 Network definition

To detail the applications used in these specific topologies, the following is a table indicating which VLANs and IP addresses each service has:

SERVICE	NETWORK	MASK	VLAN
PC	192.168.10.0	255.255.255.0	10
WiFi Management	192.168.80.0	255.255.255.0	80
Guest WiFi	192.168.81.0	255.255.255.0	81
Management WiFi	192.168.82.0	255.255.255.0	82
NOC WiFi	192.168.83.0	255.255.255.0	83
Floor 1 WiFi	192.168.84.0	255.255.255.0	84
Floor 2 WiFi	192.168.85.0	255.255.255.0	85
Floor 3 WiFi	192.168.86.0	255.255.255.0	86
Floor 4 WiFi	192.168.87.0	255.255.255.0	87
Floor 5 WiFi	192.168.88.0	255.255.255.0	88
Profinet	192.168.110.0	255.255.255.0	110

13.2 Services definition

For the following table it is possible to check the connection information of each ONU, indicating which equipment is connected to each of the ETH ports and FXS ports of the ONUs:

Scenario	ONU	Port 1	Port 2	Port 3	Port 4
1	FKW0001	AP	AP	AP	AP
2	FKW0002	AP	AP	PC	PC
3	FKW0003	Industrial Lamp	Industrial Lamp	Industrial Lamp	Industrial Lamp

13.3 Profile for more than 8 VLANs

The following scenario will use the ONU G400B PoE S2, where ports 1 to 4 are used for APs, which will have 9 different services for SSID. Furukawa ONUs have a standard limitation of 8 VLANs per ONU, but with this special profile it is possible to configure up to 12 VLANs.

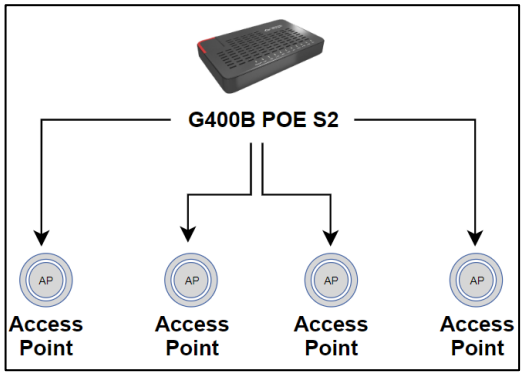

Figure 10: Topology of the scenario for more than 8 VLANs

onu-profile TRONCO tcont 1 dba cir 256 pir 1000000	Creation of the onu-profile TRONCO. In this case the services will share a single T-CONT for upstream traffic.
service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type single-tagged filter inner vid any priority any	Creation of the service that will be associated with the ONU ethernet ports. Association of T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. In this case, every packet with VLAN tag will be allowed in the ONU.
interface ethernet 1 associate service ethernet 1 interface ethernet 2 associate service ethernet 1 interface ethernet 3 associate service ethernet 1 interface ethernet 4 associate service ethernet 1 exit	Service configuration on the ONU LAN ports. In this case the four ports are associated with the ethernet 1 service.
interface red12 switchport mode trunk switchport trunk allowed vlan add 80-88	It is recommended to filter the desired VLANs on the GPON port. In this example VLANs 80 to 88 are allowed. Using the command "switchport trunk allowed vlan add" the desired VLANs will be

	allowed on the GPON port, along with the previously added VLANs.

13.4 Profile using the same VLAN as Untagged and Tagged

The following scenario will use the ONU G400B PoE/S2, ports 1 and 2 will be used for PC (VLAN 10) and ports 3 and 4 for APs, which will have WiFi management (VLAN 80 - access (untagged)), Guest WiFi SSID (VLAN 81 - trunk (tagged)), Management WiFi SSID (VLAN 82 - trunk (tagged)), NOC WiFi SSID (VLAN 83 - trunk (tagged)) and PC (VLAN 10 - trunk (tagged)).

This scenario is special because VLAN 10 is used within the VLANs forwarded to the APs as tagged, and used for computers connected directly to the ONU as untagged.

Note: The following settings are unique to the ONU G400B PoE/S2.

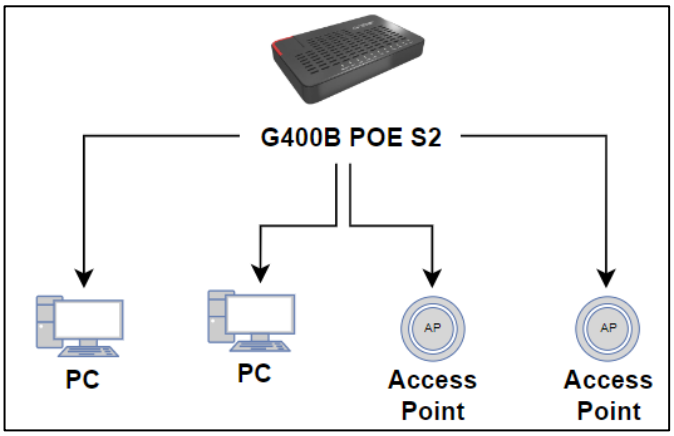

Figure 11: Topology of the scenario with the same VLAN being used as Untagged and Tagged

onu-profile TAG-UNTAG tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000 tcont 3 dba cir 256 pir 1000000 tcont 4 dba cir 256 pir 1000000 tcont 5 dba cir 256 pir 1000000 tcont 6 dba cir 256 pir 1000000	Creation of the onu-profile TAG-UNTAG. It is recommended to have a T-CONT for each service in order to have an independent DBA for upstream bandwidth control. In Laserway networks the maximum allowed value is used by default: 1000000 Kbps. In this case 6 T-CONTs were created.
service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 80 priority 0	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type untagged defines the VLAN treatment for access. The VLAN 80 tag will be added to every untagged packet.
service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type single-tagged	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended.

filter inner vid 81 priority any remove single insert inner vid 81 priority copy-inner	The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. Only packets with VLAN tag 81 will pass through the ONU ethernet port. Packets with other tags will be discarded.
service ethernet 3 upstream tcont 3 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 82 priority any remove single insert inner vid 82 priority copy-inner	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. Only packets with VLAN tag 82 will pass through the ONU ethernet port. Packets with other tags will be discarded.
service ethernet 4 upstream tcont 4 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 83 priority any remove single insert inner vid 83 priority copy-inner	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. Only packets with VLAN tag 83 will pass through the ONU ethernet port. Packets with other tags will be dropped.
service ethernet 5 upstream tcont 5 switchport mode extended extended-vlan-operation type single-tagged filter inner vid 10 priority any remove single insert inner vid 10 priority copy-inner	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. Only packets with VLAN tag 10 will pass through the ONU ethernet port. Packets with other tags will be dropped.
service ethernet 6 upstream tcont 6 switchport mode extended extended-vlan-operation type untagged insert inner vid 10 priority 0	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type untagged defines the VLAN treatment for access. The VLAN 10 tag will be added to every untagged packet.
interface ethernet 1 associate service ethernet 1 associate service ethernet 2 associate service ethernet 3	Accesses the configuration mode of the ONU ethernet port 1.

associate service ethernet 4 associate service ethernet 5 interface ethernet 2 associate service ethernet 1 associate service ethernet 2 associate service ethernet 3 associate service ethernet 4 associate service ethernet 5 interface ethernet 3 associate service ethernet 6 interface ethernet 4 associate service ethernet 6 !	It associates the services created to the ONU port. In this case, VLAN 10 (service ethernet 5) is configured as trunk (tagged). Accesses the configuration mode of the ONU ethernet port 2. It associates the services created to the ONU port. In this case, VLAN 10 (service ethernet 5) is configured as trunk (tagged). Accesses the configuration mode of ONU ethernet port 3. Associates the service to the ONU port. In this case, VLAN 10 (service ethernet 6) is configured as access (untagged). Accesses the configuration mode of the ONU ethernet port 4. Associates the service to the ONU port. In this case VLAN 10 (service ethernet 6) is configured as access (untagged).

13.5 Profile for Profinet and Profibus protocols

The following scenario will use the ONU LW110-44B, ports 1 to 4 are for industrial lamps (VLAN 110). For this case, the Profinet and Profibus protocols use VLAN 0 for operation, so it will be necessary to use a special profile for configuring the ONU.

Note: The following settings are unique to the ONU LW110-44B.

onu-profile PROFINET tcont 1 dba cir 256 pir 1000000 tcont 2 dba cir 256 pir 1000000	Creation of the PROFINET onu-profile. For this case 2 T-CONTs were created for upstream bandwidth control. In Laserway networks the maximum allowed value is used by default: 1000000 Kbps.
service ethernet 1 upstream tcont 1 switchport mode extended extended-vlan-operation type untagged insert inner vid 110 priority 0	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type untagged defines the VLAN treatment for access. The VLAN tag 110 will be added to every untagged packet.
service ethernet 2 upstream tcont 2 switchport mode extended extended-vlan-operation type single-tagged filter inner vid any priority any remove single	Creation of the service that will be associated with the ONU ethernet port. Association of the T-CONT to the service. Configures the VLAN treatment mode as extended. The extended-vlan-operation type single-tagged defines the VLAN treatment for trunk. Packets with

insert inner vid 110 priority copy-inner	PROFINET VLAN tag 0 will be admitted and VLAN tag 110 will be added, keeping the CoS value intact.
interface ethernet 1 associate service ethernet 1 associate service ethernet 2 interface ethernet 2 associate service ethernet 1 associate service ethernet 2 interface ethernet 3 associate service ethernet 1 associate service ethernet 2 interface ethernet 4 associate service ethernet 1 associate service ethernet 2 !	It associates the services to the ONU port. In this case VLAN 110 is configured as access (untagged - service ethernet 1) and as trunk (tagged - service ethernet 2). This is to treat the VLAN 0 tagged packets sent by the PROFINET protocol and add the correct VLAN 110 tag.