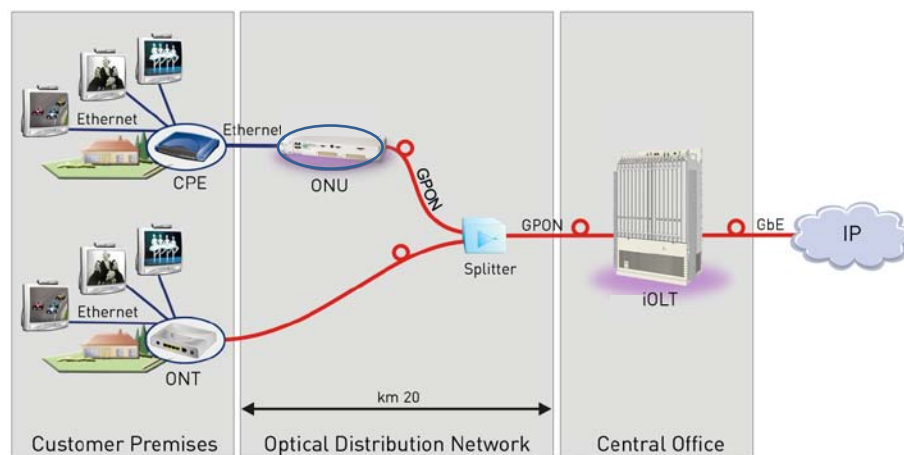


GPON Access Services

Nowadays there are two kinds of technology for FTTx solution; active and passive optical network. The former applies active devices like layer2/3 switches as main elements for connecting users in network via optical fiber, whereas the latter uses passive equipments e.g. splitter to distribute optical network to users. This article focuses on the Passive Optical Network (PON) which have several technique. Today the most interesting one shall be Gigabit-capable Passive Optical Networks (GPON).

The core of the GPON architecture is the point-to-multipoint (P2MP) concept. Instead of stretching a set of fiber optic lines from a CO to each user, a single line is brought to the user area and split into multi-users. This approach, illustrated in the following figure, enables a large number of users to share the fiber optic advantages with minimal investment in infrastructure.



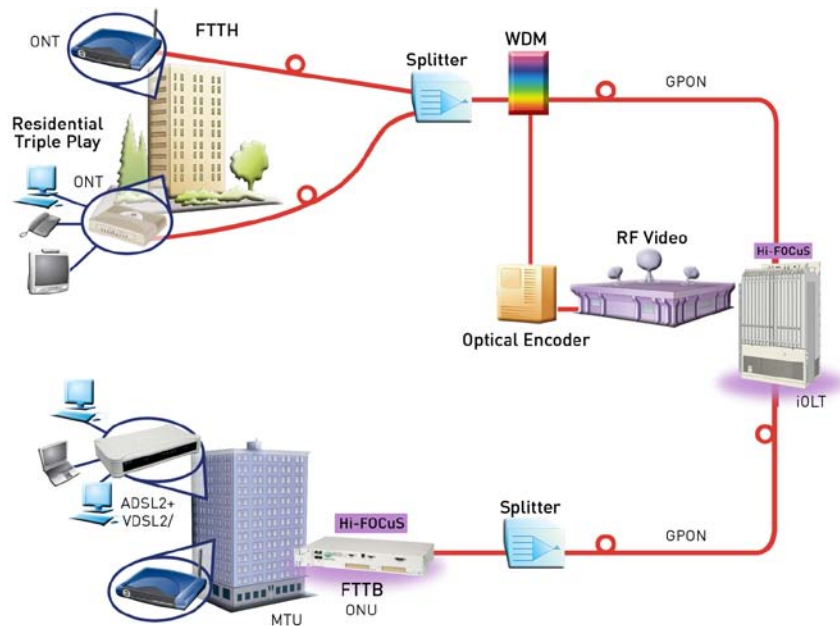
A generic PON network consist of the following elements:

- **OLT:** Aggregates GPON traffic towards the IP network over multiple GbE or 10 GbE links.
- **ONT:** Device located at the premises to convert the optical data signal to Ethernet. Typically used in FTTP and FTTH deployments.
- **ONU (Optical Network Unit):** Device that terminates the optical fiber and connects to multiple end users. Typically located in the basement or curb and used for FTTN, FTTC, and FTTB deployments.
- **ODN (Optical Distribution Network):** Composed of fibers and splitters connecting the OLT to ONU and ONT units. Splitters are passive, splitting the power received from the OLT fiber to all downstream fibers.

The OLT aggregates GPON traffic toward the IP networks via GbE or 10 GbE ports. The downstream GPON traffic is carried over a 1490 nm wavelength and upstream traffic over a 1310 nm wavelength.

GPON Termination Equipment Types

The following figure illustrates the variety of GPON terminating options available for various user applications:



Terminating options include:

- Single Family Unit (SFU), supporting POTS, Ethernet ports, RF Video, and Wi-Fi
- Single Business Unit (SBU), supporting E1/T1 trunks
- Cellular Backhaul Unit (CBU), targeted for cellular backhaul applications with 2G/3G collocation, providing full support for ATM and TDM pseudowires
- Multiple Dwelling Unit (MDU), extended SFU
- Multiple Tenants Unit (MTU), extended SBU
- Optical Network Unit (ONU), supporting Ethernet or xDSL2 over the subscriber local loop physical access

Optical Distribution Network

The ODN provides the optical pathways by which the OLT communicates to multiple ONU and ONT terminals. The ODN is implemented as a single-fiber P2MP tree and branch configuration based on an outside plant infrastructure of passive optical cables and splitters with no active electrical components (ITU-T G.984). This passive ODN serves as the physical network transporting optical coded information from the network down to the customer and vice versa. Broadband traffic is carried simultaneously over the single strand of ODN fiber in three different frequencies: downstream data traffic at 1490 nm, upstream data traffic at 1310 nm, and an optional downstream RF video traffic overlay at 1550 nm.

The benefits of passive ODN include:

- CO serving area coverage is expanded to reach distant customers, thus allowing CO site consolidation.
- Reduction of operation maintenance costs due to:
 - Reliability of the passive ODN, cables, and splitters significantly improving the dependability of traditional copper outside plant and active electrical components.
 - Reduction of power consumption.
- Better future-proof access network:
 - Passive fiber infrastructure inherently supports smooth future BW upgrades.
- Improved hardiness with passive fiber optic networks less sensitive to harsh environmental conditions and electromagnetic interference phenomena.

Deployment Distance in PON Networks

Two main types of optical budgets are used in GPON networks:

- Class B+ defines a 28.5 dB budget
- Class C+ defines a 32.5 dB budget (including FEC gain)

Customer deployment distance depends on the number of customers per PON and the number of splices and connectors in the path.