Wavelength division multiplexing

Karishma Yuvraj Naitam, Dr.Dinesh Vithalrao Rojatkar
Student, Asst.Professor
Dept. of Electronics and Telecommunication
Government College of Engineering,Chandrapur,Maharastra.

***Abstract*: Now days, telecommunication's future technology is increased day by day with need for more data rate with high speed of reliable data transmission. An optical WDM technology is being deployed in the market place at a very rapid rate. The main purpose of this paper is to summarize the basic optical networking approaches, briefly report on the WDM deployment strategies of two major U.S. carrier's and outline the current research and development trends on WDM optical fiber network.**

Keywords: wdm system.

1 INTRODUCTION

In optical fiber communication system, wavelength division multiplexing is technology which combines a number of optical carrier signal and then transmitting through a single optical fiber by using different wavelength (i.e. colors) of laser light. This technique enables bidirectional communication over one strand of optical fiber, as well as multiplication of capacity.

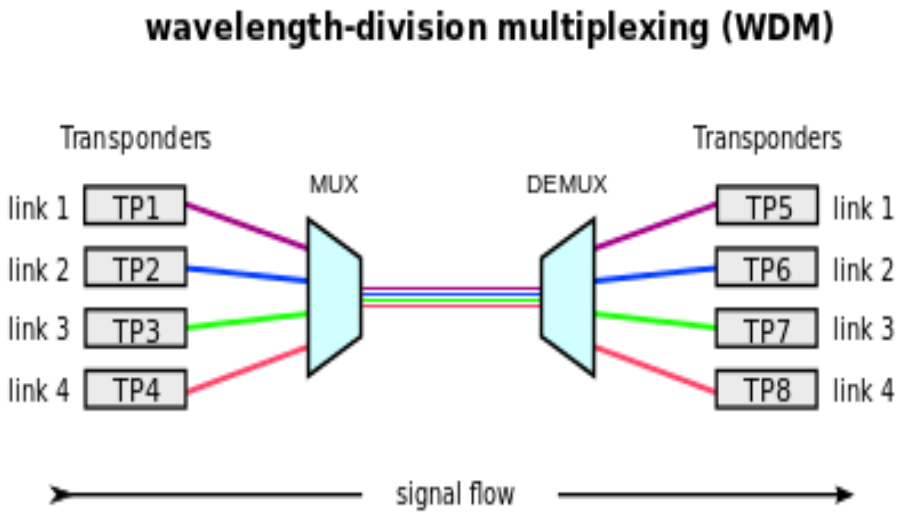

Figure 1: WDM

The term wavelength division multiplexing is similar to that of frequency division multiplexing. that commonly applied to an optical carrier (which is typically described by its wavelength), whereas frequency division multiplexing typically applied to radio carrier (which is more often described by frequency).since wavelength and frequency are tied together with a simple directly inverse relationship, in which the product of frequency and wavelength equals (the propagation speed of light), the two terms actually described the same concept.

When optical fiber communication systems were first deployed, they consist of simple point-to point link in which a single fiber line had one light source at its transmitting end where as the one Photo -detector at the receiving end. The initial use of wavelength division multiplexing (WDM) was to upgrade the capacity of installed point-to-point transmission links. The Use of WDM offers a further boost in fiber transmission capacity. The idea of WDM is to make use multiple light sources operating at different wavelengths to simultaneously transmit several independent information streams over the same fiber. Figure illustrate the WDM's basic concept, a TDM in figure is included for comparison.

Due to this fact that each channel is transmitted at a different frequency, here we can use a tuner to select from them. With the appearing of tunable lasers that have extremely narrow spectral emission widths, one could then space wavelengths by less than a few nano-meters. Each an every wavelength carries an independent signal, so that the link capacity is greatly increased. The key is to ensure that the peak wavelength of a source is spaced sufficiently far from its neighbor to avoid creating interference between their spectral extents.

To maintaining strict control over the wavelength, the system designers usually include an empty guard band between the channels. Different separate optical fibers are connected into the optical Multiplexer, each of which carries its own data streams and wavelength; the received signals are multiplexed and transmitted onto one single optical fiber.

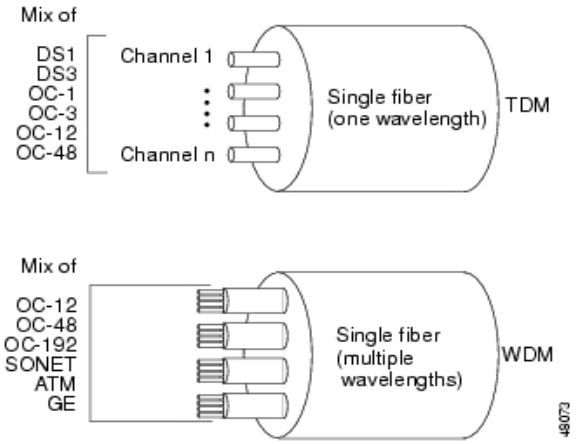

Figure 2: TDM and WDM interfaces

WHY IS WDM USED?

Over the past two decades the network traffic has been growing exponentially ,this caused mainly by the wide acceptation of internet, many carriers are finding that their estimation of fiber need have been highly underestimated although most cable included much spare fiber when installed, this growth has used many of them and new capacity is needed. There are three methods are existing for expanding capacity:

1) Increasing system bitrates to multiplexing more signal.
2) Installing more cable
3) Wavelength division multiplexing.

In many cases Installing more cable will be the prefer method, especially in metrolitan area. Since optical fiber has become incredibly inexpensive and installation method more efficient but if conducts space is not available or if major construction is necessary,this may not be the most cost effective. We have seen that it is possible to pack many channels into a SONET/SDH network, using the principle of time division multiplexing (TDM). However, available technology puts an limit to the realizable bandwidth. Now a day OC-48/STM-16 with a speed of 2.488 Mbit/sec is most popular. More expensive OC-192/STM-64 with a 10 Gigabit/sec is also available. Practical upper limit using developing technology is 40 Gbps. An alternative is to assign different frequencies to different channels, multiplex them for carrying information over optical fibers and finally demultiplexed at the receiver end.

2 LITERATURE SURVEY:

A new generation of fiber optic technology that bringing to networks such as the aptly named Project Oxygen. the founder of the CTR Group in Woodcliff Lake Neil Tagare, N.J., that name picked for the global network, because he considered the tremendous bandwidth offered by the new technology to be as vital for telecommunications, as oxygen is to life itself. By sending signals at 16 different wavelengths through each of the four pairs of optical fibers, 640 gigabits per second (Gbit/s) across whole oceans carry by Project Oxygen. That is the equivalent of 10

million transpiring telephone conversations-enough for every person in Hungary or Belgium to call the United States at the same time.The technology which makes this new bandwidth possible is called wavelength division multiplexing, or WDM. Long-distance telephone companies were the first to realize that wavelength division multiplexing could cut the cost of bandwidth. , WDM technology provides "a much more effective way to add capacity," When Compared with the alternative of adding new fiber, according to Dana Cooperson, optical network analyst for RHK Inc., a market consultancy in South San Francisco. Laying new cable are expensive as well as time-consuming. When the carriers saw the need, manufacturers were equally quick to sense the market. Lucent Technologies of Murray Hill, N.J., produced technology developed at its Bell Labs subsidiary. Ciena, a Linthicum, Md. company founded in 1992, charged ahead faster, delivering its first commercial 16-channel system in 1996-at the same time as the AT&T spinoff. Other telecom giants around the world followed, including Nortel, Alcatel, Pirelli, NEC, Hitachi, Fujitsu and Ericsson. Through the past two to three years, several companies-including Ciena, Lucent and Nortel of Saint-Laurent, Que.-have begun to market systems that slice the erbium-amplifier spectrum into 32 or 40 slivers, each are 0.8 nanometer wide. Last September, Lucent delivered its first 80-channel system to AT&T. Pirelli Cable of Lexington, S.C., followed by promising a 128-channel version, but had not delivered hardware as of mid-January. On land, regional telephone companies have just begun to adopt wavelength multiplexing. In the last year, Bell Atlantic began to test WDM on a 35-kilometer cable between Brunswick and Freehold, N.J. says Robert A. Gallo, the Bell Atlantic engineer in charge of the trial. Four channels each carried signals at speeds of 2.5 Gbit/s-the top rate between company switching offices-and the Ciena-built system has slots for up to 16 wavelength channels. Bell South tested three of 16 channels in a similar system on a cable spanning 80 kilometer's between Grenada and Greenwood, Miss. The economic's are clear: RHK analyst Cooperson says that, "It is cheaper to add WDM capacity than to add new fiber".

3 CONCLUSIONS:

The purpose of this paper was to provide an overview of the research and development work in the area of optical networking. The result of an investigation into the use of wavelength division multiplexing technology to simultaneously carry away four different channels of analog RF signal transmission onboard an aircraft. This overall system analyses of signal-to-noise ratio (SNR), transmission response, group delay, and active range that were carried out during the investigation were promising and indicated that the WDM system suitability for avionics applications. The recent publicity of Internet availability during commercial air flights, The WDM technology can be used to simultaneously transmit Voice-over-IP, IP-Television, and RF signals on a single optical fiber cable.the paper summarized the basic optical networking approaches.

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