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Research Article

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Comparative study on optical fiber communication multiplexing technology

Min Li[1] and Fengming Bai[2]

[1,2]Changchun University of Science and Technology, China
[1]Changchun University of Technology, China

ABSTRACT

The optical multiplexing technology is a feasible method for improving the capacity of optical fiber communication network by exploiting multiple wavelengths on each fiber used for data transmission independently. With the help of this technology, optical fiber communication network capacity can be greatly improved to meet the increasing requirements of the network.

Key words: Optical fiber, Communication, Multiplexing technology

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INTRODUCTION

Since the optical fiber communication came out, its features of light weight, small volume, anti-electromagnetic interference become the major advantage, which is not easy to crosstalk with low transmission loss, broad transmission bandwidth, as well as larger amount of transmission information. Thus, the advantages of it have brought about a revolution in the communication field with more concern and favor from the industry of technology. At present, 40 Gb/s optical network transmission equipment has been widely used, but today, with the capacity of information exploding, it is still growing at an annual rate of 40% per year. The high demanding services with high rate have emerged, such as 4G high speed mobile communication service, HD video, real time game, telemedicine, video conferencing, electronic business and other multimedia digital business, smart grid, super computer, cloud computing and other high speed information network with the next generation and signal storage, processing technology, which put forward higher demand for bandwidth and capacity of optical fiber communication system. It is very urgent for the broadband network to increase its capacity. At the same time in the system of communication, it is an important issue to reduce the transmitting cost from the equipment and make full use of the frequency resource. In order to further develop the ability of optical fiber communication, so as to meet the social development requirements, some advanced optical fiber communication technology emerged as the times required.

FIBER OPTIC COMMUNICATION MULTIPLEXING TECHNOLOGY

The main idea of multiplexing technology is a data link, which is divided into many different channels to provide different services for different use. Its essence is: multiple user information of a region with the collection through the multiplexer, and then pooled information group through a physical line transmitted to the receiving device, receiving device through the multiplexer can spread information into individual information, then to the multiple users in distribution. In addition, you can use a multiplexer, a communications line, instead of multiple sets of sending, receiving device as well as the communication lines.

Optical multiplexing technology, is developed on a number of different wavelength for the transmission of data in parallel within each of the optical fiber. Then it becomes the means to satisfy an important method for high bandwidth applications increasingly expanding the capacity of fiber communication network. With the help of this technology, capacity of each fiber can be improved greatly so that multiple data streams can be carried out in parallel transmission which does not cross the channel. Fig.1 shows the concepts of optical multiplexing technology.

As it can be seen, the optical fiber bandwidth is divided into N wave length, the optical fiber can also support N different application. Nowadays, a fiber can support hundreds of wavelength division multiplexer channels with transmission rate that each WDM channel can achieve one gigabit per second.

Since the optical multiplexing technology is introduced, the advantages of optical fiber multiplexing network can be summarized as follows: (1) The transmitting capacity is increased. When there is no introduction of fiber multiplexing, each fiber can support only one connection, however, with the introduction of this technology, an optical fiber bandwidth can be divided into N wavelength with N different connection requests. That is to say, in the optical fiber multiplexed network, each fiber capacity without the introduction of multiplexing technology is increased by N times. (2) The different modulation signal transmits at the same time. Due to the differences in the specific application, the signal from each application may require different modulation. According to the above description, each multiplexer channel can be independent in operation at different rates accordingly. With the help of this technology, signals of different modulation can be on the same fiber and then transmitted. (3) The capacity of the network is easy to be extended. After laying a fiber multiplexing network, the network capacity can be simply improved by updating the optical terminal optical multiplexer. Specifically, the optical multiplexer is a multi-channel optical device with optical input signal into one output signal. And the optical demultiplexer with optical device will carry an input signal at multiple wavelengths into a corresponding number of output signal.By updating the two optical devices, optical multiplexer network capacity can easily be extended without the need of laying more fiber. (4) The cost of network is lower. In the optical fiber communication network, the main cost is laying the cable. Therefore, through the introduction of this technology, the cost of the optical fiber communication network can be significantly decreased.

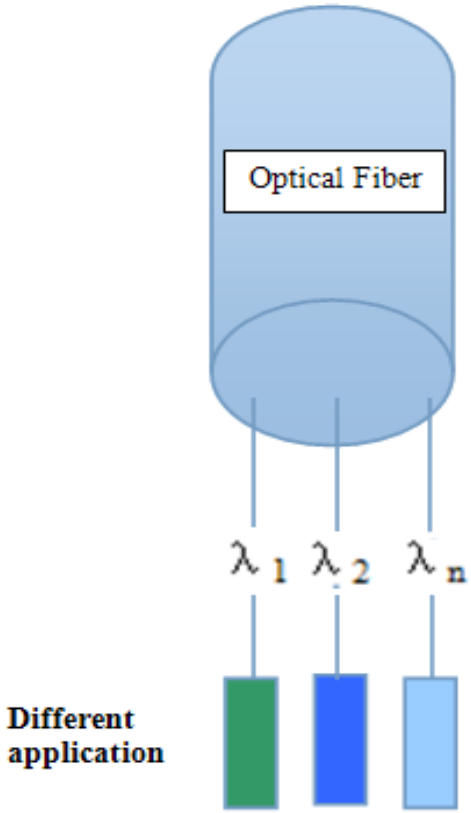

Fig. 1 Optical multiplexer

Based on the above characteristics, in practice, in order to increase the transmitting capacity of optical fiber communication systems, people put forward several different methods, such as: time division multiplexing, WDM technology, code division multiplexing technology and so on.

WAVELENGTH- DIVISION MULTIPLEXING TECHNOLOGY

The Interpretation of Wavelength-Division Multiplexing Technique. The so-called wavelength- division multiplexing technology is to make full use of the resource of huge bandwidth brought by the low loss region of single-mode fiber. According to different channel optical frequency can divide the different low loss window into a

plurality of channels. Taking the light as the signal carrier, then using wavelength division multiplexer at the sending end with the different wavelengths of light carrier merged signal into a piece of fiber to transmit. At the receiving end, using wavelength division multiplexing, making these different wavelength optical carrier bear different signals in a separated multiplexing method[1].

The Characteristics of Wavelength-Division Multiplexing Technology. (1) The optical multiplexing technology can make full use of low loss optical fiber in the band, which can effectively promote the optical fiber transmitting capacity. It can increase several times as much as the physical limits of optical fiber transmission information. At present we only use a small part of fiber low loss. The single mode fiber broadband with wavelength division multiplexing technique used about 25THz, therefore, the broadband transmission is adequacy. (2) Division multiplexing technology in a single fiber wave can transmit more than two non-synchronous signal at the same time, with better compatibility of analog and digital signal. It has nothing with the rate of modulation mode and data transmission, which can be accessed at any time or added in the middle of lines. (3) The earlier fiber system established especially with laying less number of optical cable cores. As long as the original system has a certain margin of power, which can increase organizational capacity. The transmission form with single or double signal does not need to change the original system,which can reflect its strong flexibility. (4) It reduced the number of using optical fiber. Due to reducing the number of using optical fiber, so in the earlier construction phase, it can effectively reduce the fiber costs, saving the cost. In addition, it can reduce the use of optical fiber quantity and reduce the difficulty of the later maintenance work on the user fiber, so as to ensure that the efficiency of working. (5) During the process of optical fiber to transmit signal, it can use wavelength-division multiplexing technology to complete the preservation of each optical signal information for the various source signal and change it into the corresponding electric signal. This transmitting method can effectively utilize the characteristics of large capacity fit the optical fiber transmission.

OPTICAL TIME-DIVISION MULTIPLEXING TECHNOLOGY

The Definition of Optical time-division multiplexing technology. Time-division multiplexing refers to the signal occupies time gap is different in the same channel for communication. By sampling theory, an important role of sampling is to make the continuous time signal into a discrete time signal. Its feature of limited time in the channel provides conditions for multiple signals along the same channel transmission[2]. In particular, the time gap time is divided into some homogeneous one, the transmission time of each signal distribution in time space is different, separating with each other in order to achieve the purpose, which does not interfere with each other. In the high-speed time-division multiplexing mode of transmission, optical pulse time slot width must be less than the rate of bit. Pulse spectrum width should be narrow, because of transmission distance spectrum signal is determined by the dispersion limit, which is better to use the limited pulses. Pulse generation should be with stability and good repeatability.

The Characteristics of Optical Time-Division Multiplexing Technology. (1) High utilization of bandwidth. Because there must be a certain protecting band between the WDM channels, therefore, the utilization rate of the wavelength division multiplexing system can not be too high. And the optical time-division multiplexing technology use ultra short optical pulse, the rate of single channel can be up to 640 Gbit/s, which can make full use of the frequency resources. (2) It is very convenient to control and manage. Since the transmission use only one carrier, optical time- division multiplexing can conduct signal processing directly in optical frequency.

OPTICAL CODE DIVISION MULTIPLEXING TECHNOLOGY

The Interpretation of Optical Code Division Multiplexing Technology. Optical code division multiplexing technique in principle is similar to code division multiplexing technique. In a transmitting node, optical pulse for each bit codes itself according to the law "the data flow in the data source codes 1", then forming high speed optical pulse sequence, each of which is called a chip. Bit "0" does not code, which can be replaced by all zero sequence. So each user can have a unique optical orthogonal code as the user address code. Through the optical fiber and the star coupler, the optical sequence of encoded is transmitted to each receiving node. At the receiving end, if the decoder matched with the encoder, the decoder signal can become the autocorrelation output. Moreover, code design requires a good correlation between unipolar code sequence, namely autocorrelation values should be as large as possible, while cross-correlation value should be as small as possible, each code word and its shift codes should be easy to distinguish, which can reduce signal. It means to reduce the rate of error[3]. In addition, it also can provide as much code as possible for the user, which is easy to realize in engineering.

The Characteristics of Optical Code Division Multiplexing Technology. (1) It can improve the capacity of the network. (2) It can improve the ratio of the signal-to-noise, improving the performance of the system. (3) It has high security. Code division adopts multiple access as the spectrum technology, only the receiving and sending end strictly matched can it be obtained the user signal, otherwise as a pseudo noise signal, which can enhance the

confidentiality. (4)It can reduce the need for synchronization. Code division multiple access does not require each node be synchronization, there is almost no access delay. It can achieve "tell-and-go" working style, which is suitable for busy traffic, large flow rate and high rate environment. (5) It has random access with channel sharing. Assigning different codes for each user to distinguish it between different user information.therefore, the optical code division multiple access allows multiple access users in the same channel,which does not require the wavelength to be adjustable or a stable device. (6) It can form all-optical network communication in real "transparent". The optical code division multiple access can code only at the transmitting node and receiving node with the users' data, which has nothing to do with the network structure. In addition, the optical code division multiple access may constitute a high-speed flexible network, which can also provide various services.

FREQUENCY DIVISION MULTIPLEXING TECHNOLOGY

The Interpretation of Frequency division multiplexing technology. In general, channel communication system can provide much wider bandwidth than the required transmission of a signal with its bandwidth. Therefore, it is very wasteful if a channel transmission uses only one signal. In order to make full use of the bandwidth of the channel, the channel frequency division multiplexing is offered. Frequency division multiplexing means that at the sending end, it can use different carrier frequency spectrum modulation multiplex signal into different frequency bands, in order to realize the multiplexing. Multichannel signal frequency division multiplexing can not overlap in frequency, merging together through a channel transmission, which can be received by different center frequencies with band-pass filter to separate.

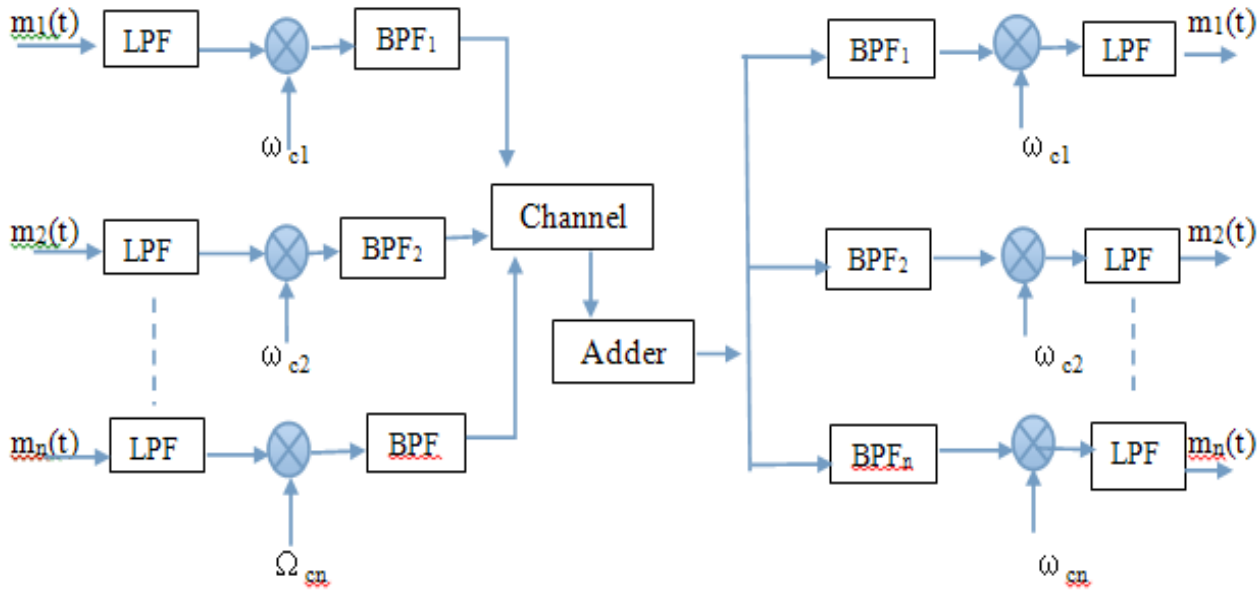

Fig.2 Frequency division multiplexing technology

The characteristics of frequency division multiplexing technology. In principle, frequency division multiplexing signal can directly transmit in the channel. But in some applications, it also needs for multiplexing signal to be merged with another modulation. The biggest advantage of OFDM channel is the high rate of reuse, allowing to reuse more approaches, at the same time, the shunt is also very convenient. Therefore, it becomes a main communication of simulating multiplexing mode. Especially, it is widely used in cable and microwave communication system.

CONCLUSION

An important advantage of optical fiber communication is its relatively fast speed, which has been widely used in the field of information transmission. But with the continuous extension of the application field, people began to find that this kind of transmission of information had higher negative effects on energy consumption, which increased capital investment. Therefore, the researchers looked through a lot of analysis, putting forward new wave division multiplexing technology. This technology of depleted fiber can effectively solve the problems in the field of communication, which has gained positive application. Although the WDM technology has certain advantages, it is very lack of practical application of this kind of technology. Therefore, during the period of promoting this technology, the technical personnel also need to continue to study. It needs the practice to prove that this technology

is an innovative technology,which has good prospects for developing.

REFERENCES

[1] Z.P.Nie. *China information Technology*, Vol. 126 (**2012**) No.2, p.55-57.
[2] J.Wang. *East China Science and Technology*, Vol. 142 (**2012**) No.1, p.66-67.
[3]X.F.Zheng. *Journal of Chongqing Institute of Technology* (Natural Science Edition), Vol. 89 (**2008**) No.6, p.24-26.