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REDUCTION OF BIT ERROR RATE IN IN BAND CROSSTALK USING RWA ALGORITHM IN WDM/DWDM RECEIVER

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ABSTRACT

Optical networks are the backbone of the communication because of their high throughput in the order of tera bits per second. Optical networks are having low cost and high capacity network. The first generation of optical networks provides point to point communication in electronic domain. To make cost effective network, development in DWDM techniques occur. In order to focus on the transparent network, the connection between the source and destination is established through WDM. At the receiver the signal quality is not good and the bit error rate (BER) is high. For setting up light path we use various routing and RWA techniques.

Keywords: BER, DWDM and WDM

I. INTRODUCTION

Optical fiber communication transmit data at very high rate and also gives large bandwidth. The optical fiber channel is capable of transmitting signal having data rate in tera bit per-second, but through a single communication system we are unable to get the high speed[1]. An optical network provides a general infrastructure over which a variety of services which can be delivered. These networks are also helpful in giving suitable bandwidth in a flexible manner where and when needed.

Optical fiber provides much higher bandwidth than copper cables and is susceptible to various kinds of electromagnetic interferences and other undesirable effects. Optical fibers are widely useful today in all kinds of telecommunications networks. The amount of deployment of fiber is often measured in sheath miles. Sheath miles is defined as the total length of fiber cables, where each route in the network comprises many fiber cables. Optical fiber communication transmit data at very high rate and also gives large bandwidth. The optical fiber channel is capable of transmitting signal having data rate in tera bit per-second, but through a single communication system we are unable to get the high speed [2]. In first generation optical fiber is replaced copper cable and used as a transmission medium. These networks give point to point transmission service. The switching and processing of the data in these networks handled by electronics. The main advantage of DWDM techniques for example amplifiers, lasers, filters and optical switches is to provide large capacity of bandwidth over a single mode fiber (SMF). In the second generation of optical networks we consider switching , routing and restoration of the signals. Optical communication system has an advantage of having the large bandwidth (THz) of an optical fiber. And it is extremely difficult to develop all of the vast bandwidth of a fiber using a single high capacity wavelength channel due to optical-electronic bandwidth mismatch [3]. A major breakthrough occurred with the advent of wavelength division multiplexing (WDM), which is a method of sending many light beams of different wavelengths simultaneously down the core of an optical fiber. In WDM net- works, prisms and diffraction gratings can be used to multiplex or demultiplex different wavelength signals.

Component crosstalk basically occurs in optical networks when a desired signal and an unwanted signal from neighboring input ports are having the same wavelength arrive at a channel. The desired and the unwanted signal are not associated with each other due to power fluctuation of laser. When they interact with each other. They cause power fluctuations and increasing bit error probability of the system [3].

In optical network, WDM networks gives high bandwidth i.e., in the order of tens of Gigabits per second per channel. Due to this all Optical networks using wavelength routing techniques. In present there are two approaches to explore the traffic grooming problem in WDM networks. First approach is the bandwidth requirements of most of the current applications are the bandwidth offered by a single wavelength in WDM networks. Second approach is the dominant cost factor in WDM networks [9].

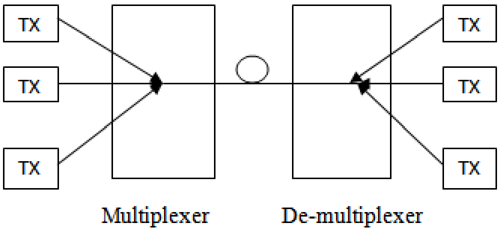
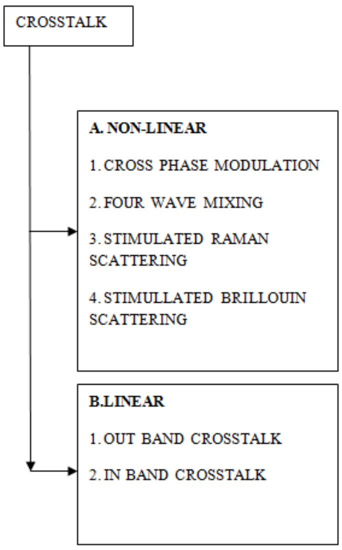


Fig 1.WDM Receiver

II. CROSSTALK



In high-capacity optical networks, basically wavelength channel have a data rate of 10Gbit/sec or higher per channel. We get the required information capacity when the number of wavelength per channel in an optical fiber has to be very large, but it is also limited by the bandwidth of the optical devices, such as optical amplifier. In order to get the required wavelength to be within the amplifier bandwidth, we have to make the wavelength channel as close as possible [4].

These wavelength channels results in system impairments when optical wavelength selective components along the light path are not able to determine the closely- spaced wavelength channels [5, 6]. Crosstalk also occurs when the combined optical power of the wavelength channels is very high that the optical fiber cannot be treated as a linear medium. Crosstalk results in significant decrement of signal quality and should be consider during routing and wavelength assignment.

III.OUT-OF BAND AND IN BAND CROSSTALK

A. Out-of Band- These are generally occur in optical fiber under high power condition and for large distances. It can also occur due to non-ideal demultiplexing where one channel is selected and other channel is not perfectly rejected. Optical switches are also source of out-of band crosstalk which is arises due to imperfect isolation in different output ports.

B. In-Band Crosstalk-In-band crosstalk is more hazardous than the out-of band crosstalk that is, the damage signal at the same wavelength cannot be removed by the demultiplexers. Both the multiplexers and demultiplexers are the sources of In-band crosstalk .In-band crosstalk inherent to optical switches can also be used for tapping. For example, if there are some unused ports are present at the output of a switch to which a gains can access, then they can determine traffic and gain information carried at other signals on the same wavelength. This can be reduced by individually amplifying only signals, it means that the crosstalk would not be amplified. However, an attacker can still request a data channel and not send any information over the channel, but use it to tap other signals at the same wavelength.

IV.COMPONENT CROSSTALK

Component crosstalk is one of the main physical layer impairments that arise due to non-ideal nature of optical add-drop multiplexer & cross switches used in present optical networks. Linear crosstalk in optical components can be divided into mainly as in-band or inter-band crosstalk depending on whether it has the wavelength as the desired signal or not [8].

V. Physical Layer Impairments(PLI'S)

The PLIs depend upon the network type, network access, reach, and the type of network applications. The network type could be non-transparent that is, an optical signal undergoes OEO conversion at all intermediate nodes along its path can be translucent, or transparent and the light paths are switched completely in the optical domain. The PLI reach basically consist of access, or core/long-haul network and the type of network applications consist of real-time, non-real time, mission-critical, etc.

VI. RWA TECHNIQUE

RWA problem is divided into two problems that are light path routing (LR) and wavelength assignment problem (WA).The objective of LR problem is to minimize the light path using a fiber links and is to minimize bandwidth, ports, switching. The objective of WA problem is to minimize, the maximum wavelength used on a fiber link.

For WA problem, we have following constraints-

1. Two lightpaths must not be assigned the same wavelength on a given link.

2. If no wavelength conversion is available in a switch , then a lightpath must be assigned the same wavelength on the links through a switch. If wavelength conversion is not available in the network, then a lightpath must be assigned the same wavelength all its route.

V. CONCLUSION

In this paper we study about the Physical layer impairments occur in the optical networks and the crosstalk occur in WDM/DWDM networks and also the effect of crosstalk in optical networks that is, BER increases or decreases at the receiver.

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