


Design and Analysis of AWG and FDL-Based Optical Switch in Data Centre Network

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INTRODUCTION

The fast growth in modern computing applications such as video on demand, multimedia application use of the internet of things generates thousands of discrete data in every minute. This rapid growth of data generation, generates a heavy workload on the data center servers. Major content provider companies such as yahoo, google, Microsoft, amazon, etc, has installed mega data center systems which house hundreds of thousands of servers in large scale layouts. (Habib, 2012; Koley, 2010; Katz, 2009). In the network as the demand of network services increases the requirement of high bandwidth also increases. The electronic devices do not fulfil this demand of higher bandwidth because of speed constraints (Sato and Hasegawa, 2009). So, the use of optical technology plays a significant role. Now days to meet this increasing demand in communication network the optical network technologies are explored by researchers. The one of the promising techniques is an optical packet switched network. In an optical packet switching system all switching functions are performed optically. The optical network system consists of core and client networks. In optical switching system, this is difficult to implement the control and processing units in optical domains and this is not technical feasible. So, in most of the optical switching system, the buffering and switching are performed optically while all the control functions are performed in electronic domain.

The main objective of this article is to discuss a wavelength division multiplexed, optical switch. The physical layer and network layer analysis of switch is presented in the article. The switch is placed in to the network and the overall performance of switch is measured under different conditions when it is placed in to the network.

BACKGROUND

In this section a brief background of optical network is presented the various devices which are used in to the core of optical switches is also discussed in this section.

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Advantages of Optical Communication

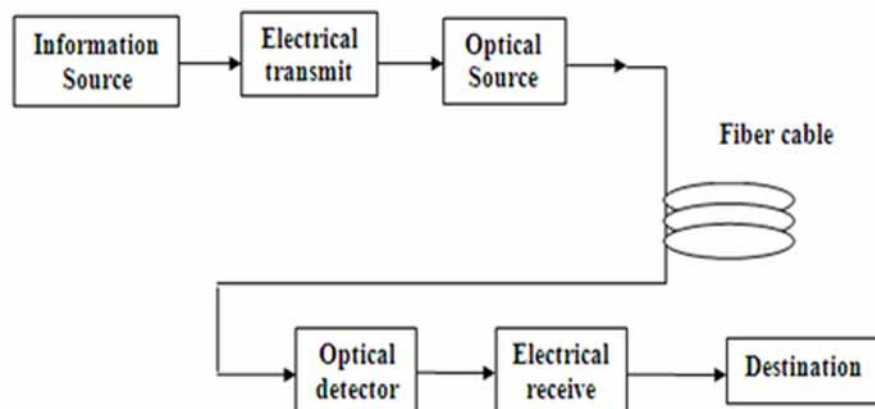
The optical fiber technology is based on the propagation of the optical pulses in optical fiber. Hence, the system offers advantages like large optical bandwidth (theoretically infinite), shock proof immune to interference etc. The advantages of the optical fiber communication can be summarized as (Agrawal, 2012):

1. The optical fiber cable offers a very large bandwidth, it is very light weight, and diameter is very small, hence laying of cable is not a daunting task.
2. The optical fiber cable is non-conductor; hence systems are shock free.
3. The optical fibre systems are immune to Interference and Crosstalk
4. The transmission is very secure and fiber lay down under ground and tapping of the signal is not possible. Thus, it offers very high security of signals.
5. In the region of interest the transmission loss is negligible.
6. The optical fiber communication systems are rugged and very flexible.
7. The optical fiber communication systems are very reliable and maintenance is easy.

GENERIC OPTICAL FIBER COMMUNICATION SYSTEM

In 1960, during his research for US Air force, RAND corporation scientist Paul Baran was the first one to introduce the concept of packet switching in 1960 (Agrawal, 2012). In packet switching, the information is transferred into small size packets. Each packet contains small chunks of data which is to be transmitted between various nodes into network. Inside the network, at each node the packets are either buffered or it can be directly transmitted towards the output port which results into variable queuing delay among packets. This feature makes a difference between circuit and packet switching as in circuit switching a dedicated path is established in advance and continue till communication takes place. For optimizing available network channel capacity, packet switching technologies are used (Agrawal, 2012). By using packet switching, the transmission latency can be minimized (i.e. the time taken by data to pass across the network), and the robustness of network can be increases (Koch, 2012).

Figure 1. The generic optical fiber communication system.



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