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Performance Analysis of WDM Pon At 10 Gb/S

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Abstract- In this paper we have studied the Wave length division multiplexing in Passive Optical network using software OPTSIM. We transmit the signal at 10gb/s in MAN Optical network With long Distance(50 km) also minimize the bit error rate. The main aim of the proposed design is to build a MAN optical network using ten-gigabit Ethernet technique, and what are the necessary requirements to build these networks. As a case study, all states center are connected as Star – Bus topology using layer2 and layer3 optical switches. In addition, in this paper one-gigabit optical transmitter and receiver are designed to work as a node in the network topology. Furthermore, the benefits of using L- Band wavelength for transmission take in consider the linear and non-linear effects on fiber optic is presented.

Key words- Wave length division multiplexing, Passive Optical network, OPTSIM

I. INTRODUCTION

Optical network are high-capacity telecommunication network based on optical technologies and components that provide routing, grooming and restoration at the wavelength level as well as wavelength-based services. It uses Optical Fibers for data transmission. The advantages of Optical networks can be used for long distances, easy to install and has long-term financial benefits, lasts for a long time and has a high bandwidth. Optical networks are based on the emergence of the optical layer in transport networks provide higher capacity and reduced costs for new applications such as the internet, video and multimedia interaction and advanced digital services.

A. MAN:

Metropolitan networks play a critical role in the overall expansion of network services. They not only provide for services within individual metropolitan areas, but they also serve as the gateways for wide-area national and international-scale networks [9]. A metropolitan area network of the near future will be characterized by the quantity and diversity of its end users, by the high percentage of randomly fluctuating packet-based data traffic and by the incredible load placed on the network at peak usage times. World-Wide Web suggests that as soon as subscribers view images, they desire video clips. Hyperlinks and low cost memory suggest that many of us will become servers, and video sources are likely to be practically available in our backyard.

B. Network Topologies:

The topology of the network defines how the nodes of the network communicate with one another over physical media. Each is used in specific network types. There are five major topologies in use today: Bus, Star, Ring, Tree, and Mesh. Each topology has its own strengths and weaknesses.

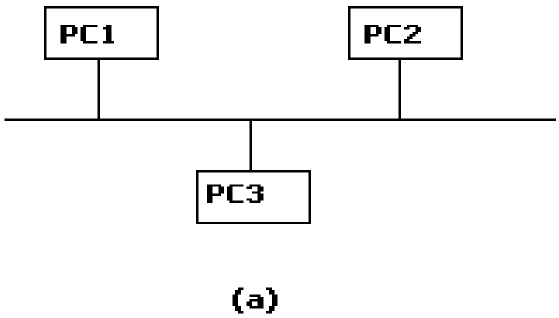

Figure 1:Network topologies

C. TDM:

Time Division Multiplexed Passive Optical Network (TDM-PON) in Figure 1.9 originally referred to as Telephony on PON (TPON) is the most common commercial PON architecture. Bidirectional transmission is based on Wavelength Division Duplex (WDD). In the DS direction the OLT broadcasts the traffic through an optical power splitter to the entire ONUs in the access network. Correspondingly, all broadcasted information is received at every ONU. The data streams for different ONUs can be virtually differentiated using ONU address labels that are embedded in the transmission. At the ONU, only the relevant data with correct address labels is processed and all other data is discarded. There is an apparent security issue as the data intended for one ONU

also reaches the other entire ONUs in the PON.

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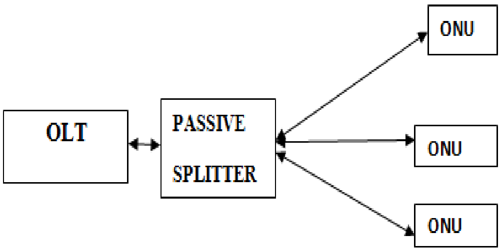

Figure 2: Single stage TDMPON architecture

D. WDM:

The term Wavelength Division Multiplexed Passive Optical Network (WDM-PON) is used somewhat loosely to describe a PON that employs Wavelength Division Multiplexing (WDM). A common feature of WDM-PONs is that separate wavelengths are used for each ONU in the DS. In the US, traffic multiplexing can be achieved either by WDD or Time Division Duplex (TDD). Hence a variety of different WDM-PON architectures are possible. Some of the cornerstone WDM-PON architectures are shown below.

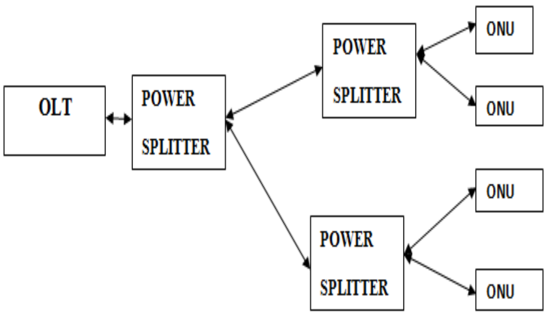

Figure 3: Multistage splitting TDM PON architecture

II. METHODOLOGY:

OPTSIM :The core version of Opt Sim was first developed in 1983 by the Optical Communication Group of Politecnico di Torino. The optical simulation software was originally known as Top Sim, a transmission system simulation package, which was developed for mobile and satellite communication.

The proposed network based on AWG multiplexers and AWG demultiplexers have not been analyzed and no optimization has been done in this regard. Moreover, no work over comparative analysis for suitability of better data modulation format was done. Arrayed Waveguide Gratings multiplexers and demultiplexers for WDM applications have proven to be capable of precise multiplexing and demultiplexing of a large number of channels with relative low losses and with a very low BER of 1 x10-40 for a transmission distance of 50 km.

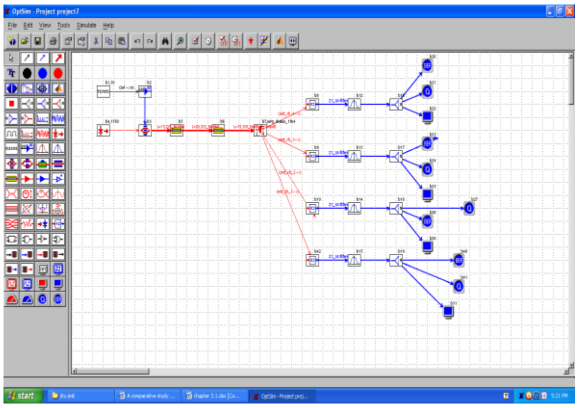

Figure 5: 1X4 WDM-OPN Architecture

Optical transmission link based on AWG optical network has the simulation set up as shown in figure 5. It consists of stages: an optical transmitter and optical receiver and between them a method of reconfiguring the paths. The AWG optical network and the wavelength channels that are to continue on, from various nodes onto a single output Fiber through optical combiner. The optical AWG demultiplexer separates wavelengths in an input fiber on to ports.

Optical splitter are also used an attenuation of 0dB at each output port so this component implements an ideal splitter without any insertion loss, i.e. a component that perfectly splits the input signals. The electrical scope is used to obtain eye diagram, and from the eye diagram the values of BER, Q factor, jitter and eye opening are determined.

The basic architecture of the network based on an AWG demultiplexers optical network is shown in Figure 5. Each node is connected to the network via two fibers i.e. one for transmission and the other for reception. At each AWG multiplexer input port data is collected from attached nodes. At each AWG multiplexer output port, a wavelength-insensitive combiner collects data from multiplexers out ports.

After the amplification by SOA the data is transmitted through single mode optical fiber. SOA‘s gain is 5 dB. Similarly, after the transmission fiber data is amplified by the SOA and the signals are distributed by a wavelength-insensitive splitter. After that the signal is distributed to nodes by AWG demultiplexers. Each node is equipped with a laser diode (LD) and a photodiode (PD) for data transmission and reception, respectively. In this WDM system, CW laser emit light at a different wavelength, with all the light multiplexed together onto a single optical fiber. After being transmitted through a high-bandwidth optical fiber, the combined optical signals must be demultiplexed at the receiving end by distributing the total optical power to each output port and then requiring that each receiver selectively recover

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only one wavelength by using a tunable optical filter.

III. Result Analysis and Discussion

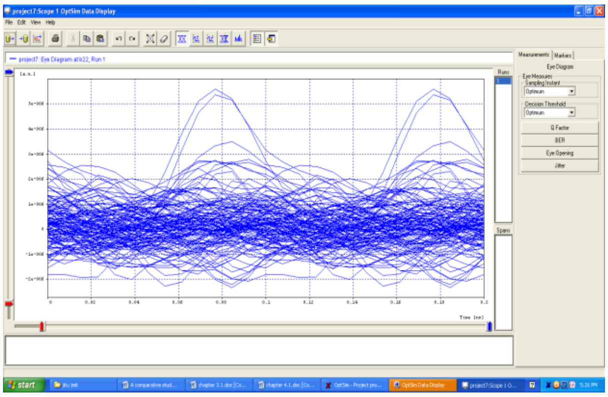

Figure 6: Eye Diagram at b22(5o km)

Figure 6: shows the results obtained in the form of eye diagrams. Figure 6. shows the distance eye diagram of AWG optical based network, it is observed at the receiving end. This eye diagram shows the result at the distance of 50km.

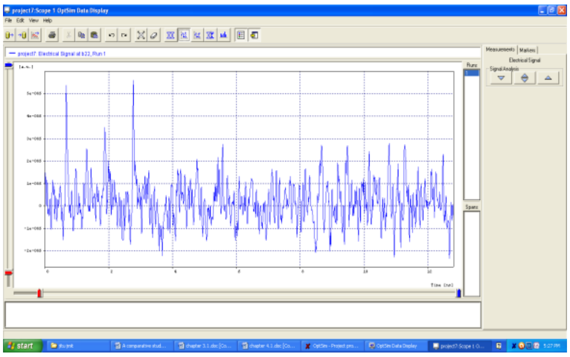

Figure 7: Electrical signal at b22(50 km)

Figure 7: shows the results obtained in the form of Electrical signal. Figure 7. shows the distance Electrical signal of AWG optical based network, it is observed at the receiving end. This Electrical signal shows the result at the distance of 50km.

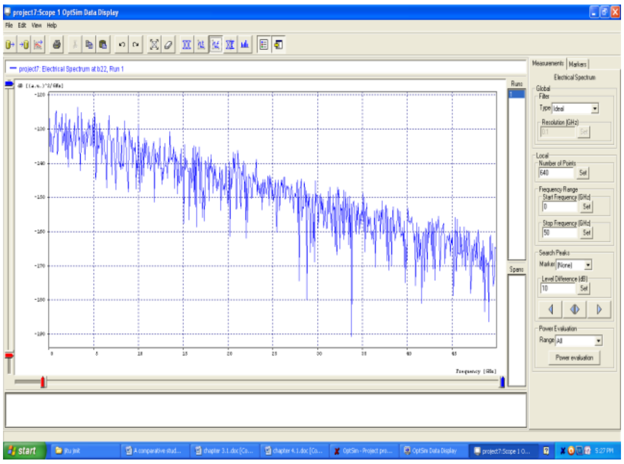

Figure 8: Electrical spectrum at b22 (50 km)

Figure 8: shows the results obtained in the form of Electrical spectrum. Figure 8. shows the distance Electrical spectrum of AWG optical based network, it is observed at the receiving end. This Electrical spectrum shows the result at the distance of 50km

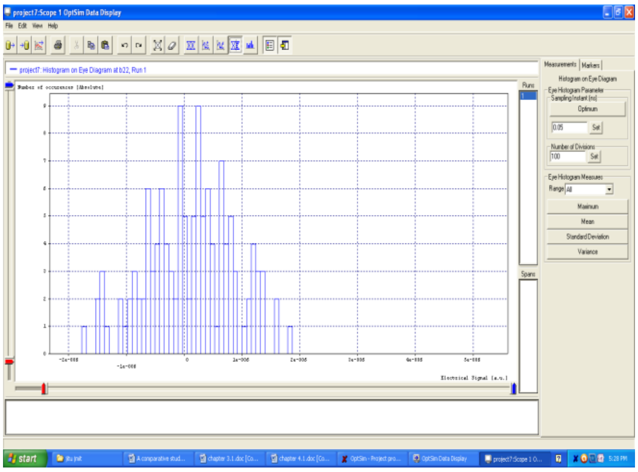

Figure 9: Histogram on eye diagram at b22 (50 km)

Figure 9: shows the results obtained in the form of Histogram on eye diagram. Figure 9. shows the distance Histogram on eye diagram of AWG optical based network, it is observed at the receiving end. This Histogram on eye diagram shows the result at the distance of 50km.

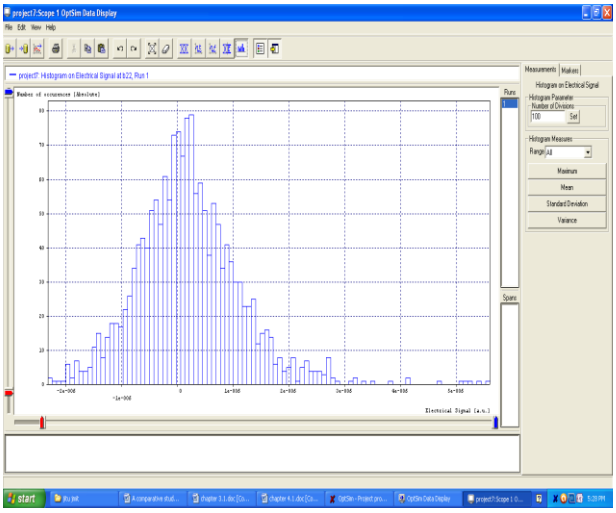

Figure 10: Histogram on electrical signal at b22(50 km)

Figure 10: shows the results obtained in the form of Histogram on electrical signal. Figure 10. shows the distance Histogram on electrical signal of AWG optical based network, it is observed at the receiving end. This Histogram on electrical signal shows the result at the distance of 50km.

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IV. CONCLUSION

This dissertation first reviews the evolutionary path of optical networks and shows the drivers from technology and business perspectives for high bandwidth and low cost. A variety of research challenges in this optical passive network is reviewed, from optical components in the physical layer to the control and management issues in the upper layers. This chapter discusses the requisites for optical sources, optical amplifiers, and optical receivers and modulators in optical access networks with high transmission rate (10 Gbps) and large power attenuation (due to large split, transmission over 50 km and beyond, and propagation). We analyze the key topological structures to guarantee physical protection (e.g., tree-and-branch, ring-and-spur). The optical amplifiers design models with WDM and TDM were successfully and the performance has been compared on the basis of transmission distance and bit error rate, quality factor, jitter performance and their respective eye patterns. It is observed that semiconductor optical amplifier provides the highest output power (14.23dBm) and least bit error rate (1e-040) at 50 km The performance of WDM/TDM optical network was evaluated using the eye patterns, BER measurement.

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