ANALYSIS AND DESIGN FTTH (FIBER TO THE HOME) NETWORK WITH GPON TECHNOLOGY AT PT TELKOM, Tbk

Noyan Bathara P Siahaan[1], Solly Aryza[2], Siti Anisah[3]

Faculty Science and Technology,
Universitas Pembangunan Panca Budi
Medan, North Sumatera, Indonesia
E-mail:Bathara152@gmail.com

ABSTRACT

In today's era, the need for telecommunication, information and entertainment facilities that can be accepted and have high performance is definitely very much needed. To fulfill this, a network that supports its performance is needed. For now the network that is able to provide the best performance is optical fiber. In Indonesia itself, there is a rise in the deployment of fiber optic cables directly to the house or called FTTH. The city of Medan is one of the cities that is densely populated, especially for the North Sumatra area. With these conditions, the FTTH network design is suitable to be implemented in this location. In the design, a survey using GPS will be developed into Google Earth and AutoCad data. In the design data can be estimated about the number of devices, specifications and position of the placement of the device from the STO to the position of the customer. This data is to be developed along with calculation data based on FTTH GPON. In the design of the FTTH GPON network, the direct measurement results obtained the Power Link Budget value of -18.283 dBm for the downlink (-8.248) ns for the uplink at the farthest point, and the Rise Time Budget, which was measured at the farthest point. The Rise Time Budget is <70% with a value of (0.363) nm for Downlink and (0.251) ns for Uplink.

Keywords: Triple Play, GPON, Power Link Budget, Rise time budget

1. INTRODUCTION

Information Technology (IT) has now become a very important need for almost all circles of society in order to meet the needs of people who are now almost all using IT and the internet as well as following technological developments. To achieve this, we need a computer network that can provide data connections that can be used for public service purposes and support the government system. Computer network is something that is not foreign today. Based on ARIN and APNIC whois records, the first internet protocol (IP) from Indonesia was registered by the University of Indonesia on June 24, 1998, namely 192.41.206/24 (Telkom, 2009). Currently, most people need a computer network for individual or organizational purposes. Judging from the data in Figure I.1, it can be seen that computer network users are growing rapidly every year.

Figure 1. Number and penetration of internet users in Indonesia
(Source: ITU, 2019)

The internet that is gaining popularity today is a giant computer network which is a network of computers that are connected and can interact with each other. To take advantage of the development of computer networks, the government will move towards a smart city which has two main things, namely supporting the government system and fast service to the community.

Fiber optic network technology is an unquestionable medium to provide large bandwidth, is not affected by electromagnetic wave interference, is corrosion free and has the least adverse impact on data transport compared to copper cables and electromagnetic waves. Currently, most of the network backbone has been constructed with optical fiber, but at each node that has been determined in the topology, a new problem is whether to continue to use optical fiber at the distribute layer and the access layer? The reason why this is a problem is that the efforts in multimedia are not enough to ensure that the existing conditions at each node require a lot of bandwidth. Another reason is that fiber optic installations are currently too expensive. So therefore,

To design a network requires a method. Network Development Life Cycle (NDLC) is a method for building a network that relies on previous development processes such as business strategy planning, application development life cycle, and data distribution analysis. If the implementation of network technology is carried out effectively, it will provide an information system that will meet strategic business objectives, then a top-down approach can be taken (Prihastomo, 2011).

2. METHOD

The methodology used is as follows:

This is done by studying books, references, articles, written works related to the Fiber To The Home network. Conducted by interview, namely by providing direct questions to the parties concerned at PT Telkom Tbk. Questions asked about the problems that exist in the Fiber To The Home network that is being used by PT Telkom Tbk.

Seeing firsthand the spaciousness and noting how the Fiber To The Home network works using the GPON technology made by PT Telkom Tbk is it in accordance with existing theories or different. Designing a Fiber To The Home network using GPON technology for locations that will be used by PT Telkom, Tbk.

Fiber Optical is a transmission line or a kind of cable made of glass or plastic that is very fine and smaller than a hair that can be used to transmit light signals from one place to another. This cable is less than 120 micrometers in diameter. The light that is in the optical fiber does not come out because the refractive index of glass is greater than the refractive index of air, because the laser has a very narrow spectrum. The transmission speed is very high so it is very good to be used as a communication channel.

3. RESULTS AND DISCUSSION

In accordance with the results we examined at PT. Telkom, Tbk, the proposals for the problems faced are:

1. Design complex designs, calculate the required distance, adjust the damping to avoid interference, and perform configurations.
2. By doing careful calculations, such as finding the shortest distance using a software and conducting a field survey to ensure that the entire area gets a excavation permit.
3. The person who configures GPON must be accompanied by someone who understands it too, so that if something goes wrong it can be solved easily.
4. Perform routine checks to find out if any fiber cables are crushed, folded or disconnected. If there is a broken cable or an overlapping cable, check with the device after obtaining the location, the team will immediately dig and reconnect it.
5. The cost required for the first installation is very expensive, but it will be reduced for the second time because FTTH uses a lot of splitters to divide the line. Interview with Mr. Slamet Riyanto P. as Deputy Executive General Manager at PT. Telkom, Tbk.

6. Has Telkom fully used fiber cable?
    Answer: Not yet fully using fiber, we are replacing it.
7. Does Fiber To The Home use fiber cables to get to the house?
    Answer: Yes, the fiber cable is pulled up to the house, then from the ONU or commonly called a modem using a coaxial cable.
8. What technology does Fiber To The Home use? Why?
    Answer: We use GPON technology, because GPON has transfer ratewhich is better than the others.
9. Are there other technologies prior to GPON in use?
    Answer: Yes, we have used MSAN technology.
10. What tools are needed in designing a Fiber To The Home network?
    Answer: The tools needed are Optical Line Termination (OLT), Optical Distribution Cabinet (ODC), Optical Distribution Point (ODP), Passive Splitter, Optical Network Unit (ONU).

In general, fiber to the home technology at PT. Telkom, Tbk uses a Point to Multipoint (MultipleStar) network topology, which is where the network goes from one point to many points. And because of that, its users are very limited due to the relatively high cost and the active equipment used in the network still requires electricity, including optical switches. Fiber to the home network at PT. Telkom, Tbk which uses GPON technology has almost replaced the previous technology, namely the Cooper network that uses DSLAM or MSAN technology. GPON technology is close to 70% of the overall implementation in Indonesia, more specifically in the JABOTABEK area.

PT Telkom, Tbk initially used MSAN technology to provide its services such as speedy, groovia tv, and landlines. MSAN technology is a technology that only uses Fiber Optic cables from the OLT to the MSAN itself, the rest uses cooper or copper cables. As for the FTTH technology, all the coopers that are the liaisons are replaced with Optical Fiber. The comparison of the previous technology with the current technology is shown in Figure 2 below.
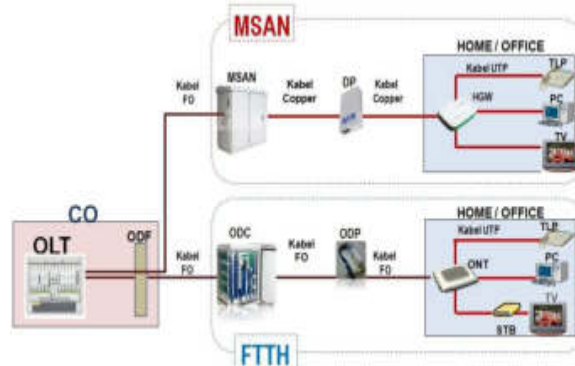

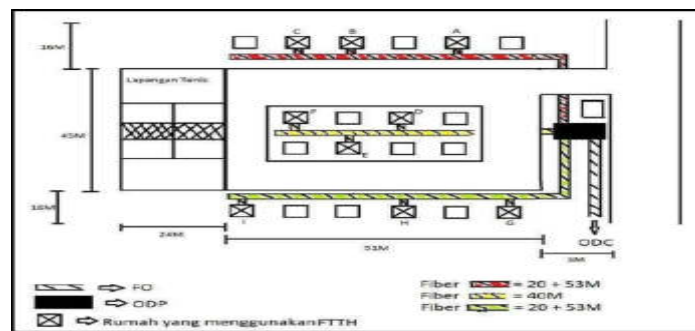Figure 2. comparison of MSAN and FTTH

Figure 3. Cable Plan Design

The length of fiber cable required for Townhouse XYZ is Fiber Block A (red) + Fiber Block B (yellow) + Fiber Block C (green) which is 186 meters.
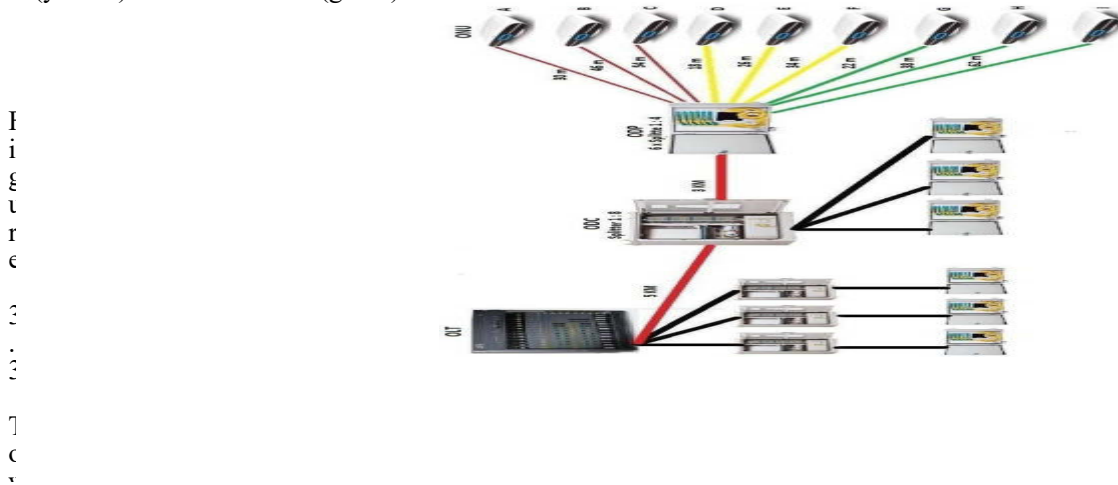

Figure 4. Network

TOTAL attenuation =

OLT – ODC Cable Attenuation+ODC – ODP Cable Attenuation+ODP Cable Attenuation – ONU+ ODC Splitter Damping +ODP Splitter Damping +Total Splice Attenuation

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Topology

Calculation of attenuation for this network is needed because by obtaining attenuation that is in accordance with the specified range, namely 15 - 28 dB, the network can be said to be good or there will be no technical interference from the transmission media. The attenuation calculation technique is by using the desktop design method. For this calculation, it is necessary to analyze the determination of the splitter because the resulting splitter attenuation greatly affects the calculation of this attenuation. The splitter to be paired is adjusted to the number of houses to which the splitter will be installed but is usually added for backups. The total houses in Townhouse XYZ are 20 houses, so we chose 6 splitters 1: 4 because if we chose splitter 1:

From the topology above, it can be seen the following information:
a. Attenuation Range = 15 – 26 dB
b. Cable Attenuation = 0.5 dB/ KM
c. Splice Attenuation = 0.2 dB/ Connection
d. Connection Distance = 2 Km
e. Number of Connections = 3 Pieces
f. Splitter Attenuation 1: 4 = 6 dB
g. Splitter Attenuation 1: 8 = 11 dB

The formula used to calculate the total attenuation is as shown in the figure below:
ONU A
OLT-ODC Cable Attenuation = 5 Km x 0.5 dB = 2.5 dB
ODC-ODP Cable Attenuation = 3 Km x 0.5 dB = 1.5 dB
ODP-ONU Cable Attenuation = 0.03 Km x 0.5 dB = 0.015 dB
ODC Splitter Attenuation = 11 dB
ODP Splitter Attenuation = 6 Total Splice Daman = 3 x 0.2 dB = 0.6 dB
TOTAL Attenuation ONU A = 21,615 dB
In accordance with the specified range, namely 15-28 Db

4. CONCLUSION

Based on the results of research conducted at PT. Telkom, Tbk. It can be concluded that several points are the basis for designing a Fiber To The Home network: Usually customers who use GPON usually belong to new housing or real estate, and users reach 80% for new housing. The goodness or badness of the Fiber To The Home network depends on the attenuation obtained during installation in the field. With attenuation standards that have quality in the range of 15 – 28 dB. The configuration is adjusted to the service that will be chosen by the customer, which for the use of IPTV requires a minimum of 10 mbps, while for voip and internet it requires 2 mbps.

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