

Prospects and Problems of FTTx Deployment in Bangladesh by GPON Technology

Md. Hayder Ali and Mohammad Hanif Ali

Data growth in the Bangladeshi telecom market has reduced the prominence of traditional wire line broadband technologies such as digital subscriber line and cable modem. These technologies are not efficient enough to meet the customers' demand for high-bandwidth applications such as high-speed internet access, video-on-demand, high definition TV, IPTV and online gaming. In this scenario, fibre-to-the-home (FTTH) technology, which offers advantages like high bandwidth capacity and the delivery of high speed, high quality and multi-play services (data, voice and video) through a single channel, presents a strong business opportunity for telecom operators. Gigabit Passive Optical Networks (GPON) is a burning technology in the world. Full Service Support, including voice (TDM), Ethernet, ATM, leased lines, and others. Strong Operations, Administration, Maintenance, and Provisioning (OAM&P) capabilities offering end-to-end service management. GPON not only provides substantially higher efficiency as a transport network, but also delivers simplicity and superb scalability for future expansion in supporting additional services. To deploy FTTx Network by GPON technology has some obstacle but it has good flavor. GPON technology is cheaper than typical Ethernet Network. Sometimes it (GPON) saves more than seven to Eight times cost then Ethernet. Not only the developed country but also the developing country like, India, Bangladesh, Bhutan are using GPON technology.

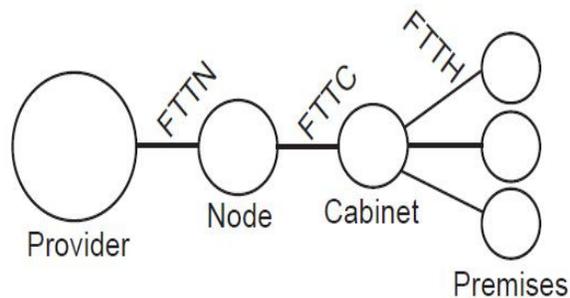
Keywords: LDP (Local Distribution Point), BDB (Building Distribution Box, OLT (Optical Line Terminal), ONU (Optical Network Unit), ONT (Optical Network Terminal),

1. Introduction

Fiber to the x (FTTx) is a generic term for any broadband network architecture using optical fiber to replace all or part of the usual metal local loop used for last-mile telecommunications. Fiber to the x (FTTx) is a collective term for various optical fiber delivery topologies that are categorized according to where the fiber terminates. Fiber access is one of the most important technologies in the next generation network. It increases the access layer bandwidth and builds a sustainable-development access layer network. OAN (Optical Access Network) adopts technologies: active point-to-point (P P) Ethernet and passive optical network (PON). There are many common subsets of FTTx like- FTTN (fiber to the node or fiber to the neighborhood), FTTC (fiber to the curb or fiber to the cabinet), FTTP (fiber to the premises), FTTB (fiber to the building or fiber to the basement), FTTH (fiber to the home) etc.

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Figure1: Open Access Network Structure (FTTx)

In this above figure-1 shows that if Splitted fiber directly goes to client Node/Premises/ Home then client will enjoy the device dedicatedly and if splitted fiber goes to Building's basement then from ONU/ONT client will enjoy their connectivity by short UTP cable.

Section 1 present an introduction about the paper while a brief about gpon technology is stated at section 2. How gpon technology works is briefly described at section 3 and how gpon technology enhanced day by day is stated at section 4, a passive FTTx network design is stated at section 5 while challenges for deploying FTTx networks stated at section 6, a comparison between ethernet network vs FTTx network is given at section 7, a cost comparison between ethernet connectivity and FTTx connectivity is stated at section 8, at section 9 properties of FTTx is stated while major conclusion about this is stated at section 10.

2. GPON Technology

GPON or Gigabit Passive Optical Network is an optical technology based on the industry standard ITU-TG.984x which was ratified in 2003. This technology was originally developed to provide high speed Ethernet services for residential and small business customers. It supports higher rates, enhanced security, and choice of Layer 2 protocol (ATM, GEM, Ethernet). A **passive optical network (PON)** is a point-to-multipoint, fiber to the premises network architecture in which unpowered optical splitters are used to enable a single optical fiber to serve multiple premises, typically 16-128. A PON consists of an optical line terminal (OLT) at the service provider's central office and a number of optical network units (ONTs, ONUs) near end users. A PON reduces the amount of fiber and central office equipment required compared with point-to-point architectures. A passive optical network is a form of fiber-optic access network.

3. How GPON Technology Works

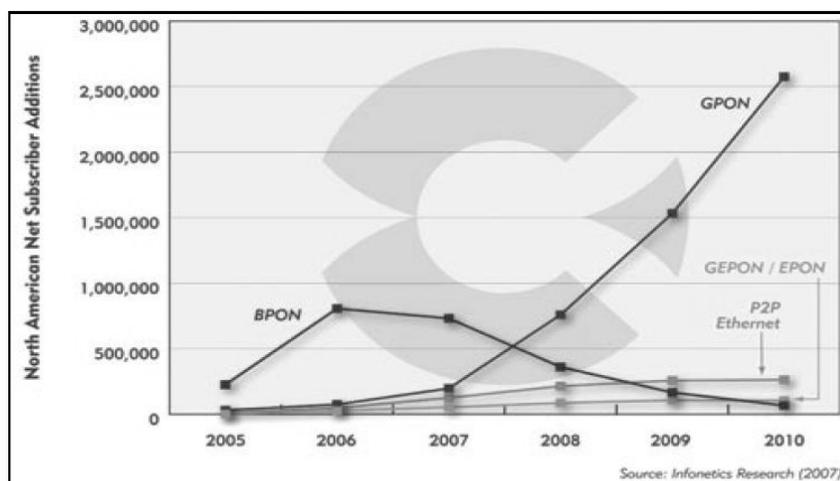
GPON has a downstream capacity of 2.488 Gb/s and an upstream capacity of 1.244 Gbp/s that is shared among users. Encryption is used to keep each user's data secured and private from other users. Although there are other technologies that could provide fiber to the home, passive optical networks (PONs) like GPON are generally considered the strongest candidate for widespread deployments. It

provides unprecedented bandwidth (shared by up to 128 premises), and a greater distance from a central office (20 to 40 kilometers), allowing service providers to enable bandwidth-intensive applications and establish a long-term strategic position in the broadband market. Enterprise GPON is also a carrier class technology that provides a high level of Quality of Service (QOS) 99.999% for those customers with mission-critical requirements. GPON manufacturers are now working on devices that will allow up to 10Gbps on bandwidth. As a result, a new standard known as G987 or also known as 10-PON has 10 Gbit/s downstream and 2.5 Gbit/s upstream – framing is “G-PON like” and designed to coexist with GPON devices on the same network. This is great news for data network managers looking for low-cost, high-bandwidth, networking technologies in order to keep up with the demands on data applications and growth including “cloud” services. By GPON Technology service provider could provide several services to its customers like- IP TV, Voice (VoIP), Video, Data Connectivity, Internet connectivity, value added service (Online gaming, Social networking, Video on Demand etc) and other services.

4. GPON Technology Is Enhanced Day by Day

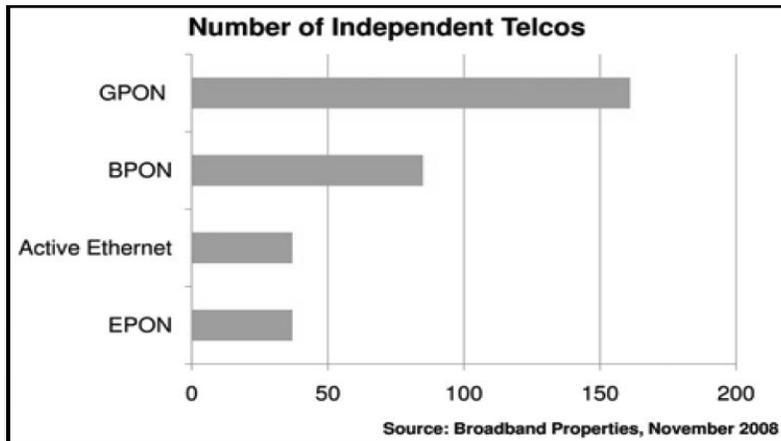
In North America, service providers’ decisions about technology standards have been whittled down to two: GPON and point-to-point (also described as P2P or active Ethernet). Most third-party market research firms have projected that GPON will account for more than 80 percent of all North American FTTH deployments over the next few years, with P2P accounting for 10 to 15 percent of deployments. A potential third choice, BPON, is quickly fading away as Verizon and others shift from BPON to GPON.

Figure 2: Comparison between GPON, EPON, BPON and Ethernet Connectivity.



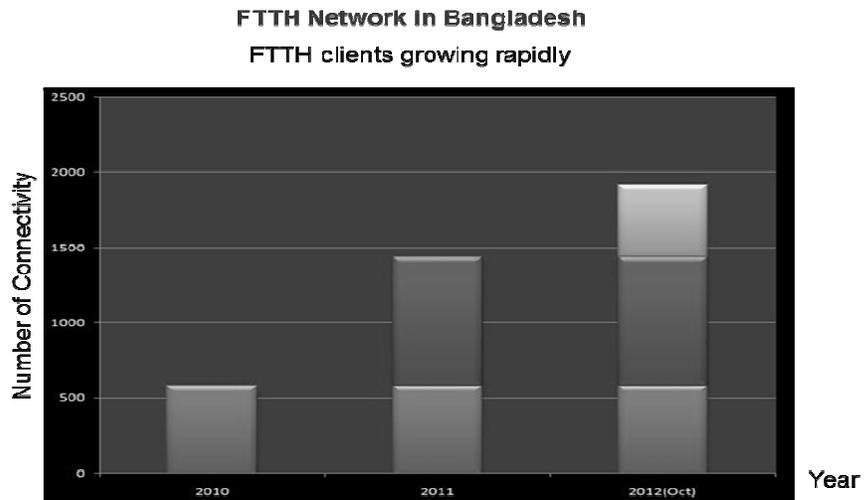
A potential fourth choice, EPON, which has proven the most popular standard in the Asian market, has never gained much momentum in North America. A separate study by Broadband Properties of independent telcos in the US found a similar trend in the adoption of FTTH technologies.

Figure 3: Independent telcos and GPON technology



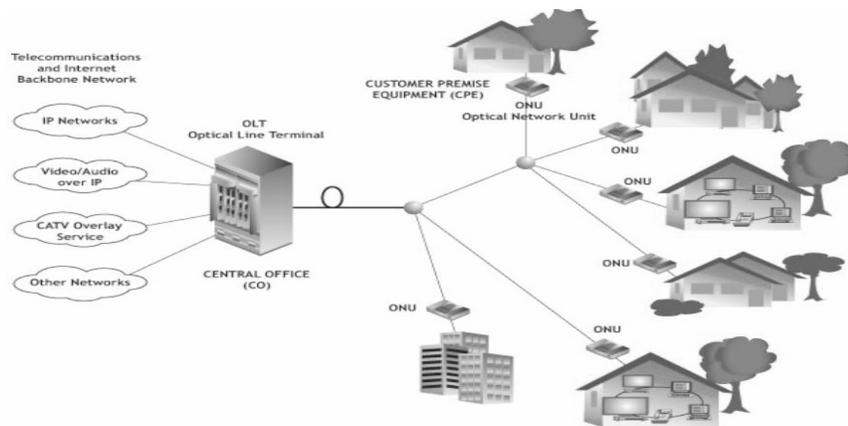
Bangladesh is also growing up with GPON technology day by day. It's GPON clients are growing rapidly. Bangladesh Company starts to deploy FTTx Network by Fully underground optical fiber in 2009 and they have covered Mohakhali DOHS, Motijheel Commercial Area, Niketon residential area, Banani, Mirpur, Dhanmondi, Gulshan, Uttara area by FTTx Network.

Figure 4: FTTx Connectivity in Bangladesh



Bandwidth usages are also increasing day by day for GPON technology users for Bangladeshi users. They are more interested to enjoy GPON's flavor now.

Figure 7: FTTx Network

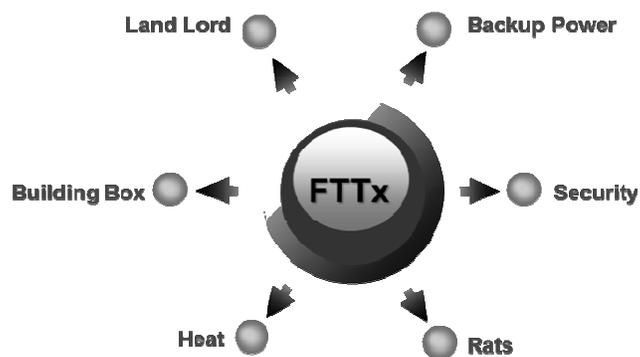


In the above figure-6 and 7 show that from service provider's central office (CO) PON port (to Downstream) directly goes to LDP. In LDP there is IN-ODF and OUT-ODF. PON port directly enters to the IN-ODF. From IN-ODF, PON port enters in to the OUT-ODF. From OUT-ODF, PON port enters to the Splitter (Generally 1:32). From Splitter, Splitted fiber directly goes to the client's Building/ Home/Premises etc.

6. Challenge to Deploy FTTx Network in Bangladesh

Practically there is huge obstacle to deploy FTTx Network in Bangladesh. Most of them are shown by the bellow figure.

Figure 8: FTTx Deployment Problem



Land Lord Problem: Most of the Land Lords are not agree to put ONT in their building premises. Most of them think it as an extra hassle. But now a day's awareness is growing, most of them are realized the good sides of GPON technology and some of house owner are willingly request the put BDB in their Building Premises.

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Power Backup Problem: Commercial power backup is another big challenge for FTTH service providers. An ONT consumes very little electrical power. If an ONT get on 24 hours of a month. It will cost only 0.60\$ to 1\$. But in our country, most of house owner/ Land lord are not agree. In Bangladesh load shading is a regular matter; during load shading client will not be able to get service. But now a day most of client get power backup from their own UPS or IPS.

Building Distribution Box Problem: Most of land lord is not agreeing to install a BDB in his building. After BDB box installation, sometimes BDB key is broken by thief or bad peoples.

Security: Security is another concern issue for FTTx Deployment. Bad peoples are always bad, they steal ONTs, BDBs sometimes fiber.

Heat: In case of Asian country like Bangladesh, heat is a major problem for ONTs. Sometimes service providers have to install ONTs in outdoor. After some months it goes damage due to heat and dust.

Rats: Sometimes patch cords are cut by rats. Practically Bangladeshi company has faced this type of problem continuously.

Weak Planning for Deployment: The process of laying fiber involves securing approvals from multiple agencies, which is a key challenge. The lack of government intervention in addressing this issue is a major roadblock.

The governments in countries such as Finland, Germany and Singapore have been instrumental in facilitating the roll-out of FTTH networks. For instance, in Germany, the Munich government has laid an underground duct system, which can be used by all utility service providers including telecom operators to provide services to customers. The Singapore government has made it mandatory for every household to allow access to operators for deploying fiber infrastructure. Such initiatives requiring the involvement of municipal corporations have not been taken in Bangladesh.

Lack of Consumer Awareness: The limited uptake of FTTH services is as big a challenge as the deployment of the service infrastructure. Besides the high cost of these services, the lack of relevant content to be delivered through these networks has weakened the business case for FTTH deployment in Bangladesh. However, entertainment offers high potential for these services. High speed infrastructure such as FTTH needs to be supported with relevant applications and content in order to encourage users.

To Deploy FTTX in Bangladesh There are Some Other Problem Like-

- Charges for laying fiber in towns and cities are very high.

-The return on investment in FTTH networks is realized only when a subscriber uses services at the connected location. The returns are impacted when subscribers shift from their location as unlike wireless connections, the FTTH network deployed at

premises remains idle until the next user occupies it. Wireless connections allow operators to provide services to customers irrespective of their location.

- The high cost of the related consumer premises equipment and optical network terminals is another challenge. Currently, most of this equipment is imported, which accounts for a significant part of overall costs.

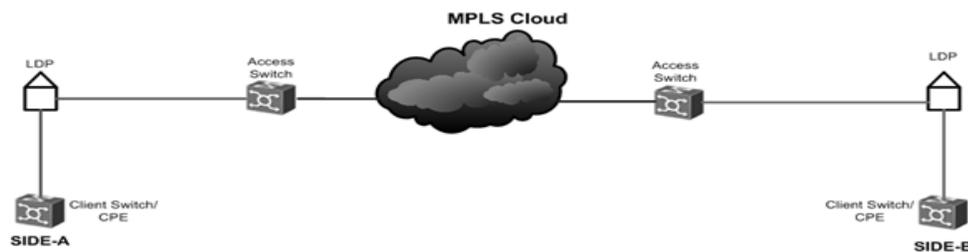
- The efficient transportation of the huge bandwidth, selecting the FTTx access mode and design, ensuring quality of experience for multi-play services, fiber resource saving, long distance coverage, reliable fiber transporting and rational planning of the optical distribution network.

- Currently, the RoW within housing projects or resident welfare associations is controlled by the builder, which generally gives access to one or two operators. Rolling out FTTH in these areas is viable for an operator, if it is guaranteed a subscriber base. Otherwise, competition from other operators reduces the maximum penetration an operator can expect.

7. Ethernet Network vs FTTX Network

GPON is the most advanced PON protocol in the marketplace today, offering multiple-service support with the richest possible set of OAM&P features. It offers far higher efficiency when compared to ATM- and Ethernet-based PON technologies. GPON also offers the lowest cost for all modes of operation. Not only is the system cost itself expected to be lower as no external adaptation is required, but exceptionally higher efficiency also leads to more "revenue bits" from the same system, i.e., a much shorter payback period. Traditional Ethernet connectivity is like bellow figure.

Figure 9: Ethernet Connectivity



A comparison between Ethernet connectivity and FTTx connectivity.

Figure 10: Ethernet Vs FTTx Connectivity

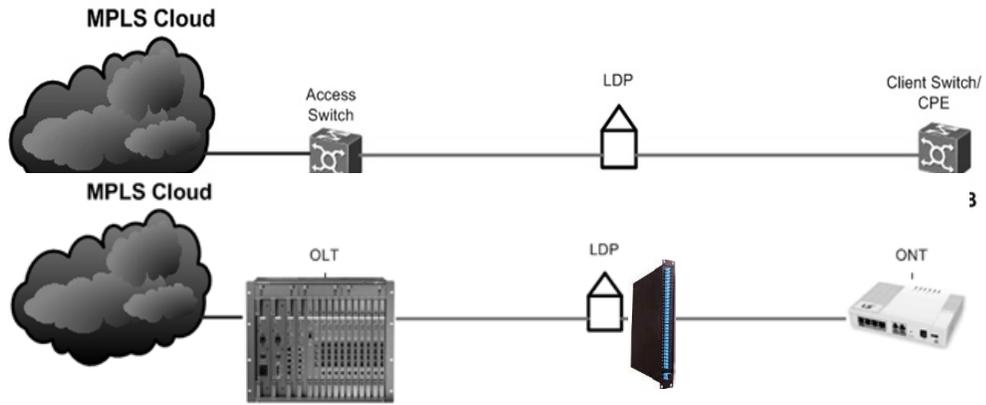
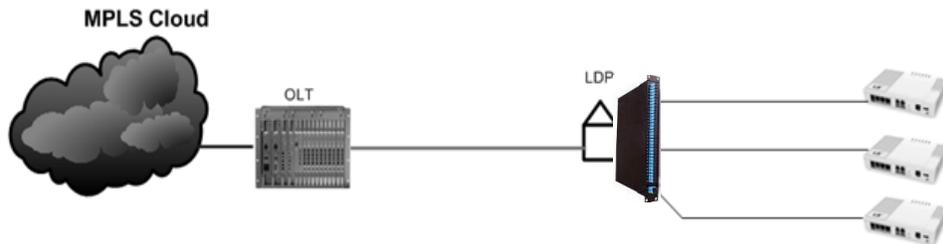


Figure 11: FTTH Connectivity

Fiber To The Home connectivity.



8. Cost Comparison

The cost comparison between Ethernet Connectivity and FTTx Connectivity is given below. From the below table is clearly understand that FTTx Connectivity is cheaper than the traditional Ethernet connectivity. An approximation is given below-

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Table 1: Ethernet Connectivity Cost Analysis

Ethernet Connectivity Cost: Passive Device (OSP)		
Particulars	Cost (BDT)	Remarks
Patch Cord: Switch Port to LDP	400.00	20M Patch Cord Price
ODF Cost at CO	381.00	144 Port ODF: 55000TK
Space Cost at CO	17.00	42U Open Rack: 9000TK. Considering 2U Price: 428 1U for ODF and 1U for Switch
U/G Fiber: CO to LDP	27,777.00	Considering 216 Core Cable Average Distance OLT/ODF to Splitter: 4,000 Meter Underground Fiber cost/Meter: Tk. 1,500.00 (consisting of 216 core Fiber, Duct & Fiber laying cost)
ODF Cost at LDP/Port	341.00	24 Port ODF: 8200TK Considering pigtail and adapter
LDP Space Cost/Port	83.00	1U LDP Space: 2000TK
ODF Installation Cost/port	41.00	1U ODF Installation:1000TK
Per Connectivity Cost	29,043.00	

Table 2: FTTx Connectivity cost analysis

FTTx per Client Cost (Head-End):			
Particulars	Unit Price (USD)	Qty	Sub Total Cost (USD)
OLT Chesis including dual power	1,420.00	1	1,420.00
Packet switching and CPU management	2,185.00	2	4,370.00
8-port GPON ports with SFP type line Card	7,801.00	8	62,408.00
2 Port Gigabit Ethernet Unit	79.00	1	79.00
PON SFP Module	320.00	64	20480.00
GE Uplink SFP Module	120.00	2	240.00
		Total Cost (USD):	88997.00
		Per Client Cost: 1:32 in BDT	2,890.00
		Per Client Cost: 1:64 in BDT	1,445.00

Table 3: Cost Calculation for FTTH Connectivity

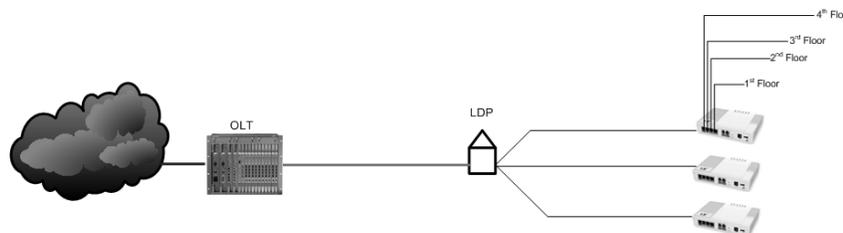
	Central Office	OSP – Fiber Optic	CPE	Total Cost
GPON	63.44 % (Less)	91.75 % (Less)	118.5 % (Higher)	44.40 % (Less)

Table 4: Cost Calculation for FTTB Connectivity

	Central Office	OSP – Fiber Optic	CPE	Total Cost
GPON	90.86 % (Less)	97.94 % (Less)	51 % (Less)	84.34 % (Less)

Fiber To The Building or Premises connectivity and it's cost comparison.

Figure 12: FTTB Connectivity



9. Prospects of FTTX

There is huge benefit of FTTx over Ethernet. Like-

- Low cost
- It is a single fiber to the end user, providing revenue-generating services with industry standard user interfaces, including voice, high-speed data, analog or digital CATV, DBS, and video on demand.
- Faster than others like DSL, Dial Up
- Fiber has a virtually unlimited bandwidth coupled with a long reach, making it "future safe," or a standard medium that will be in place for a long time to come [source: ICT Regulation Toolkit].
- A single copper pair conductor can carry six phone calls. A single fiber pair can carry more than 2.5 million phone calls simultaneously [source: Federal Communications Commission].
- Easy to troubleshoot.
- FTTH features local battery backup and low-power consumption.
- FTTH is reliable, scalable, and secure.
- The FTTH network is a future-proof architecture.
- It is a passive network, so there are no active components from the CO to the end user. This dramatically minimizes the network maintenance cost and requirements, as well as eliminating the need for a DC power network.

10. Conclusion

FTTH networks' ability to deliver high bandwidth has made investments in this infrastructure very important for operators. They are increasingly deploying FTTH technology to complement their wireless networks. Spectrum crunch is another major factor that has led operators to look for viable alternative mediums. Also, to achieve the broadband targets set by the government under the National Telecom Policy, it will be important to drive FTTH growth along with other technologies. GPON, through the Generic Framing Procedure (GFP)-based adaptation method, offers a clear migration path for adding services onto the PON without disrupting existing equipment or altering the transport layer in any way. In contrast to both APON and EPON--which require a specific adaptation method for each service and the development of new methods for emerging services--the core foundation of GPON is a generic adaptation method, which already covers adaptation schemes for any possible service. In conclusion it could conclude that FTTx Connectivity is more efficient than Ethernet connectivity. It is possible to provide 7/8 FTTx Connectivity by the cost of one Ethernet connectivity.

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