

FTTX NETWORK DESIGN ARCHITECTURES

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ABSTRACT

FTTx, fibre to the generic is very important technology for fibre optics internet network communications. In today's internet network infrastructure world, fibre optics is used as the main media for internet network communications. The whole of the backbone internet network i.e. PON network as well as AON network is constructed with the help of different fibre optic cables like indoor cables and outdoor cables. The backbone infrastructure is deployed UG, OH, direct buried cables, duct buried cables, ducts are of wide variety 2 ways, 4 ways, 7 ways, etc., When PON and AON, splitters, closures, junction boxes (JBs) or Distribution Panels (DPs), drop cables, patch cords, pigtails, SFPs, manholes come together for making the services live for the customers those services are termed as FTTx technology i.e. fibre to the generic. FTTx combines different network design architectures of fibre internet services like FTTH, FTTB, FTTP, FTTC, FTTN these are the main network design architecture types of fibre optics internet network design. This paper will give explanation for different FTTx network design architecture technologies and network methodology for different network design architectures as mentioned above.

Keywords: FTTx (Fibre To The Generic), PON (Passive Optical Network), AON (Active Optical Network), UG (Underground), OH (Overhead), JB (Junction Box), DP (Distribution Panel), FTTH (Fibre To The Home), FTTB (Fibre To The Building), FTTP (Fibre To The Premises), FTTC (Fibre To The Curb/ Cabinet), FTTN (Fibre To The Node), MDU (Multi Dwelling Unit), SDU (Single Dwelling Unit), FCP (Fibre Concentration Point), PCP (Primary Concentration Point), SCP (Secondary Concentration Point), ONT (Optical Network Terminal)/ ONU (Optical Network Unit), CO (Central Office), FTTP (Fibre To The Pole)-New, POP (Point Of Presence), PPOP(Primary POP) SPOP (Secondary POP).

I. INTRODUCTION

Fibre to the generic or different fibre network design architecture i.e. called FTTx, where the term FTTx denotes the expansion of the fibre optics internet network for further areas, future expansion of the internet network services and new places need to be covering with the internet network services expansion. Due to this the most important methodology for expansion of internet network for backbone internet network services infrastructure as well as access network infrastructure part is FTTx technology. FTTx technology network design architectures use PON and AON networks methodology to expand the reach of the internet network infrastructure for different customers, users or subscribers. The network infrastructure for expansion of the FTTx technology takes place with the help of different architecture designs of different users like FTTH, FTTB, FTTP, FTTC, and FTTN. FTTH, fibre to the home, is the network service where a single dedicated fibre is assigned for a home. FTTB, fibre to the building, is the network service where a single fibre or more than one fibre in a cable is dedicated for the building- by DPs or junction box. FTTP, fibre to the premise, is the network service where a single fibre or more than one fibre of a cable is connected in DP/ JB and through DPs or JB's SC ports are connected to the subscriber whether he is single user or multi user in a same premise based on MDU or SDU of the premises design. FTTC, fibre to the cabinet or curb, is the network service where a cable of fibre is terminated or spliced in the cabinet. Cabinet may be on the road side or under the tower area. Road side cabinet provides services to the nearby homes, buildings and offices. By road side cabinet service is given to the customers by drop cables. The important point here is that during installation of the services, cable, drop cable and DPs location is located on the design map based on the detailed survey report from the field scenarios, by the designer for the best possible solution for the deployment of network structure for further expansion and to the customer for the requested services. FTTN, fibre to the node, is the network service where a dedicate fibre or fibre cable of multiple fibres is terminated at a node device and then further moves with copper cable. Also

what I observed from the field that node may also be termed as POP for the fibre to start or originate from the point. So, POP may be primary POP or secondary POP, design and expansion of the internet network takes place from these POP location points. These all designs are explained in the details in the FTTx network design architecture part below.

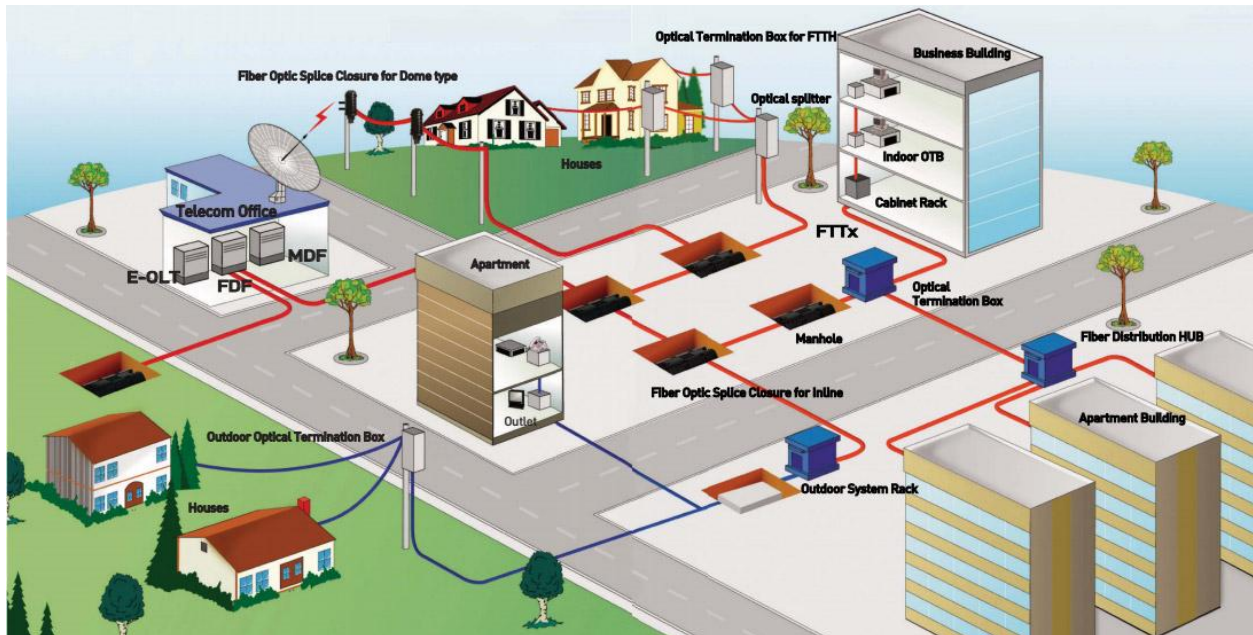


Figure 1: Different network design architectures combined together for FTTx services.

II. METHODOLOGY

The Working principle of different network design architectures is the different ways of reaching the customer for providing the services. The main components for expansion are different cores of fibre cables, Splitters, enclosures or splice closures, manholes, splice trays, patch cords, DPs, patch panels etc. In FTTx technology, splicing of different fibres to each other takes places with the help of splitters; different ratios of splitters are taken for splitting the route of the network as per customer best possible solution and further expansion of the FTTx network services in the area or even beyond the area. That is street, colony, district, city, state etc. takes place with the help of FTTx technology expansion. The design for the expansion of internet network facility or for service providing to the customers as per their needs is defined with the help of different network design architectures like FTTH, FTTB, FTTP, FTTC, and FTTN.

III. TYPES OF FTTx NETWORK DESIGN ARCHITECTURES

Basically, there are FTTH, FTTB, FTTP, FTTC, and FTTN all together with speed, wavelengths, different cores of fibre cables, drop cables, different types of splitters, splice closures, different ratios of splitters, manholes, blower, ducts, and splicing methods and other needed equipment's and devices. The all together for the services connectivity is termed as FTTx technology.

FTTH

FTTH (Fibre to the home) network design defines the internet services provided by a service provider to the customer by using design architecture in which, a direct fibre cable or drop cable is terminated or connected at the users ONT or ONU in the home directly from the POP (Point of presence) may be Primary POP or Secondary POP as designed in the LLD (Low level design). A single fibre of a fibre cable or drop cable is connected to the customer ONT/ONU at home.

In the figure below main fibre cable is coming from OLT, the main cable optical signals are further split with the help of a splitter, then from the splitter each end, a separate connection can be provided. Here a fibre drop cable is directly connected from a splitter end to the home customer equipment i.e. ONT/ONU.

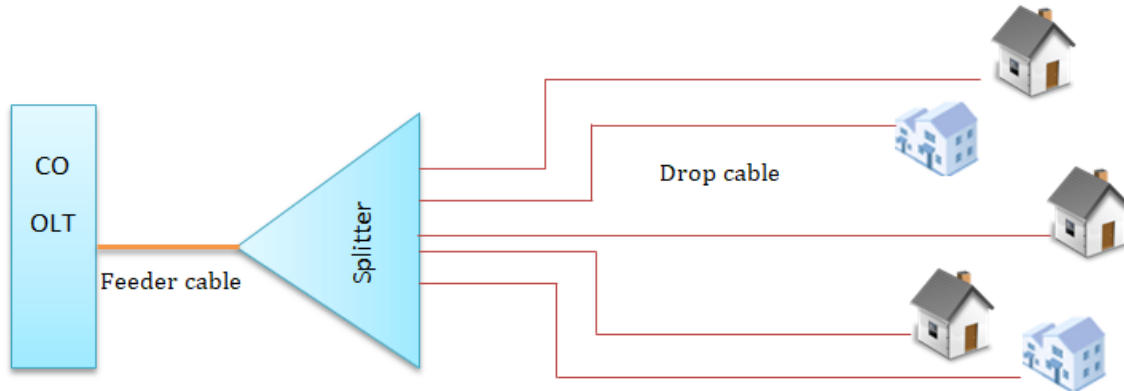


Figure 2: FTTH network design architecture

FTTB

FTTB (Fibre to the building) network design defines the internet services provided by a service provider to different customers in the building. In this network design architecture a direct fibre cable is terminated at the DP Box or Junction Box inside or outside the building. A single fibre or multiple fibres in a cable provides connectivity to a DP BOX or Junction Box from the POP may be Primary POP or Secondary POP as designed in the LLD. Through that DP or Junction box connectivity to different flats in the building is provided with the help of a drop cable going from the port of DP/Junction box to a user ONT/ONU inside the customer flat.

In the figure below main fibre cable is coming from OLT, the main cable optical signals are further split with the help of a splitter, then from the splitter each end, a separate connection can be provided. Here a secondary fibre cable is directly connected from a splitter end to the DP (distribution panel) box. DP box have different SC ports for connectivity. Then from DP box ports each flat is connected by drop cable, this drop cable is connecting the customer equipment ONT/ONU from a dedicated port of the DP box. DP box image can be expanded for clear view.

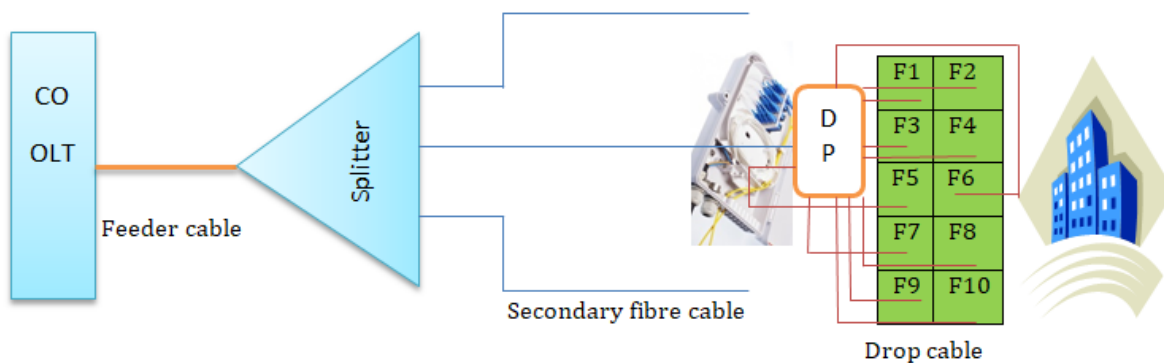


Figure 3: FTTB network design architecture

FTTP

FTTP (Fibre to the premises) network design defines the internet services provided by a service provider to different customers in the premises; premise may be a single dwelling unit or multi dwelling unit. In this network design architecture a direct fibre cable is terminated at the manhole or at DP Box or Junction Box inside or outside the premises. Through DP box port customer is connected by drop cable to the customer ONT/ONU. In single dwelling unit single fibre of a drop cable is given to the customer, in multi dwelling unit multiple fibres of a drop cable is provided for multiple ONT/ONU of different customers in a premises.

In the below diagram feeder cable is coming from CO (central office) through OLT terminating at the splitter end. Then from other splitter ends giving connection for MDU. From splitter a split end side is connected with a secondary fibre cable which is terminating in the manhole M1, inside manhole splitter is used for connecting to different dwelling units by connecting drop cable into the customer ONT/ONU from the manhole M1. In SDU a direct drop cable is connecting to customer ONT/ONU from a split end of first splitter.

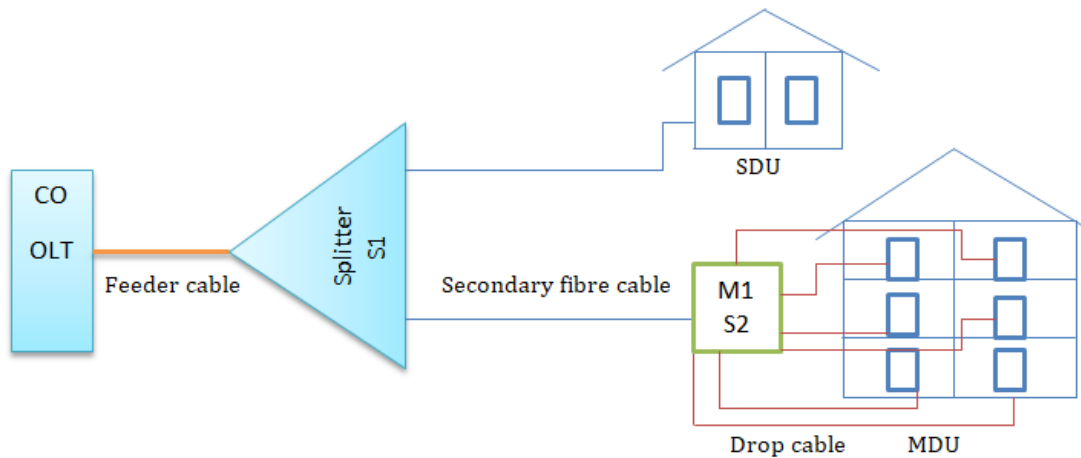


Figure 4: FTTP network design architecture

FTTC

FTTC (Fibre to the curb/ cabinet) network design defines the internet services provided by a service provider to different customers in the area with the help of curb or cabinet for that area. In this network design architecture a direct fibre cable is terminated at the curb or cabinet for further distribution of the network to different customers. Here terminated fibre cable provides connectivity to the cabinet then through that cabinet drop cable may route OH/UG directly to customer or to DP Box based on the requirement of the customer then from DP/Junction Box port to the customer ONT/ONU by drop cable.

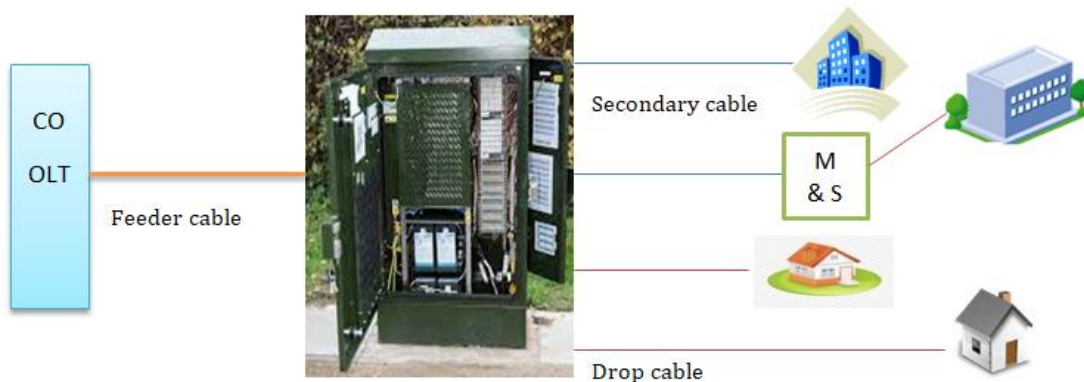


Figure 5: FTTC network design architecture

FTTN

FTTN (Fibre to the node) network design defines the internet services provided by a service provider to different customers in the area with the help of node in the area, node is defined as pop (point of presence) may be primary pop or secondary pop. In this network design architecture a fibre cable is spliced from pop that pop is termed as node for that fibre cable. Then the fibre cable is routed to the further expansion based on the requirement as defined in the LLD for customer needs. Also defined as fibre optic connection from OLT to node and then from node to customer as copper cable connection. Both are acceptable as per requirement of the customer in the area.

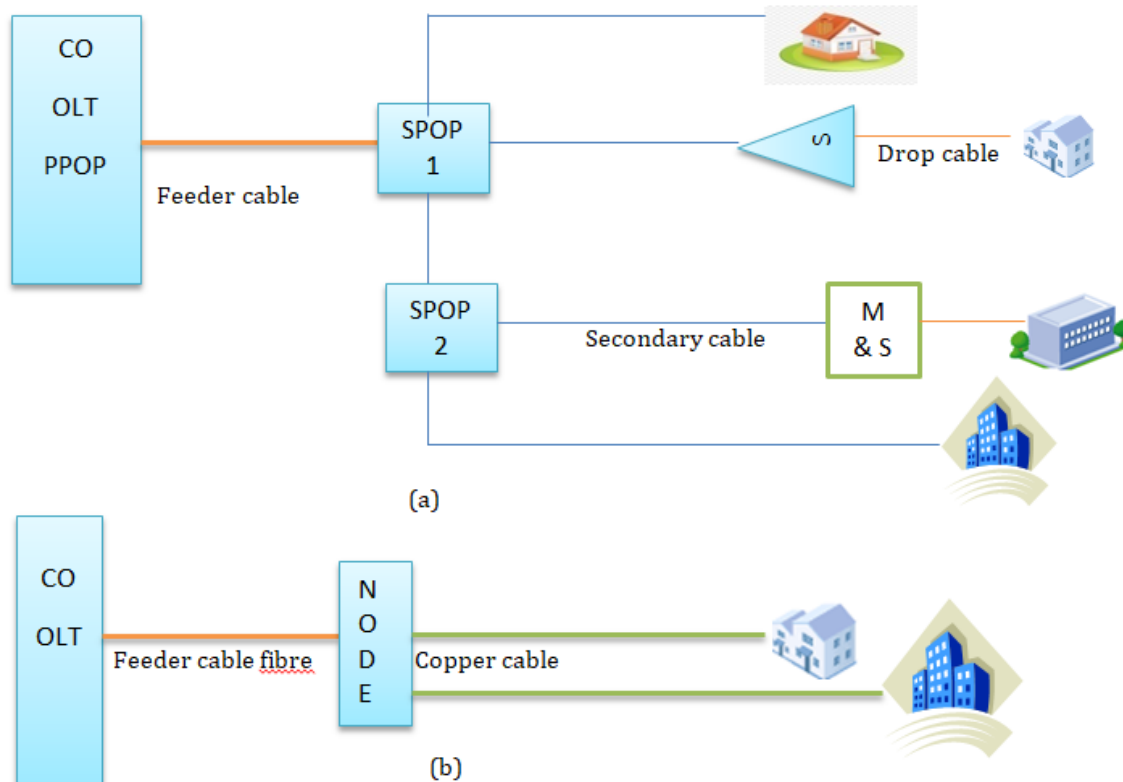


Figure 6: FTTN network design architecture (a) & (b)

IV. CONCLUSION

In these FTTx network design architectures as mentioned and defined above, the design method for providing services to the customer is important and intelligent method so that best possible or optimum solution for the network design can be provided by the service provider to its customers. The best possible design optimizes the cost for the deployment of the services to the customers. Optimizes cost for different phases like civil cost, material and equipment's cost, saves lots of time, spend in these activities, labor resources, skilled power like technicians, supervisors, engineers, and so ultimately optimizes the project cost for the deployment of services to the optimum needs of the customers. Overall it is very important for the successful implementation of the project to consider best possible network design architecture. The very important point to be noted here is the expansion of the network services for the future customers. Thus, the different design architecture methods play a very important role for the further and future expansion of the internet network services to the existing and future customers.

V. REFERENCES

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