Optimization and performance study in DWDM for PON’s with OpticalADM

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Abstract— In the present era of optical communication DWDM technique in conjunction with OADM has moved the communication industry considerably nearer to the drastic improvement of the optical networks. The OADM may be placed between any two end terminals along any route and can be a substitution of an optical amplifier. Different service providers could get flexibility to allocate income generating traffic and can minimize costs associated with deployment of end terminals on the small traffic areas along any of the routes. Add–drop multiplexers are a must need for WAN and MAN in which one or more information channels can be dropped or added while preserving integrity of other channels. In light of it in this paper OADM with high data transmission rate based on dense wavelength division multiplexing has been investigated for used fiber transmission length of three hundreds kilometers, for its optimum performance and with a number of transmission parameters, randomly selected channels have been investigated for its optimum value in terms quality factor in order to ascertain its optimum transmission performance. Simulated results indicated with dispersion value of 1.5 ps/nm/km, EDFA power of 4dBm and with smaller value of attenuation factor link has showed optimum transmission performance for selected transmission distance of more than 300km.

Index Terms— Dense Wavelength Division Multiplexing, Optical Amplifier, Meshed, Ring.

I. INTRODUCTION

The requirement for high capacity communication services has spurred concentrated research on gigantic spectral efficiency and high data rate fiber optic communication networks. Therefore an efficient technology with optical communication referred as dense wavelength division multiplexing (DWDM) has been developed. It increases the capability of a single fiber to many times. These systems have been deployed presently increases a single fiber’s capacity multi fold and hence throughput of transmission system. This revolutionary communication technology which when united with optical network management systems and add/drop multiplexers facilitate carriers to implement optical communication networks which may meet to fiery spectrum needs of the coming generation at a considerably much inferior cost than installing newer fiber [1]. This optical add and drop multiplexer based on dense wavelength division multiplexing technology has been thrilling the optical information industry hugely faster and expanding optical communication networks with wavelength selective optical add and drop filters. That is necessary for inclusion and dropping of a particular dense wavelength division multiplexing (DWDM) channel on every subscriber's point in the DWDM based optical communication access networks [1]. Optical add and drop multiplexer could be employed between any of two end terminals along with any communication route and can be substituted for an optical amplifier. In the commercially available optical add and drop multiplexer (OADM) which allow many of the carriers to drop and/or add up to multi channels between dense wavelength division multiplexing (DWDM) terminals. With application of optical add and drop multiplexer in spite of using an optical amplifier different services providers may obtain flexibility to allocate revenue generating traffic and hence minimize costs associated with deploying end terminals at less traffic areas along any communication route. It is particularly well suited for branched or meshed network structures in addition to different ring architectures employed to improve efficiency, with tunable bandwidth in OADM is much more advantageous. In one of the development presented for the results on ring type network with four nodes only and separation between the nodes is set to 12.5kilometer and 25 kilometer, also presented performance for ring type network at filter bandwidth range 10 MHz to 40 MHz [2].
With optical communication ring networks interchannel crosstalk may start from optical add drop multiplexer and from cross phase modulation. Optical add and drop multiplexer can be used to add and drop any of frequency at intermediate nodes without affecting several other communication optical channels. It increases the capacity of the communication network as the dropped wavelength could be again reused [3]. With specific optical cross connects and optical add drop multiplexer provides wavelength routing capabilities such that every channel can be routed through all optical network to its own wavelength path [4]. For wavelength division multiplexed optical networks dense wavelength division multiplexing technology is essential for maximizing the inadequate communication bandwidth. Therefore add and drop filters were employed for dense wavelength division multiplexing based optical communication networks and have to have very good reflection characteristics and temperature stability also very narrow spectral bandwidth, very small implementation cost [5]. Few other study has been reported about a ring network having twelve nodes with single channel is included and another is dropped. With systems performance analysis on a reference data rate of 10 Gbps [6].

In the forth coming decade’s information transmission will drastically alter from now a day’s point to point connections towards transparent meshed optical communication network. In order to meet rising requirement of bandwidth may need larger transfer capacities per fiber than current ones. Therefore it is still an open subject whether to enhancement of the capacity can be fulfilled with a huge number of wavelengths per fiber. Another way is with higher data rates per wavelength or likely to be a combinations of both. In light of it in this work paper has been proposed for optical add/drop multiplexers for high transmission data rates and products for next generation of optical communication networks which were based on dense wavelength division multiplexing for single mode fiber link lengths, for it a number of number parametric scan have been taken to optimize performance.

II. DESIGN AND SIMULATION MODELING
One of the major functions of an optical multiplexer is to couple two or more wavelengths into the same fiber. It selectively removes a wavelength from an array of wavelengths in a fiber and thus from communication traffic on the specific channel. There after add in the similar direction of information flow of the same wavelength but with dissimilar information content. It is particularly used in wavelength division multiplexed ring network systems as well as in long haul with add/drop features. The optical add and drop multiplexers can be classified as dynamic wavelength selectable and fixed-wavelength. The wavelength has been selected and remains the same till the human interference changes it for fixed wavelength and for dynamically selectable wavelength optical ADM wavelengths between the optical multiplexer and demultiplexer were dynamically directed from the outputs of the demultiplexer to any of the inputs of the multiplexer [7].

In the communication link for wave length division multiplexed signal is transmitted over a medium haul link, in which total of sixteen channels spaced 50GHz and transmitted signal is preamplified by booster a erbium doped fiber amplifier of boosted signal is transmitted over single mode fiber of length of 300 kilometers. Now in the middle of communication link four of the channels were dropped and on the receiving end four of the channels were detected. At the receiving end transmitted channels were detected and passed to eye scope device and Q factor meter and parametric simulations have been done in order to investigate optimized performance.

III. RESULTS AND DISCUSSION
With passive optical ring networks using dense...
wavelength division multiplexing optical add-drop multiplexer is one of the important component. In any of the transparent optical link optical ADM can be employed for selectively inserting and dropping required channels. In this study performance has been successfully investigated for high bit rate system for three hundreds of kilometers of length of single mode fibers employed, booster power, dispersion values and attenuation. The DWDM systems performance has been optimized for number of transmission parameters with four of the channels has been dropped at optical add and drop multiplexer and four of channels have been detected on the receiver end. In the figure (3) indicated that performance plot with for quality factor and dispersion, demonstrated that as dispersion increases, this leads to decrease in quality factor that is performance degraded. Results in figure (5) demonstrated that as attenuation factor increases, this leads to decrease in quality factor that is performance degraded. That means low attenuation factor can be chosen. Results in figure (6) have demonstrated that as booster power increases, this leads to decrease in quality factor that is performance degraded. Consequently it can be concluded that for DWDM-OADM sixteen channel system the optimum performance has been achieved with 4dBm of booster power and dispersion value of 1.5ps/nm/km and with lower value of the attenuation values.
IV. CONCLUSION

Optical add and drop multiplexers are the key component in the modern optical communication so this paper has been proposed in Optical ADM and successfully investigated for high transmission bit rates and products in next generation optical communication networks based on dense wavelength division multiplexing for different parametric variations at room temperature for best performance efficiency. Simulated results indicated with dispersion value of 1.5 ps/nm/km, EDFA power of 4dBm and with smaller value of attenuation factor link has showed optimum transmission performance for the selected transmission distance of more than three hundreds of kilometers.

REFERENCES


Author Biography

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