CHAPTER 2

LITERATURE RIVIEW

2.1 Introduction

In communications, the multiplexed signal is transmitted over a communication channel, which may be a physical transmission medium. The multiplexing divides the capacity of the low-level communication channel into several higher-level logical channels, one for each message signal or data stream to be transferred. A reverse process, known as demultiplexing, can extract the original channels on the receiver side. A device that performs the multiplexing is called a multiplexer (MUX), and a device that performs the reverse process is called a demultiplexer (DEMUX).

2.2 Other Project

Improving Signal Quality in a Spectrum-Sliced WDM System Using SOA-Based Noise Reduction

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We present an experimental and numerical study into the filtering effects in a spectrum-sliced incoherent light system incorporating a semiconductor optical amplifier (SOA) for noise reduction. Techniques to reduce the signal degradation caused by post-

SOA filtering are investigated. The alignment of the receiver/demultiplexer filter relative to the input spectrum-slice is demonstrated to have a noticeable impact on the receiver signal quality. We also show that the linewidth enhancement factor α of the SOA has a marked effect on the observed spectral distortion, which results in a strong dependence of the received signal quality on α. Our results illustrated the potential to improve system performance by SOA design.

Hybrid Coherence Multiplexing/Coarse Wavelength-Division Multiplexing Passive Optical Network for Customer Access

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We propose a passive optical network for customer access based on a hybrid coherence multiplexing/coarse wavelength-division multiplexing (WDM) technique. Coherence multiplexing provides asynchronous multichannel transmission, and coarse WDM provides bi-directional transmission. A costshared superfluorescent is used for downstream transmission, and inexpensive light-emitting diodes are employed for upstream transmission. Asynchronous two channel transmission at 40 Mb/s per channel is demonstrated for both upstream and downstream. Our experiment indicates that upstream and downstream aggregate bit rates of 640 Mb/s are feasible based on current commercially available components.

2.3 Multiplexing

In electronics, telecommunications and computer networks, multiplexing is a term used to refer to a process where multiple analog message signals or digital data streams are combined into one signal.

Figure 2.1: Multiplexer

The aim is to share an expensive resource. For example, in electronics, multiplexing allows several analog signals to be processed by one analog-to-digital converter (ADC), and in telecommunications, several phone calls may be transferred using one wire.

There are three main types of the multiplexing techniques in communication systems. There are Time Division Multiplexing (TDM), Frequency Division Multiplexing (FDM) and Wavelength Division Multiplexing (WDM). [11]

2.3.1 Time Division Multiplexing (TDM)

Time-division multiplexing (TDM) is a method of putting multiple data streams in a single signal by separating the signal into many segments, each having a very short duration. Each individual data stream is reassembled at the receiving end based on the timing. [12]

The circuit that combines signals at the source (transmitting) end of a communications link is known as a multiplexer. At the other end of the long-distance cable, the individual signals are separated out by means of a circuit called a demultiplexer, and routed to the proper end users. A two-way communications circuit requires a multiplexer/demultiplexer at each end of the long-distance, high-bandwidth cable [13].

An asset of TDM is its flexibility. The scheme allows for variation in the number of signals being sent along the line, and constantly adjusts the time intervals to make optimum use of the available bandwidth. The Internet is a classic example of a communications network in which the volume of traffic can change drastically from hour to hour. TDM is more efficient, easier to operate, less complex and less expensive than FDM.

2.3.2 Frequency Division Multiplexing (FDM)

Frequency-division multiplexing (FDM) is a scheme in which numerous signals are combined for transmission on a single communications line or channel. Each signal is assigned a different frequency (sub channel) within the main channel [14].

Frequency Division Multiplexing (FDM) is an analog technique where each communication channel is assigned with a carrier frequency. To separate the channels, a guard-band would be used. This is to ensure that the channels do not interfere with each other. FDM does not require all channels to terminate at a single location. Channels can be extracted using a multi-drop technique; the terminals can be stationed at different locations within a building or a city. FDM is an analog and a slightly historical multiplexing technique. It is level to noise problems, and has been overtaken by Time Division Multiplexing (better suited for digital data) [15].

When FDM is used in a communications network, each input signal is sent and received at maximum speed at all times. This is its chief asset. However, if many signals must be sent along a single long-distance line, the necessary bandwidth is large. Frequency-division multiplexing typically applies to a radio carrier (which is more often described by frequency).

2.3.3 Wavelength Division Multiplexing (WDM)

In fiber-optic communications, wavelength-division multiplexing (WDM) is a technology which multiplexes multiple optical carrier signals on a single optical fibre by using different wavelengths (colours) of laser light to carry different signals. This allows for a multiplication in capacity, in addition to making it possible to perform bidirectional communications over one strand of fibre [16].

WDM is the technique that allows several different signals to be carried along a single fiber at the same time. It achieves this by using different wavelengths for each transmission and can be employed on single mode or multimode fibers using lasers.

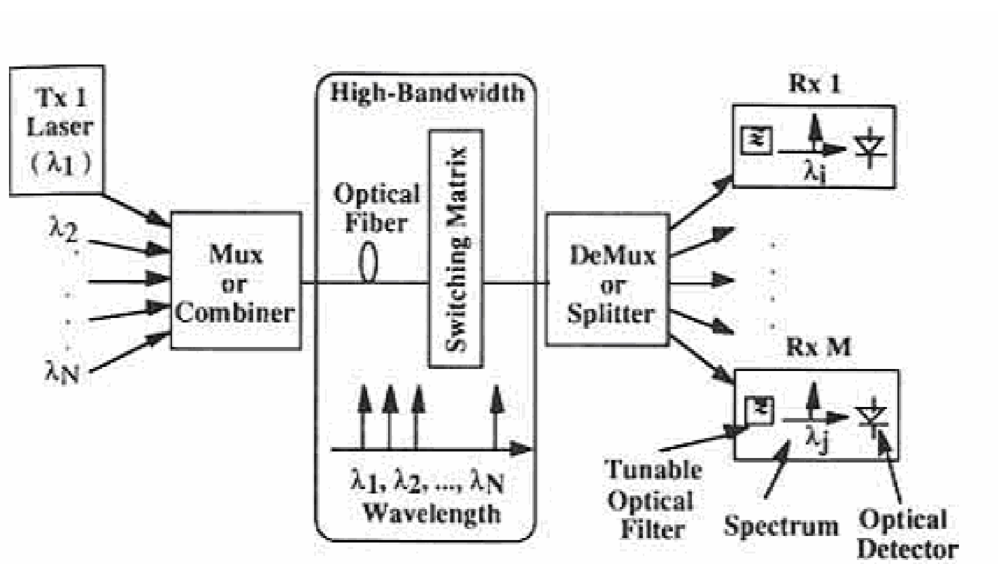

Figure 2.4: Diagram of a Simple WDM System

Usually WDM uses multiple coherent lasers, modulators, detectors and filters, all tuned to different wavelengths, resulting in network planning, and provisioning and operations nightmare in the rapidly changing metro environment. When amplification is used, it needs to be sophisticated and adaptive to accommodate varying numbers and power levels of signals at different wavelengths. WDM is the latest multiplexing technology adopted worldwide. The term wavelength-division multiplexing is commonly applied to an optical carrier (which is typically described by its wavelength).

2.3.3.1 WDM Components

The implementation of WDM technology for fiber-optic communication systems requires several new optical components. Among them are multiplexers, which combine the output of several transmitters launch it into an optical fiber, demultiplexer which split the received multichannel signal into individual channels destined to different receivers, star couplers which mix the output of several transmitters and broadcast the mixed signal to multiple receivers, tunable optical filters which filter out one channel at a specific wavelength that can be changed by tuning the passband of the optical filter, multiwavelength optical transmitters whose wavelength can be tuned over a few nanometers, add-drop multiplexers which can distributed the WDM signal to different ports, and wavelength shifters which switch the channel wavelength. [17]