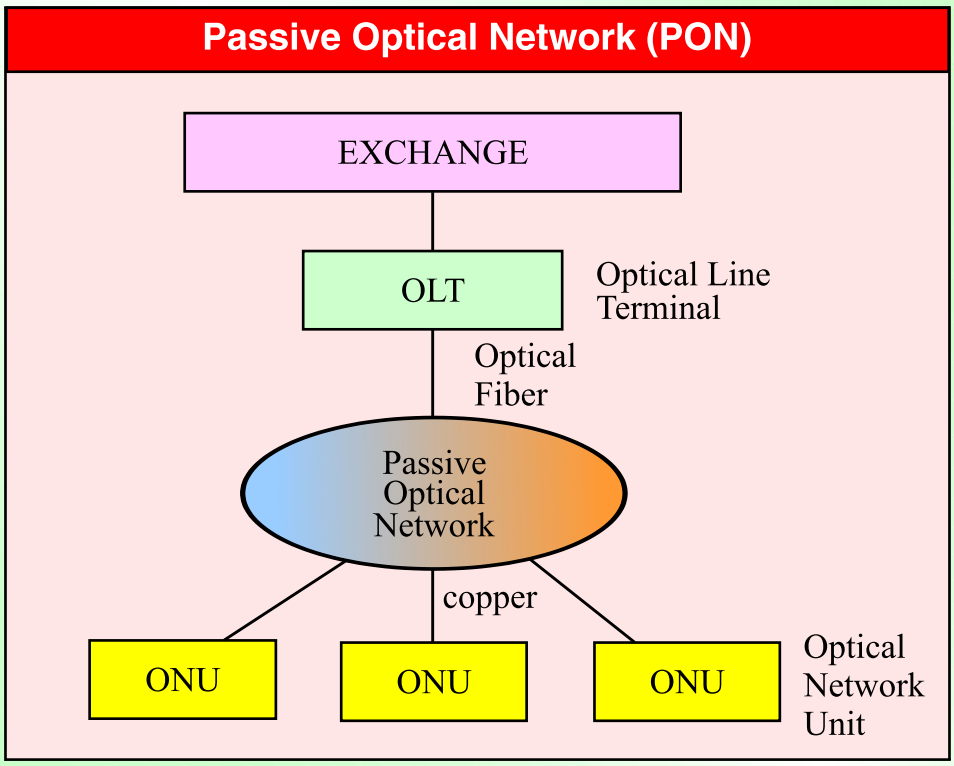
TEC
TELECOMMUNICATION ENGINEERING CENTRE

NEWSLETTER
टी ई सी संचारिका

VOL 12 JUNE 2008 ISSUE 2



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Passive Optical Network PON)

Passive Optical Network (PON) is a broadband access network architecture based on Fibre-to-the-Home/Building/Curb/Cab (FTTH/FTTB/FTTC/FTTCab) commonly called FTTX architectures. The PON architecture basically implements a single fibre to serve multiple customers. It is a low cost solution to provide bandwidth to the customer on demand. There is no active device such as regenerator or amplifier involved in the outdoor plant and hence, the name "passive".

PON technology lowers deployment of optics and maintenance costs and also creates cleaner signals by using passive devices. PON consists of OLT (Optical Line Terminal) connected to ONU (Optical Network Unit) or ONT (Optical Network Terminations) through the point-to-multipoint connection. The technology's point-to-multipoint connection enables carriers to support numerous end locations with a single fibre.

PON architecture:

A PON consists of an OLT in Central Office and distributed ONU or ONT to terminate customer traffic at various remote locations. The access node in FTTH architecture for network termination installed within user premises is called as ONT whereas the access nodes in FTTB/FTTC/FTTCab architectures, installed at other locations i.e. Curb/Cabinet/MDU (or MTU) basement, are termed as ONU. A single-fibre connects OLT to an ONU or ONT in point-to-multipoint configuration through optical splitter/coupler. Such splitters/couplers are installed at various outdoor as well as indoor locations (at Central Office and remote nodes) depending upon the number of customers to be served and consequently, on the FTTX architecture chosen for the deployment. Depending upon the customer density and speed requirements in the serving area, single or multi-stage splitting may be used by Service Providers as shown in figure 2.

There are also cases where PON system might be deployed in a point-to-point (p2p) architecture where a separate fibre is terminated for each user. Such a configuration is used to cater to higher customer bandwidth requirements in specific cases, and as per requirements. Another application for such point-to-point connectivity is to provide

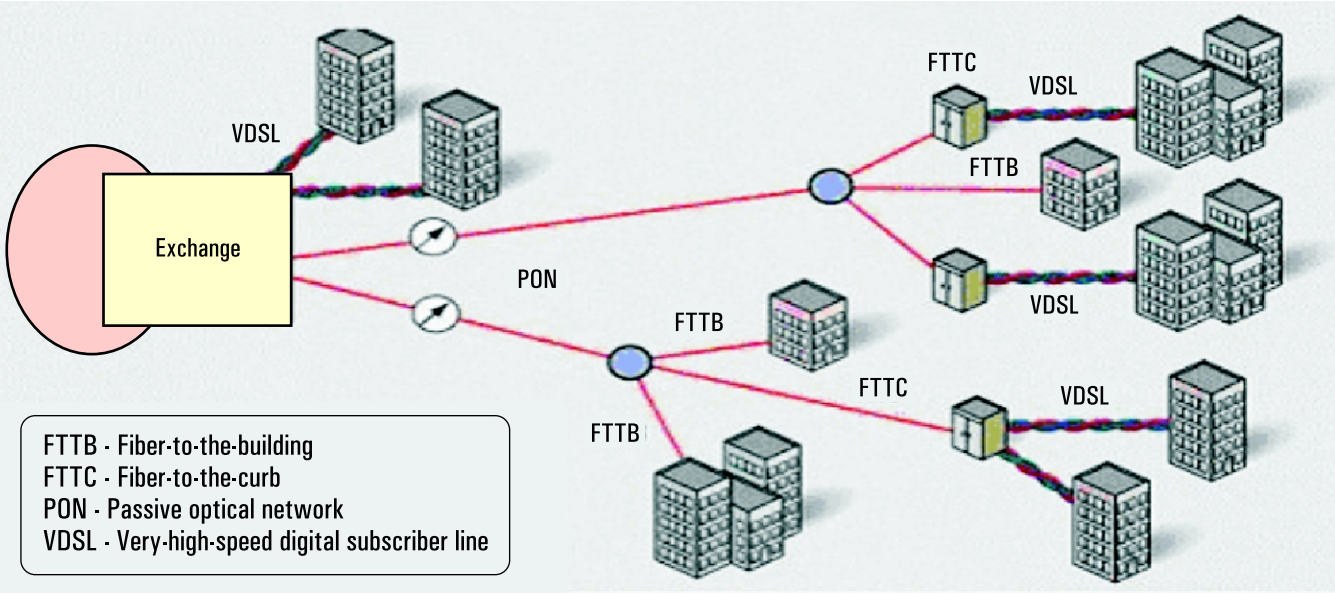

Figure 1

backbone connectivity to the existing infrastructure. Various ONU/ONTs are terminated at OLT.

Components of PON:

ONU/ONT

ONU and ONT are the system blocks which provide access to the users.

ONTs are deployed in Fibre To The Home (FTTH) and Fibre To The Building (FTTB) architectures, where the fibre termination shall take place at the premises. The UNI are integrated in the ONT box to provide data, voice, RF video and WiFi interfaces.

ONUs are deployed in MDU, cabinet and at curb site. ONU provides PON interface towards the OLT and UNI interface towards the customer of high density living or working areas. Thus, an ONU may comprise of two separate devices – one to connect IP backhaul traffic to the OLT through the PON interface and the other an NT device such as DSLAM (VDSL2 or ADSL2+).

OLT

An OLT provides aggregation and switching functionality between the core network and PON interfaces. It offers PON interfaces towards ONU/ONTs & Service interfaces towards core network. The interfaces towards ONU/ONTs are called PON interfaces **(IF_{PON})** and the interfaces towards core network are called Uplink interfaces **(SNI)**.

Optical Splitters

Optical splitters split the signal to a number of directions on end to end basis, per PON interface on OLT. There are various options available to the service provider such as m:N where m = 1 or 2 and N = 4, 8, 16, 32 and 64 or even 128 in some cases.

Commonly, two types of technologies used in splitters -

- Fused fibre splitter
- Planner waveguide splitter.

WDM Couplers

Multiple dedicated wavelengths may be used for various applications like voice, video, internet, data etc., enabling combined optical transport through a single fibre. For example, two dedicated wavelengths are used – one for downstream and the other for upstream (~1490nm & ~1310 nm respectively) for data & voice transport and the third one (~1550nm) is used for downstream RF video.

Fibre plant for PON

ITU-T Rec. G.652 fibre is primarily used between OLT and ONUs/ONTs. Special access fibre e.g. ITU-T Rec. G.656 fibre are also being used for FTTB/FTTH intra-building, campus etc.

FTTX architectures:

The 'X' in FTTX stands for a lot of things, often not very different, but for practical purposes they can all be grouped under any of the three basic approaches:

a) Fibre all the way to residential or business customer by using PON or Ethernet

- Fibre to the Home (FTTH)
- Fibre to the Building (FTTB).

The distinction is basically between single homes or apartments and business or multi-tenant buildings.

b) Fibre all the way to the customer by using PON only

- Fibre to the Premises (FTTP).

c) Fibre partial: These all use copper from the partial point to the user:

- Fibre to the Curb (FTTC)
- Fibre to the Cabinet (FTTCab).

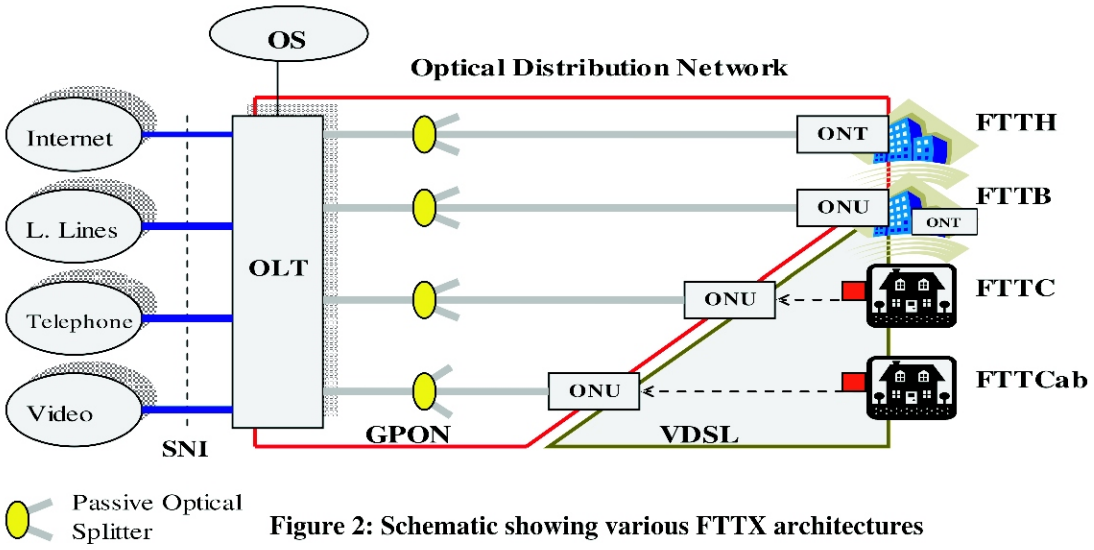

Figure 2: Schematic showing various FTTX architectures

Fibre partial means that fibre goes to some point near to the customer, and then another mechanism usually copper-pairs supporting VDSL2 or ADSL2+ takes over for the final link to the customer.

In FTTCab architecture, the fibre is brought up to a point close to the customers, where a cabinet is installed in the existing network (approximately 1000-2000m from users). To a rough approximation, this node may serve ~50-100 customers or households. Whereas, in FTTC, the fibre is brought even closer, upto a roadside telephone pole in the distance range of 200-400 m from end users. Usually, this architecture may serve ~ 8-32 customer drops (copper).

In FTTH architecture, fibre termination takes place right up to individual home. The user installs an ONT and connects to OLT in CO directly or through cascaded splitter stages. In FTTB architecture, fibre is extended right upto the building. Based on home and business applications, the following scenarios are possible in this architecture:

i). FTTB for residential applications in MDU

ii). FTTB for business applications

iii). A mix of these applications in MDU/MTU

The PON equipment mainly provides three types of interfaces, namely

- User-Network Interface (UNI) - provided by ONU/ONTs towards the customers,
- Service-Node Interface (SNI) - provided by OLT to access the core network,
- PON interface (IF_{PON}) - ONU/ONT provides IF_{PON} interface towards OLT and OLT provides IF_{PON} interface towards ONU/ONT.

Service support

- High speed data/Internet
- Voice (VoIP)
- ISDN (BRA, PRI)
- RF video
- 2 Mb leased lines
- IP Video
- WiFi

Types of PON

There are various types of PON. The architecture is same. The main differences among them are the specifications and protocols. They are:

APON – ATM PON (155M to 622M),
BPON – Broadband PON (155M to 1.25G),
GPON – Gigabit PON (155M to 2.5G),
EPON – Ethernet PON (1.25G)

WDM PON – Wavelength Division Multiplexing PON (unlimited).

Among the various types of PONs, GPON and EPON are mostly favoured by the service providers today. A comparison between the GPON and EPON is given in the table below

Features	GPON solution	EPON solution
Usable Bandwidth	Asymmetric	Symmetric
Down stream	2.5 Gbps	1 Gbps
Upstream	1.2 Gbps	1 Gbps
Protocols	GEM	Ethernet
Standards	ITU-T G.984.x	IEEE 802.3ah
Maximum Splitter Factor	1:128	1:64
Maximum Logical Reach	60 km	20 km
Maximum Differential Distance	20 km	NA
Legacy TDM Support	Yes	No
Video Support	IPTV and CAT	IPTV
Encryption	128-bit AES (DS)	128-bit AES (DS and US)
Dynamic Bandwidth Allocation (DBA)	Yes	Yes
QoS Support	Yes	Yes
Forward Error Correction (FEC)	Yes	Yes
Efficiency	~72% (due to 8B/10B encoding)	~92% (due to NRZ scrambling and no encoding)
Network protection	Optional, 50ms switching time	None specified
Interoperability	ITU-T defined	None specified

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World Telecommunication and Information Society Day

Theme 2008: *Connecting Persons with Disabilities: ICT Opportunities for All*

This year, World Telecommunication and Information Society Day has adopted the theme: "Connecting Persons with Disabilities: ICT Opportunities for All" to address the special requirements of persons with disabilities

During this year's WTISD, ITU calls upon all stakeholders (policy makers, regulators, operators and industry) to raise awareness on the need to adopt policies and strategies that would meet the ICT needs of people with disabilities by ensuring that both equipment and services are accessible. This move would not only ensure an inclusive information society, but would also enable Member States to meet their obligations under Article 9 of the UN Convention on the Rights of Persons with Disabilities (CRPD) adopted by the United Nations General Assembly in December 2006.

Message from Mr Ban Ki-moon, UN Secretary-General

Connecting Persons with Disabilities: ICT Opportunities for All

Starting with the earliest drum beats, telegraphy -- "writing in distance" -- has been with us in dynamic, evolutionary motion. The ability to relay important information quickly across vast distances, closing the gaps of time and space, has expanded exponentially all manner of human activity, from sending out personal messages to completing complex financial transactions to engaging critical matters of war and peace. World Telecommunication and Information Society Day heralds the enabling and transformative role of communications and information in societies, and the universal need to communicate and cooperate across borders

It is also the day in 1865 when the International Telecommunication Union was founded. At the time, the idea to transmit electronic signals across wires had already set forth a dramatic chain reaction of competing technologies. ITU was formed to address the growing need for international standards. From these early days, ITU has played a key role in connecting the world, a challenge which continues today with 3G mobile and broadband technologies.

Yet the reach of communications technology is not universal, its benefits have not been shared equally. The World Summit on the Information Society, held in Geneva in 2003 and Tunis in 2005, linked information and communication technology (ICT) with human development and called on Member States to build a global "inclusive, people-centred and development-oriented information society" through the sharing of information and knowledge.

The Summit also urged Member States to address the special requirements of persons with disabilities and other vulnerable groups. The theme of this year's observance, "connecting persons with disabilities", highlights the importance of making ICT equipment and services accessible to meet the needs of persons with disabilities. There are an estimated 650 million persons living with disabilities worldwide. Including their families, there are nearly two billion persons who are directly affected by disability, almost a third of the world's population. It is important to remember that anyone can become disabled at any moment.

It is vital that we change attitudes and approaches to persons with disabilities, ensuring that all fundamental rights and freedoms are honoured, including the right to fully participate in the information society, and bring forth input, ideas and effort from the disability community. This is a significant development challenge. But we must find creative solutions, including the development of new assistive technologies, and facilitate a broader access to ICT. I urge policy-makers and industry leaders to accelerate scientific and technical research aimed at developing technologies that will be inclusive and accessible to all.

On this day, let us pledge to adhere to the guiding principles of the Convention on the Rights of Persons with Disabilities and work together to connect all humankind equally to the present opportunities and those yet possible in our ever-evolving world.

Ban Ki-moonUN Secretary-General

Messages from Dr Hamadoun I. Touré, ITU Secretary-General

Connecting Persons with Disabilities: ICT Opportunities for All

The key to the information society is universal access. Everyone must have equal opportunity to participate in the digital age. And no one should be denied the potential benefits of new information and communication technologies (ICT), not least because they are hampered by their disabilities. As ICT bring a range of innovations in the workplace, at home and in every facet of our lives, these benefits must also be harnessed for the benefit of persons with disabilities.

This year, ITU has adopted the theme: "Connecting Persons with Disabilities: ICT Opportunities for All" to mark World Telecommunication and Information Society Day. The World Summit on the Information Society urged Member States to address the special requirements of persons with disabilities along with other marginalized and vulnerable groups in their national e-strategies. A further call was made to encourage design and production of ICT equipment and services adhering to the Universal Design Principle and the use of assistive technologies for research and development to facilitate accessibility to ICT for all, including persons with disabilities.

The last World Telecommunication Development Conference (WTDC-06) held in Doha, Qatar in 2006, created a new Special Initiative on "Access to telecommunication services for persons with disabilities". The Doha Plan of Action endorsed the Tunis Commitment of building ICT capacity for all, including persons with disabilities, through the promotion of universal, ubiquitous, equitable and affordable access to ICT. It encouraged the adoption of universal design and assistive technologies to ensure that the benefits are evenly distributed within societies as well as to bridge the digital divide by creating digital opportunities to harness the full potential for development offered by state-of-the-art ICT.

During this year's WTISD, ITU calls upon all stakeholders (policy makers and regulators as well as operators and industry) to raise awareness on the need to adopt policies and strategies that would meet the ICT needs of persons with disabilities by ensuring that both equipment and services are accessible. This would not only ensure an inclusive information society, but would also enable Member States to meet their obligations under Article 9 of the Convention on the Rights of Persons with Disabilities adopted by the United Nations General Assembly in December 2006.

Our focus this year on meeting the ICT needs of persons with disabilities is aimed at empowering every citizen with information and knowledge, improving the lines of communication to the remotest and most vulnerable groups, and building an inclusive information society geared towards the advancement of a better, more peaceful and productive world. It is clearly our duty today to provide the opportunities of ICT to all, especially to those of us with disabilities.

As we celebrate World Telecommunication and Information Society Day, we invite all stakeholders — manufacturers, service providers, international organizations, public and non-governmental organizations as well as policy makers — to join us in our endeavour to connect everyone, especially the 650 million or so people around the world who live with disabilities, to the remarkable digital opportunities offered by ICT.

Hamadoun I. Touré
ITU Secretary-General

Important Activities of TEC during March 2008 to May 2008

New GRs/IRs

- Carrier-in-Carrier Satellite Modem for C-Band
- 3.8 M Earth Station Antenna Operating in Ku-Band
- Radio Access Network (RAN) for IP Based CDMA 2000 1x Core Network
- Transient Safety Device (8 Pair Protector Module) for use on backside of mother board of C-DOT exchange

Revised GRs/IRs

- Service Requirements for Analogue Subscribers
- 1M Earth Station Antenna Operating in Ku-Band
- 1.2M VSAT Antenna Operating in C Band
- Long Distance Satellite Telephone (LDST) Operating in C-Band
- Solar Photo Voltaic (SPV) Power Supply for Fixed Wireless Terminals & Similar Systems
- 12V Switch Mode Power Supply (SMPS) for CDMA FWTs and Similar Systems
- FFTH/FTTB/FTTC Boradband Access Applications using Gigabit Passice Optical Networkr (GPON) Technology

Tests and Field trials

- C-DOT Exchange for Software version 2_2_1_9

Technical White Papers

- Carriers - in - Carrier Satellite modem for C- band
- Mobile Operating Systems
- Common Language for Telecom Systems
- MMD(Multi Media Domain), the IMS as per 3GPP2
- Multi Beam Antenna System
- Dual mode Phones (GSM & Wi-Fi)
- ENUM
- Performance indicators for telecom sector
- Multi Beam Antenna System

Manufacturers' Forum conducted for

- GR on National Standards for SIP
- GR on Interconnect Exchanges for NGN
- IR for PABX

Other Activities

- Technical specifications for IP PABX to Ministry of External Affairs.
- Request for information regarding mandatory testing and certification by designating Conformity Assessment Bodies(CABs)
- TEC has released Network Conformity Standards System & Procedures.

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जून 2008
भाग 12
अंक 2
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Prabhat Publicity, New Delhi