A COMPREHENSIVE REVIEW OF DIFFERENT FTTH CONFIGURATION AND FEATURES OF DIFFERENT PON NETWORK

Abstract

FTTH(Fiber to the habitat) is an optical fiber network architecture that use dedicated optical fiber to the subscriber end. Due to its long distance high speed and it is widely used in corporate, commercial as well residential purpose. Because of PON Architecture it is cost efficient also.

Keywords: ONU, FTTH, RU, OLT, ASE, PON, AON.

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I. INTRODUCTION

FTTH (NGPN) stands for fiber to the habitat(next generation play networks). As the name depicts it uses the optical fiber to the consumer end. As demand for expeditious web is the key reason for the recent retrieve technologies, Yet, dated technologies like DSL (Digital Subscriber Line) and wire modem, which are frequently used for broadband access and have MBPS speeds, are unable to meet the demands of modern customers for high bandwidth applications like HDTV because of a variety of factors, including distance from the local exchange and copper cable quality[1]. fast web access,IPTV,broadband delivered, gambling games and electronic learning etc.

This technology has a variety of advantages over the traditional technologies like it provides unlimited bandwidth and long distance reach. , It uses a single fiber to deliver several services (phone, video, and data, among others). Long-distance communication has historically made use of optical fiber lines.

As the demand increase for the high speed internet and high bandwidth with stability by the businesses and by the education department and by general households works in recent years the need of optical fiber cable has increased.

II. FTTX(FIBER TO THE X)

Depending on the type of fiber network—passive network (point to multipoint) or active network (point to point)—and the termination point—building (fiber to the building), habitats (fiber to the habitats), curb (fiber to the curb), etc.—fiber networks can be arranged in a variety of ways.

So, there is various type of FTTX architecture to take into account FTTH, FTTB and FTTC each one have their different configuration and characteristics.

1. **FTTH(Fiber To The Habitat):** FTTH is the best and cost effective substitute to the conventional technology i.e DSL. In the fiber to the habitat technology a communication path is provided over optical fiber cable extending from OLT(optical Line terminal) unit situated in telecommunication operators switching equipment(exchange) to an ONT(Optical Network Terminate) at customer premises[3]. It provides communication path for carrying telecommunication traffic to subscribe for one or many series like data, voice, video etc.

   As shown in fig 1. OLT situated at base station (exchange) is connected to the ONT situated at customer end via optical fiber cable. The output from the ONT is connected to customer’s PC via LAN cable.

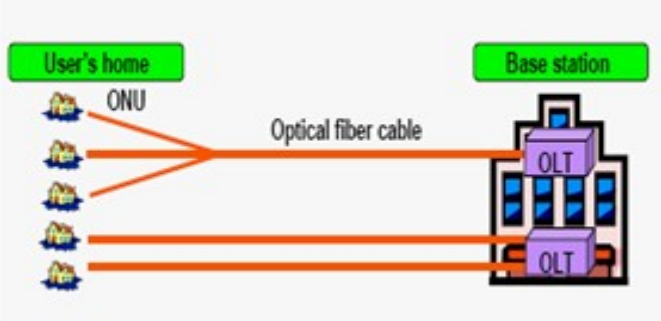

Figure 1: FTTH configuration

2. **FTTB(Fiber To The Building):** The fiber to the building architecture provides an optical fiber cable communication path between an ONU (Optical Network unit) or RT (Remote control) at the edge of the apartment, building, or office enclosing set of subscribers and the OLT (optical Line Terminal) located in the Base station (Exchange)[5].'

   In this structure, optical fiber terminate to ONU or RT units located at the frontier of the building, office and apartments and copper cable other than optical fiber is used as the physical medium which provide the access path to the subscribe. As shown in figure 2. Up to the metallic cable that is installed within the building, optical fiber cable is installed. and a Ethernet cable can be used to connect to the subscriber.

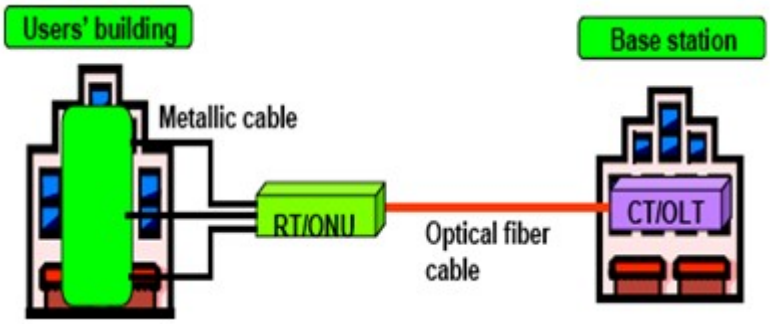

Figure 2: FTTB Configuration

3. **FTTC (Fiber to the Curb):** In the fiber to the curb/cabinet architecture, an optical fiber is used from the Base Station (Exchange) to the remote unit (RO)/ optical network unit (ONU)[4] installed outside near the curb or on street cabinet. Finally copper cable or coaxial cable is used between the remote unit (ONU) and the subscribe end as shown in figure 3.

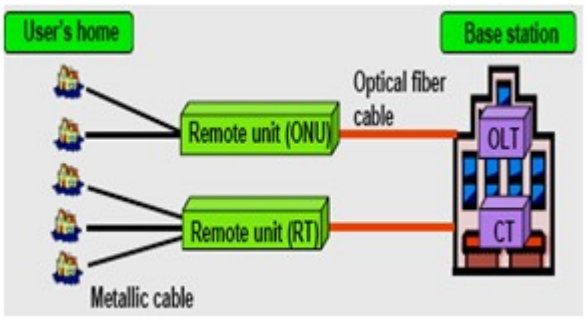

Figure 3: FTTC Configuration

III. TECHNOLOGY OPTIONS FOR FTTH ARCHITECTURE

In the current scenario, there are various technology options are available for Fiber to the home Architecture. The Architecture can be installed in various networks

- Attribute overlay network (AON)
- Passive optical network (PON).

1. **Attribute Overlay Network:** AON (Attribute Overlay network)[17] is commonly known as Active node. It mainly use a point to point (PTP) network Architecture and every subscriber or customer are provided with a committed optical cable and the distribution points are handled by active optical equipment.

   Attribute Overlay network[12] can be setup in two architecture
   - HOME RUN Fiber (Point to Point)
   - Active Star Wired Network(ASWN)

   - **Home RUN fiber (Point to Point) Architecture**: In this architecture, a devoted fiber line is connected between the ONT (optical network terminal) located at local exchange office to the OLT(Optical Line Terminator) equipment situated at the subscriber end.

     In this, both devices ONT and OLT are active, powered device and each one is equipped with an optical laser. This technique offers unlimited bandwidth for the subscriber and therefore it has greatest potential for growth.

     It is the most flexible architecture but Home Run fiber requires much more fiber because a dedicated fiber is provided to each subscribe end. So, it is very costly and become less attractive.

     The figure of habita run fiber architecture is shown in figure 4.

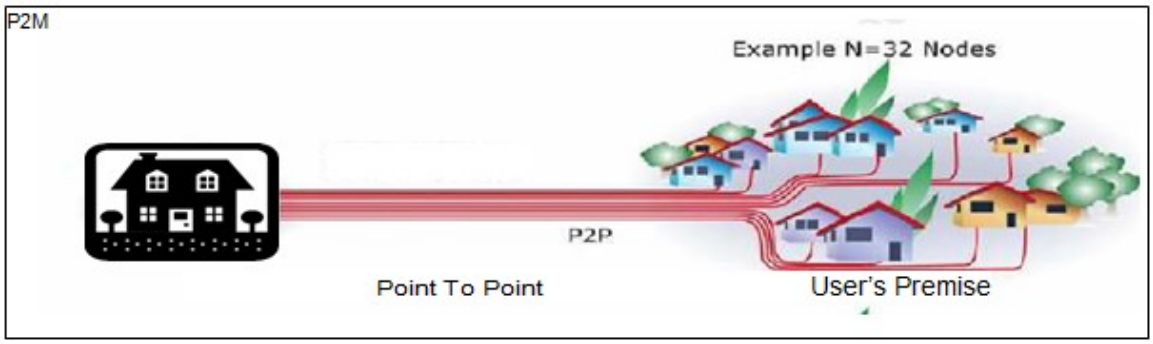

Figure 4: Habitat Run Fiber (Point-to-Point) architecture

- **Active Star wired network (Point to Multi point) architecture:** Active star wired network (ASE)[18] Architecture is point to multipoint architecture in which wired network switch is used between the exchange (CO) and the subscribe premises. In this, multiple subscribe share one feeder fiber connected from the exchange (CO) to one end of switched Ethernet and other multiple end of switched wired network is connected to multiple subscribe premises.

  In the Active Star Wired network Architecture[19], end user get a dedicated fiber, Like habitat run fiber, the fiber connects their site to an Ethernet switch, and each subscriber has a dedicated pipe that offers full bi-directional band width.

  Active Star Wired network reduce the amount of fiber .So, it is cost effective.

  The figure of active Star wired network is shown in Fig 5.

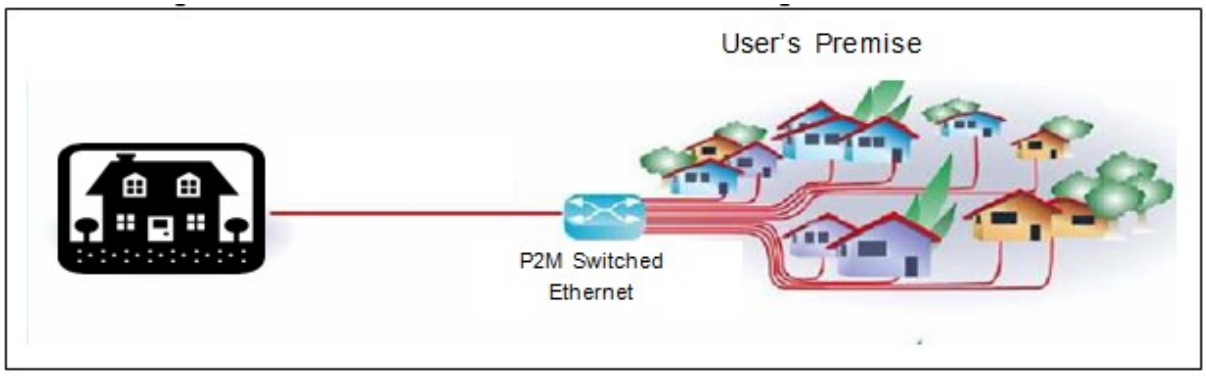

Figure 5: Active Star Wired Network (ASWN)

2. **Passive Optical Network (Point to multipoint) Architecture:** A relatively affordable optical fiber-based access system for providing multiservice (voice, data, video, etc.) to residential and corporate customers is the passive optical network.

   The point-to-multipoint design forms the foundation of a passive optical network.

The optical line terminal (OLT) at the local exchange and the optical Network unit (ONU) at the subscriber's premises are connected via a passive optical network (PAN)[23] that uses optical fiber and optical power splitters.

Passive splitter can split the fiber signal up to 32 or more time(which means that they split the bandwidth and shared between the users) over a maximum distance of ten to twenty km. passive splitters are generally located downstream from the local exchange.

This architecture is also known as passive because all the splitters and other equipment located in intermediate between the local exchange and the Optical Network unit is passive that is they does not require separate power and there is not active electronics..So, by using this architecture, it simplifies the network maintainance and operation and reduces the cost and another advantage is it requires less fiber than Habitat Run technology.

Two splitter configurations are commonly utilized in passive optical network architecture.

- Centralized Approaches
- Cascaded Approaches (as shown in Fig.6)

➢ **Centralized Splitter Approach:** It generally uses a 1*32 splitter which means bandwidth can be shared between the houses or subscriber. As depicted in Figure 6. The 32 optical network terminals (ONT) at each of the 32 subscriber/houses are connected to a single optical splitter concentrator.

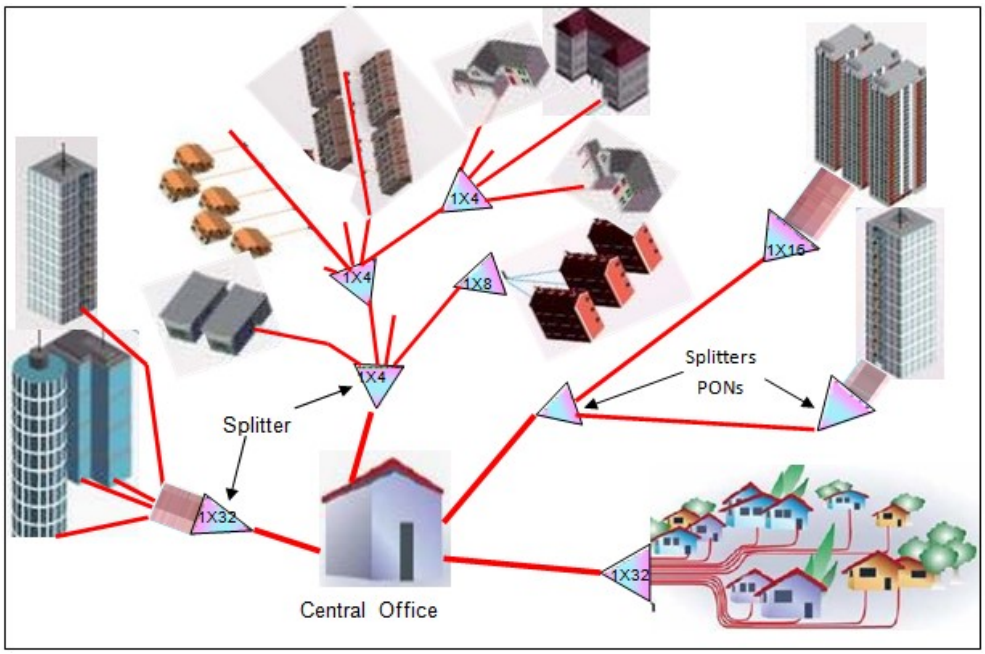

Figure 6: Centralized and the Cascaded Passive Optical Network architecture

Table 1: Features of Different PON Networks

Bandwidth	Down Stream up to 622 Mbps Up Stream up to 155.52 Mbps	Down Stream up to 2.5 Gbps Up Stream up to 2.5 Gbps	Down Stream up to 1.25 Gbps Up Stream up to 1.25Gbps
Posterior ג	1490 nm & 1550 nm	1490 nm & 1550 nm	1490 nm
Ambitious ג	1310 nm	1310 nm	1310 nm
Layer-2 Protocols	ATM	ATM, Ethernet, TDM over GEM	Ethernet
Frame	ATM	GPON Encapsulation Method	Ethernet Frame
Highest. Distance (OLT to ONU)	20 km	20 Km (supports logical reach up to 60 Km)	10 and 20 Km.
Split Ratio	1:16, 1:32 and 1:64	1:16, 1:32 and 1:64	1:16 and 1:32

- **Cascaded Splitter approach:** When using a cascaded splitter technique, the passive optical network (PON)[26] can support many homes or subscribers using a single fiber. This approach use more than one splitter of different capacity located in the pathway from the local exchange to customer/subscriber end, like a network may have 1*4 splitter leading to a 1*8 splitter further downstream in four different location. Standard splitter format range from 1*2, 1*4, 1*8,1*16 and 1*32. Ultimately, there would be 32 fiber reaching to the ONTs of 32 habitats.

  There is Various PON technology
  APON
  BPON
  EPON
  GPON

GPON delivers gigabit per second bandwidth and offer low cost and high reliability

.Features	*BPON*	*GPON*	*EPON*
Responsible Standard body	FSAN & ITU-T SG15 (G-983 Series)	FSAN & ITU-T SG15 (G-984 Series)	IEEE 802.3ah

IV. NEED OF FTTH

FTTH is a multi-service communication access that can manage multiple phone conversations, TV/video streams, and internet users in the home or workplace at the same time. The following are some of the advantages this method has over other conventional access methods (DSL):.

1. This technique provides multiply (i.e. Voice, videos and data etc) services.
2. FTTH Provides wide range of communication, entertainment services and many other new services to the end users.
3. FTTH technology deploys a fiber optical cable to every premise which will provide unlimited bandwidth (i.e. very high speed) as compare to DSL technology.
4. 4) There is potential for FTTH technology to lower capital costs and increase average revenue per user (ARPU). FTTH has the feature to deliver multiple services which result in less operational expense.
5. FTTH technology requires local battery breakup and low power consumption.
6. FTTH technology is trustworthy, scalable and vulnerable, trustworthy and it is potentially productive and future ready Architecture.

V. CONCLUSION

The desire of multiply services (i.e. Voice, data, and video) and heavy application like distance learning video application, best picture quality, video conferencing and video phone is expected to continuously increase and some observer already believe that there is already a demand in world wide today also.

FTTH is a new leading technology which uses optical fiber to provide unlimited bandwidth for new generation of bandwidth application.

As this technology uses passive network component so, it requires less maintenance and less power consumption which results in economical than active network technology.

Many countries like China, Japan, Korea, Taiwan and many others has already is in use of this technology and even in India also it has gained a reputation very quickly because of its high performance, low cost and higher constancy.

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