OcNOS-SP OLT TiBit

Application Note

Passive Optical Networking (PON) allows for a Point-to-Multipoint connectivity and is used for the last mile access. It uses passive components to divide the fiber bandwidth across access-points. It is robust and consumes less power at low cost points. It has become a hugely popular Access Technology as it provides speeds up to 10G and thus is able to provide Triple Play Services for residential customers. It is comparatively cheap and has high bandwidth connectivity for medium to small scale enterprises. The ability of PON technology to have dynamic bandwidth allocation makes it very lucrative for residential and business customers.

The PON network comprises of largely three components –

- Optical Line Termination system (OLT),
- Optical Network Terminals (ONT/ONU),
- Optical Delivery Network (ODN)

PON technology has been prevalent in the telecommunications industry since 2008. Major ISP's worldwide have ready made ODN distribution systems already in place.

In the recent past however, the bandwidth needs for the end users have been ever increasing, so the older GPON technology has now given way to higher speeds via NGPON and XGPON technologies. creation and Telemetry. OcNOS at the moment does not support IETF data models.

PON TECHNOLOGY	SPECIFICATION	CHARACTERISTICS
APON/BPON (ATM PON/ Broadband PON	G.983	622 Mbits/sec downstream and 155 Mbits/sec upstream
GPON	G.984	2.5 Gbits/sec downstream and 1.25 Gbits/sec upstream
XG-PON	G.987	10 Gbits/sec downstream and 2.5 Gbits/sec upstream
XGS-PON	G.9807.1	10 Gbits/sec downstream and 10 Gbits/sec upstream

An upgrade to the newer technology would necessarily not require the need to upgrade the existing ODN network. Only the OLT and OTN units would need to be upgraded in order to support the new standards to increase the bandwidth.

Besides the standard way of upgrading OLT and ONT units, Open Disaggregated Networking allows for a design to have a flexible OLT pool which can grow as the Customer needs increases. This design relies on using pluggable SFP form factor OLT's which can be plugged into whiteboxes and the OLT instances can be instantiated on the switch. As the number of ONT's increase, more number of these SFP form factor OLT's can be plugged in and more instances of OLT service can be started.

The TiBit SFP is a pluggable SFP+ form-factor, which can run as a 10G EPON MAC or as a 10G XGSP PON switch. It has an in-band administration and monitoring capacity. The power consumption is low and supports external power inputs for operation if required.

Source: https://tibitcom.com/technology/
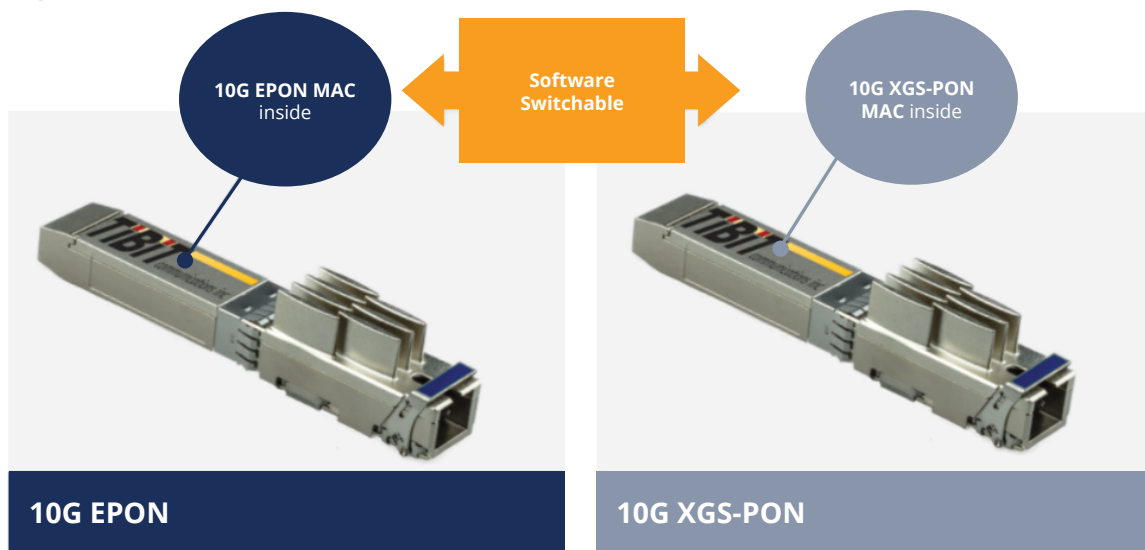
This approach allows an ISP to use a standard low-cost white box and then convert it into an OLT, matching the needs of customers. There is no need for a separate OLT equipment. The bulk of the investment cost between the whitebox and OLT service can be preserved as the whitebox can be provisioned for multiple other uses by enabling various other services. For ISP's planning to add more number of ONT's, the whiteboxes can be used as end point aggregation OLT service.

This proves to be very cost-effective for the Service provider.
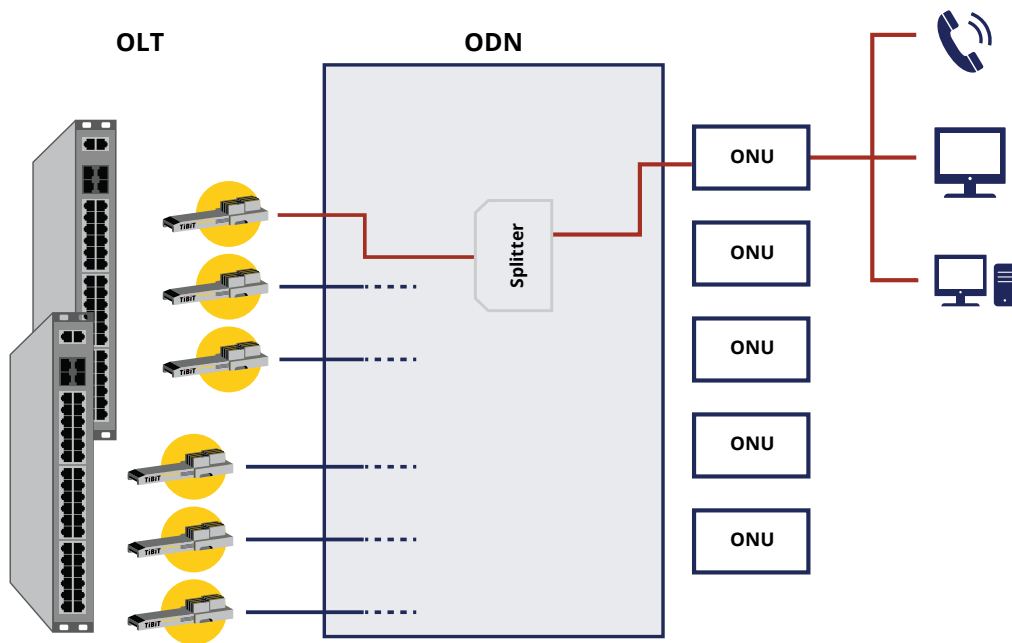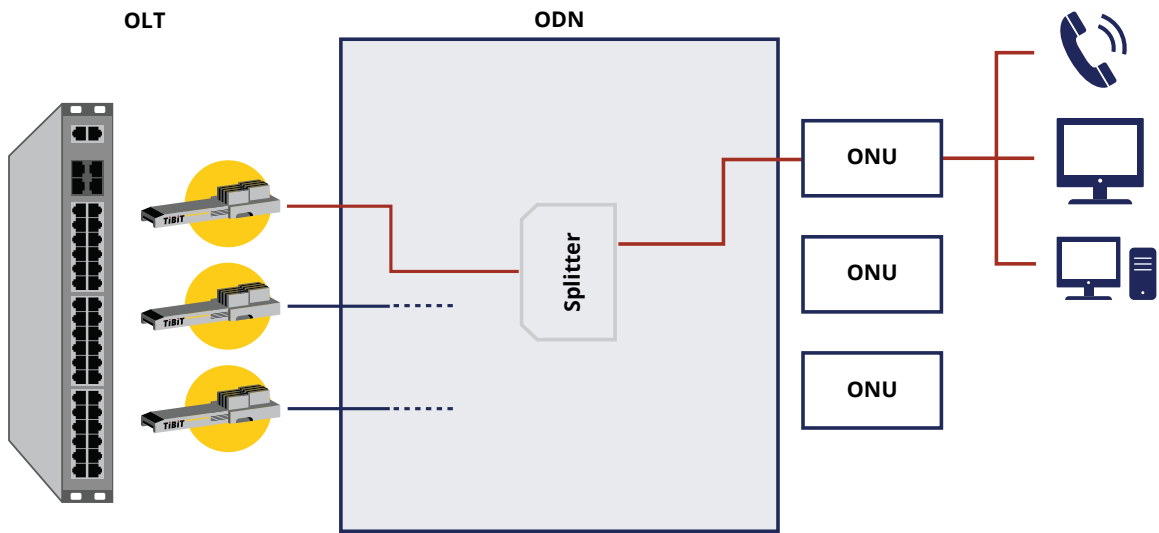
Adding capacity by stacking whitebox switches.

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Use Case Description

There are several approaches available for using the OLT SFP PON solution. All of them belong to either one of these categories;

1. FTTH (Fiber To The Home): a residential ONT that does not include residential gateway features.
2. FITH (Fiber Into The Home): a residential ONT that is combined with residential gateway features.
3. FTTO (Fiber To The Office): a business ONT dedicated to a single business customer feeding appropriate CPE.
4. MDU (Multi-Dwelling Unit): a multi-user residential ONU (FTTP/FTTC) architecture.
5. MTU (Multi-Tenant Unit): a multi-user business ONU (FTTP/FTTC) architecture.

All the above architectures have in common the ONT termination unit at the access point location. From the OLT perspective, the difference lies in the treatment of the ONT traffic flows. In cases where there are multiple flows being handled the OLT should be able to distinguish the flows separately and should be able to bundle them in Traffic groups (T-CONT's).

T-CONT: A traffic bearing object within an ONU/ONT that represents a group of logical connections, and is treated as a single entity for the purpose of upstream bandwidth assignment on the PON. In the upstream direction, it is used to bear the service traffic. Each T-CONT corresponds to a service traffic of one bandwidth type

Notably, in the case of deployment for MTU's/MDU's, the ONT termination can serve different access technologies and connect to the CPE(Customer Premises Equipment) device or RG(Residential Gateway). This allows to reuse the existing CPE/RG providing a service definition like DSL end to end, where the last mile is served by PON technology.
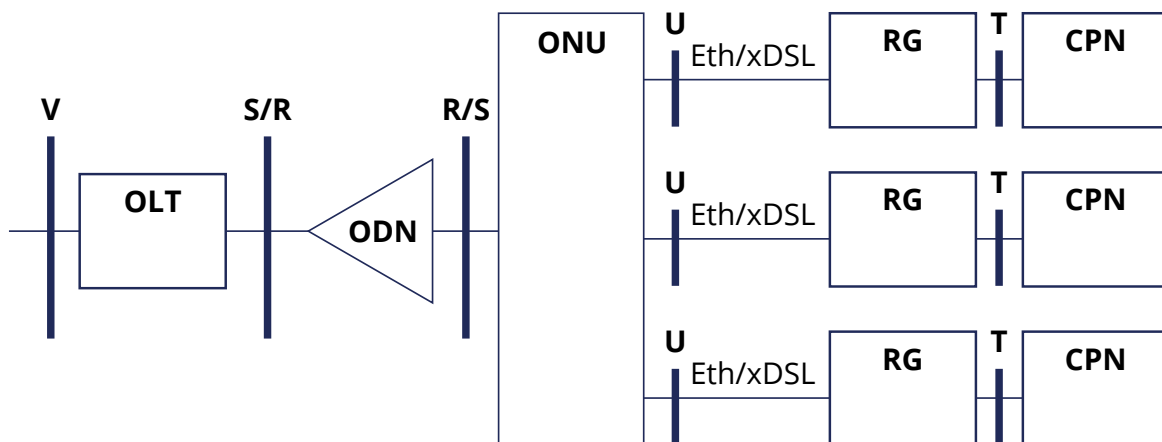
Refer: www.broadband-forum.org

The **R/S** reference point represents the OLT facing ONT interface. The **S/R** reference point represents the Optical Distribution Network (ODN) connecting GPON interface on the OLT. The S/R and R/S interfaces contain all the protocol elements necessary to allow communication between OLT and one or more ONTs over ODN.

Few use-cases are described below.
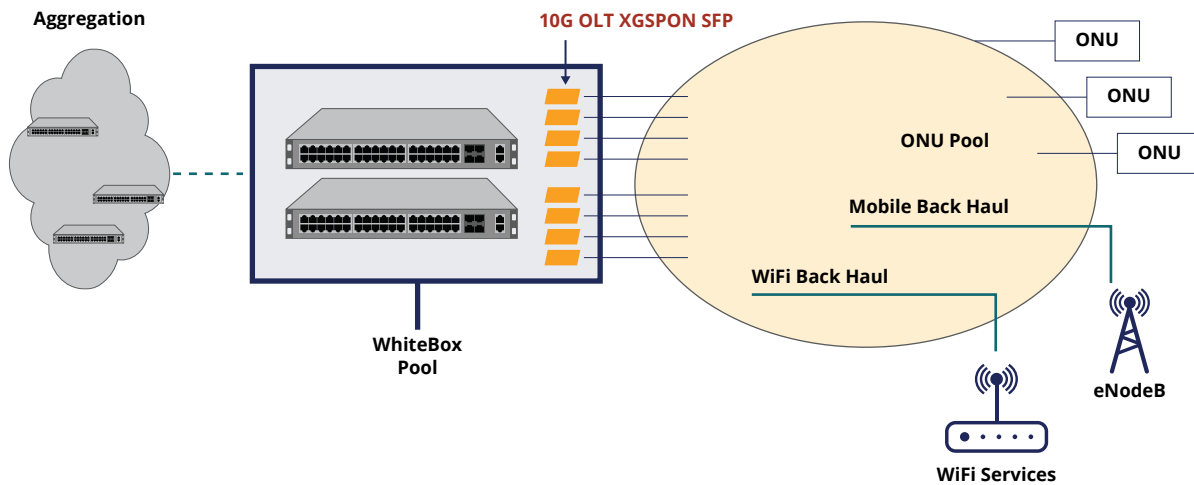
Campus Interconnect:

For Campus Interconnects across buildings and offices, using a regular white box helps in adding a higher capacity interconnect using a PON network. The bandwidth can possibly reach up to 10G of Point-to-Point connectivity, with distance reachability of about 20km.
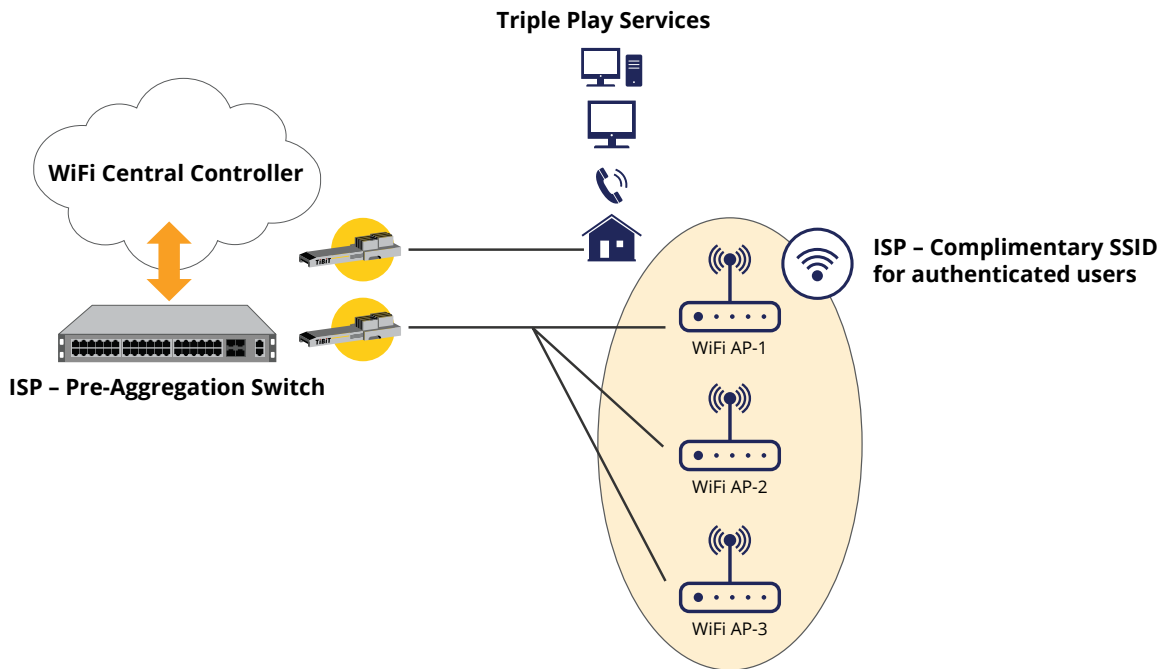
Designing a flexible solution using a pluggable OLT saves the upfront cost to purchase dedicated OLT equipment. Further, the option to split the PON to Point-to-Multipoint, the number of end point connections can be increased and more users can be added, as each OLT can support up to 128 ONU's.

In cases where the campus is already using dedicated incumbent OLT's for interconnects but with GPON technology, and now is in need for selected increased bandwidth capacity of up to 10G, a whitebox switch can be added and tied up with a pluggable OLT SFP to provide the service. This again saves cost and provides incremental increased bandwidth without the need to invest in dedicated higher capacity OLT equipment.

Wi-Fi Access Services:

Service Providers can opt to offer Wi-Fi Hotspot Services at locations covered and reachable via fiber. It can be provided as a value-added service beyond the Triple Play Services for residential customers.

PON technology allows the operators to control traffic and bandwidth being allocated for services to a customer. This would allow for Service Providers to offer features like complimentary Wi-Fi services and yet ensure the traffic is controlled and secure. With the advent of centralized Wi-Fi controllers being virtualized, the PON connectivity to the Wi-Fi access point becomes more cost efficient and services driven.

Triple Play Services

WiFi Central Controller

ISP – Complimentary SSID for authenticated users

WiFi AP-1

WiFi AP-2

WiFi AP-3

ISP – Pre-Aggregation Switch

Configuration steps:

The basic config steps involve:

a) Creating a ONU profile – which includes GEM port configs, T-Cont configs, UNI ports

b) Creating a NNI profile – here we identify the OLT instance and NNI configurations

c) Creating a translation profile – this identifies a flow and modifies the VLAN and P-bits as per the configs

d) Creating QOS profile – here we specify the upstream and downstream

e) Creating a flow – here we tie up the UNI, Translation, NNI, QOS profile.

```
onu-profile profile-name FTTB_ALPHA_ONU
  uni port-id 2
    gem-port-name gem26 p-bits 6 upstream-priority-queue 6 downstream-priority-queue 6
    gem-port-name gem24 p-bits 4 upstream-priority-queue 4 downstream-priority-queue 4
    gem-port-name gem20 p-bits 0 upstream-priority-queue 0 downstream-priority-queue 0

t-cont tcont-20
    gem-port-name gem20
 t-cont tcont-24
    gem-port-name gem24
 t-cont tcont-26
    gem-port-name gem26
!
```

```
translation-profile profile-name cvlan120_p4
  classification
   vlan-type tagged vlan-id 120 p-bits 4
  treatment
   p-bits 4 operation remove-vlan
 !
```

```
qos-profile profile-name 500Mbps
  downstream
    cir 500 mbps pir 501 mbps pbs 1 kbytes
  upstream
    cir 500 mbps pir 501 mbps
  !
```

```
flow-id 154
  uni
    onu-id 2 uni-port-id 2 vlan-tag 154 translation-profile-name cvlan120_p4
  nni
    olt-id 0 nni-port-name nni0/0/1
  qos
    qos-profile-name 500Mbps
  !
```

Platforms validated with Tibit SFP+

OcNOS supports Tibit on the following switching platforms:

SWITCH	PORT CAPACITY	ASIC/CPU
Edgecore AS5912-54X	• 48 x 10GSFP+ • 6 x 100G QSFP28	• Intel Atom C2538 (4 x 2.2 GHz cores) • Qumran-MX
Edgecore AS7316-26XB	• 16 x 10G SFP+ • 8 x 25G SFP28 • 2 x 100G QSFP28	• Intel Broadwell-DE D-1519 1.5G 4Core • Qumran-AX
UfiSpace S9500-30XS	• 20 x 10G SFP+ • 8 x 25G SFP28 • 2 x 100G QSFP28	• Intel® Broadwell-DE D-1519 1.5G 4-Core • Qumran-AX
UfiSpace S9500-22XST	• 4 x 1G Base-T (RJ45) • 8 x 10GSFP+ • 8 x 25G SFP28 • 2 x 100G QSFP28P	• Intel® Broadwell-DE D-1519 1.5G 4-Core • Qumran-AX

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