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Structure Design and Simulation of Optical Wavelength Division Multiplexing Network based on RSOA

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Abstract

Nowadays, with the continuous development of network technology, some technologies related to network technology have also been developed rapidly, such as mobile Internet and so on. Among them, the future development trend of broadband access network is wavelength division multiplexing (WDM) and passive optical network (PON). It provides almost unlimited bandwidth for every demander, which greatly increases researchers' attention to WDM-PON. With the continuous efforts of researchers, a WDM system based on amplifiers has emerged. Moreover, the price of amplifier based system is not very expensive. In addition, such a system uses optical network unit ONU, so the amplifier based WDM system has become a good choice. Therefore, the application system method based on rsoa has become a very attractive problem. Some domestic universities, such as Tsinghua University, University of Electronic Science and technology, Fudan University and so on, have studied the WDM-PON technology based on rsoa. In this paper, a WDM system based on amplifier is designed. In addition, the related knowledge of rsoa is described systematically. The structure of WDM system based on rsoa is designed and studied.

Keywords

Optical Net Work; Simulation; RSOA; Waveleng Thdi Vision Multiplexing.

1. Introduction

1.1 Research Background

Today is the era of information and network. Optical fiber communication has become the main way of communication network transmission with good transmission performance and low price. In order to meet the needs of social development, optical network has experienced many technological innovations. From the initial point-to-point optical fiber transmission link to the current intelligent and integrated optical fiber network transmission system. But so far, the research on optical network is still at the primary level, and there is no set of standards[1].

At present, the development of all-optical network has been widely used. The development of all-optical network can be divided into two stages: one is the all-optical network with wavelength multiplexing. In such a system, once set up, it cannot be changed online. Second, by applying wavelength switching technology, rsoa device can be used in wireless sensor network optical switching node system.

WDM technology has been applied in two stages of network development. The full connection from one end to the other depends on double waveguides. Wavelength channel is the basic unit of frequency width and signal transmission. In terms of performance management and bandwidth allocation, the traditional Wan has the following shortcomings: first, the bandwidth requirements of different scales need to allocate the same bandwidth resources; Second, the requirement of

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establishing fibre channel is based on spectrum network. At present, with the rapid development of optical network communication service technology, there are still some unsolved problems in the current WDM system, mainly including:

(1) In the process of bandwidth sharing, the allocation problem is still very serious. If there are two different paths in bandwidth allocation, the bandwidth will allocate larger resources to the channel with wider path, but if the demand of this path is small, it will cause great waste.

(2) The available bandwidth in communication cannot be adjusted, that is, once the allocated bandwidth is applied, all related performance cannot be changed. This way is not ideal, which also leads to the inflexibility of relevant systems and inability to adapt to the new environment.

In short, the key problem is how to allocate a complete network resources reasonably and flexibly. However, at present, because there is no ability to control and allocate the network, the whole network not only wastes bandwidth, but also cannot support the transmission of signals through super channels. Therefore, it is necessary to find a solution to improve the use and transmission efficiency of network resources in order to better meet the needs of high-power transportation services in the future.

1.2 Development and Status of Optical Network

The optical network has already had a general appearance in the 1990s. With the large-scale spread of wavelength division multiplexing (WDM) technology, the transmission system capacity of the optical network has changed greatly, and the cost has been reduced and the efficiency has been improved. At present, the development of optical network has developed from SONET, WDM to ASON including RSOA.

Optical transport network, or OTN. It is a device produced by the combination of all-optical network and power network. It has many advantages, for example, its management system and related operation technology have high flexibility and practical application effect. Applying these advantages to WDM optical network can improve the ability of WDM system in network application.In addition, OTN technology also supports the configuration, management and application of bandwidth resources. As early as the beginning of the new century, all this has been proposed[2]. Then came the WDM system.

The development of optical transmission network has two main stages: (1) Static OTN network. In such a system, the main effect is based on the OTN electrical cross flow equipment, and its main technology is the photoelectric multiplexing cross technology. (2) Wavelength assignment network, which has obvious advantages, such as high assignment capability and management capability.The OTN power crossover device also has a very strong application significance. Because it supports the transfer of big data in the network.

It can be seen that RSOA has high technology, so RSOA technology has become a hot topic in optical network research.

To sum up, the optical transmission network is mainly based on wavelength division multiplexing technology to establish an end-to-end communication path. With the diversification of services in the network, a variety of services need to be transmitted on the optical transport network. However, WDM technology has a larger cross-granularity. The optical transmission technology in the new generation of optical transmission network will gradually develop to the flexible all-optical network.In order to flexibly control and manage various services and reasonably allocate network resources, the control plane of the new generation optical transmission network will also be improved and developed in a more flexible direction.

1.3 Research Content

1.3.1 Optical Network

Optical network is a computer system using optical carrier signal as transmission medium. The functional units are connected in series to transmit information and data at a high speed and in a large range through an optical carrier. As the carrier of information, optical carrier signal has a series of

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advantages, such as extremely high space-time bandwidth product, ultra-low delay, equal channel diameter, no interference, low power consumption, strong I/O performance and so on. The key points are:The raw materials are very rich, thereby saving metal; The transmission attenuation is small and the transmission distance is long; Small volume and weight, easy to transport and lay.

At present, the very popular wavelength division multiplexing technology was first proposed in 1977, and has been continuously developed. It is the most representative advanced optical fiber communication technology. This paper will also focus on the WDM-PON optical network based on RSOA.

1.3.2 Key Devices on Optical Network

There are many optical WDM transmission devices. WDM system is generally divided into four modules: optical transceiver module, wavelength division multiplexing module, optical amplifier module and fiber module.

(1) Optical transmission/reception: a device that transmits and receives an optical carrier.

(2) Wavelength division multiplexer: optical carriers with different wavelengths are combined or separated into one or more optical fibers.

(3) Optical carrier amplifier: Under the generation of the carrier, the relevant radiation appears, so as to realize the amplification effect of the optical carrier.

(4) Optical fiber: core material, cladding, primary and secondary cladding materials from inside to outside.

1.3.3 Advantages of WDM Technology

As a very popular technology in the optical network, the technology has the following advantages:

(1) It uses the ability of minimum leakage in the optical fiber to increase the transmission capacity of the optical fiber and improve the limitation of optical fiber transmission;

(2) The same optical fiber can transmit multiple asynchronous signals, which is suitable for digital-analog compatibility. The transmission of the signal is independent of the modulation mode to ensure that the signal is easy to enter or extract from the channel;

(3) As long as the original system has enough power margin, WDM technology can be used to achieve capacity expansion, so as to achieve signal transmission;

(4) active light sharing improves stability and reduces cost.

2. RSOA-related Issues

2.1 Semiconductor Optical Amplifier

In recent years, semiconductor optical amplifier (SOA) has been studied deeply because of its excellent performance in wavelength division multiplexing (WDM). A semiconductor optical amplifier is referred to as an RSOA. It is an optical amplifier. In addition to its role in WDM systems, it is also widely used in network communication systems. It has great function in itself.In addition, it can also be used as a communication device for optical networks.

Wavelength division multiplexing (WDM) system based on reflective semiconductor optical amplifier (SOA) is the main research direction of this paper. It is important to understand the structure, functionality, and performance of RSOA.

2.1.1 Structure and Working Principle of SOA

As shown in the figure, the basic structure of the SOA is a PN junction. A depletion active region is formed in the P region and the N region, which has lost free carriers.[3] This is widely used in the ONU of the system in WDM-PON, and the optical modulator for the upstream also has an amplification function [4]:

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Figure 1. Structure of SOA

As can be seen from Figure 2, RSOA consists of the following three parts.

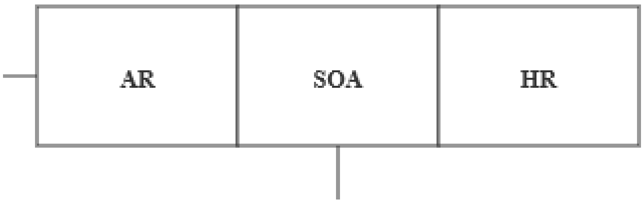

Figure 2. Structure of RSOA

The optical signal reach that HR layer aft being amplified by the SOA. Of course, most of the light is reflected vertically. The optical signal is amplified by the SOA, up-converted, and finally output to the AR layer. Obviously, the RSOA not only modulates the uplink optical signal, but also amplifies the optical signal, that is, it has the functions of modulation and amplification.

2.1.2 RSOA Technology

Because RSOA is a demonstration tool that ONU can use and can be seen as a profit model. The RSOA can find a lubrication method to reduce the amplitude of the optical injection signal, which is crucial for the WDM-PON system.

RSOA can be divided into polarization-dependent and polarization-independent [5].In addition to cold sensors with thermal characteristics, polarization-dependent RSOAs can work well in the range of 0-70 degrees, thus reducing the cost of optical transceivers. When using a single RSOA, the system uses fewer polar light sources, so the formation of a WDM-PON system based on a single frozen RSOA is essentially the same as a colorless ONU using FP-LD injection. Compared to a wide-angle SLED light source without any corrupted signal,The injected RSOA can provide more optical power to the separated spectra. In addition, if the RSOA is operated under satellite gain conditions, it can further compress the additional noise generated by visual separation. This enables the RSOA-enabled solution to deliver the highest speed. In practical application, 32 1gbi/s Ethernet signals are successfully transmitted to PON, covering 20 kilometers. If it doesn't work on the satellite,The modulation speed may exceed 2.5 gbit/s [6].

2.2 RSOA Key Issues

As a new optical network architecture, RSOA has broad application prospects, but there are still many research problems to be solved. In the traditional WDM optical network, the network has been studied comprehensively and systematically[7].

Compared to conventional WDM optical networks, RSOA has the following two important features: First, in WDM optical networks, optical channels are located on each wavelength path, while in RSOA, each optical channel is allowed to contain multi-phase phase adjacent frequencies: frequencies on the same path can be transmitted periodically, or they can be grouped by different paths at the receiver. Secondly, for RSOA without spectral transmission,Each optical path needs to follow the spectral continuity requirement, that is, the same spectrum must be used on each link of the optical path. Although reducing spectral continuity in WDM optical networks is like reducing

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wavelength continuity, the former is more challenging because it requires simultaneous continuity of multiple adjacent frequency cycles, while the second requires only continuous wavelengths.In view of the important differences in resource allocation between the two networks, although traditional WDM optical networks have been heavily studied for survivability and related protection technologies, these research results and methods can only be used as a reference and can only request that the RSOA solution direct search be more systematic and in-depth.

2.3 Research Status of RSOA Survivability

At present, RSOA technology at home and abroad mainly focus on optical network amplification, multi-channel sharing technology and wavelength division multiplexing technology. Next, we will make a specific analysis of the current research hotspots.

Assuming that the network fails, RSOA technology can share resources and realize the effective use of network resources.

Unlike the single wavelength and single channel characteristics in a conventional multiplex network with optical wavelengths, an RSOA optical channel may be composed of several sub-channels, and these sub-channels may pass through different physical paths. In view of the feasibility of RSOA, the virtual concatenation function of subnets can be fully utilized to achieve effective service recovery.

High-speed optical transceiver sharing, in RSOA, the performance of the associated transceiver is indeed quite high, but the price is also very expensive.

With the rapid development of the network, it also brings great challenges, that is, the sustainability of bandwidth growth. The energy consumption of survivability RSOA is an important research topic.

3. WDM-PON System Architecture

3.1 WDM-PON Technology

The principle of WDM-PON technology is to divide the transmission time of relevant transmission into multiple time slots, and each time slot can only communicate with one user. By controlling the time, the OLT technology uses the same transceiver, thereby reducing the construction and maintenance costs of the WDM-PON technology. As shown in Figure 3.

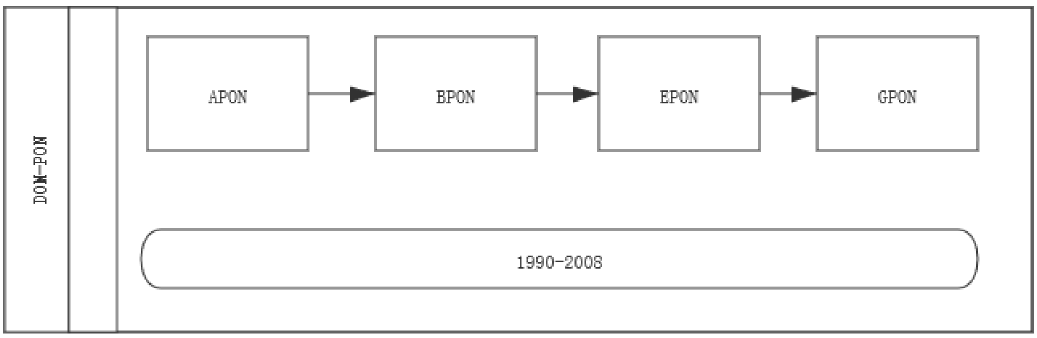

Figure 3. WDM-Pon Transmission Development

EPON is a broadband access technology. Users can access integrated services such as data-related services by sharing the same fiber line. In addition, EPON,it has the following characteristics:

(1) Low cost: For the passive optical network system, only the passive optical equipment is needed to form the transmission line, and it can work even without the related equipment. And its operation is very simple, and it has a long service life and low cost.

(2) Good compatibility: EPON can not only effectively follow a variety of transmission protocols, but also reduce the complexity of system switching by using existing network equipment.

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GPON was originally proposed by the Full Service Access Network Alliance, and the International Telecommunication Union has perfected the latest generation of passive optical network access technology (ATM-based technology) in its version. The current bandwidth of the downlink is adapted to the required bandwidth which is higher than the uplink bandwidth. EPON and GPON have many similarities in system structure and principle.

3.2 WDM-PON System

With the increasing demand for bandwidth services, the number of users has also increased. Wavelength division multiplexing technology has been introduced into the access network, and combined with PON to form WDM-PON network. Similar to the PON system, the WDM-PON system is composed of an OLT, an ONU, and an ODN. When the data is loaded, the ONU terminal continuously plays a specific wavelength, and integrates multiple wavelength signals into the optical fiber through WDM, and transmits them to the OLT receiver [8].

The WDM-PON system has the following advantages:

(1) In a WDM-PON, each channel does not overlap and a unique path is assigned.

(2) The synchronization with the network is not required, which greatly reduces the operability of the receiving end and improves the transmission efficiency.

(3) Time division system means that only one user can communicate in a time unit. As more and more people use it, the bandwidth allocated to each person will vary to varying degrees, resulting in reduced resource usage. WDM-PON can satisfy the simultaneous transmission of multi-user data and ensure the transmission rate.

(4) The loss of the waveform multiplexer input is less than that of the optical splitter, the transmission distance is longer, and the network coverage is larger. At present, the problem of WDM-PON is that the cost of optoelectronic equipment is very high, and the technology is still in the development stage and is not yet mature. However, WDM-PON has become a hot spot in the field of optical communication.Several large telecom equipment companies have researched and developed equipment related to water demand management.

3.3 Working Principle of WDM-PON

The WDM-PON technology access network is connected to the remote node through optical fiber without power supply and any active devices. The OLT has a series of advantages of high bandwidth, low loss, long service life and the like, and the number of the OLT single-station users depends on the signal transmission rate of each user. Wavelength division multiplexing PON users currently use fixed wavelengths and do not interfere with each other, with a maximum transmission distance of 64 users 10km [9].

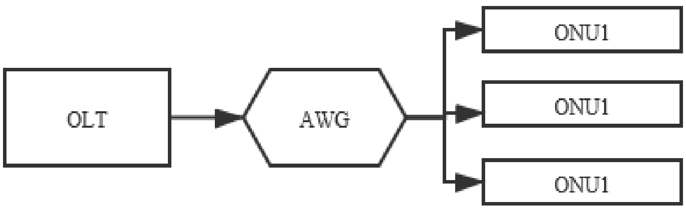

Figure 4. WDM-PON System Structure

The structure of WDM-PON is also roughly divided into three parts, as shown in Figure 4.

The OLT intervenes in the backbone network and the access network. Firstly, the signal in the sending end can be sent to the terminal of ONU according to the relevant command, and secondly, the signal received by the ONU terminal is fed back to the uplink signal. \n.

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The ODN also uses passive optical multiplexers, and each ONO is equipped with an optical transmitter and receiver with a designated wavelength to receive the signal. The uplink and downlink modulated signals are transmitted over a single line into the optical fiber group and over a backbone.

The function of ODN is to provide demultiplexing technology in WDM. It is mainly responsible for connecting to the client, modulating and demodulating the uplink signal of the downlink transmission backbone, transmitting the coded wavelength selector signal to the multi-wavelength signal at the OLT end through optical fiber, and then using the arrayed waveguide grating access network as a passive wavelength division multiplexing technology.Separate signals of different wavelengths from the optical fiber, or transmit modulated signals of different wavelengths to the user's equipment through different lines, as shown in Figure 5 below.[10]

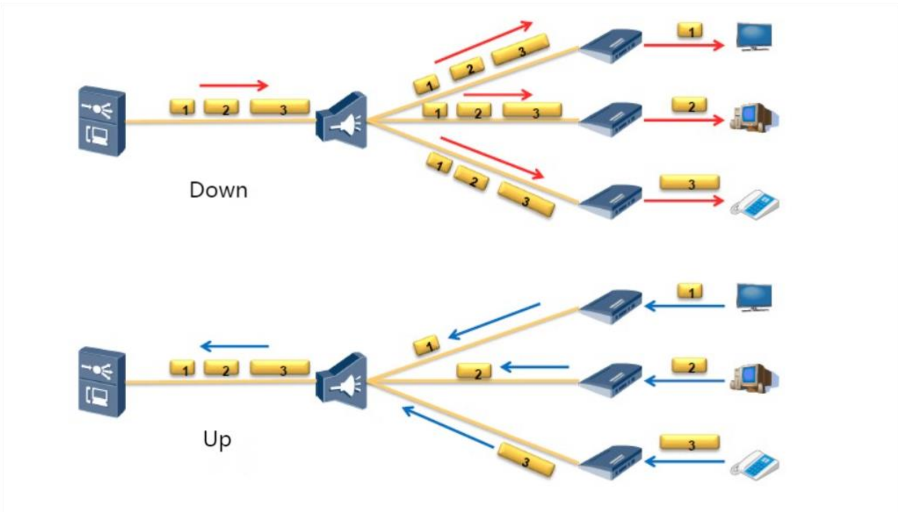

Figure 5. Working principle of WDM-PON

3.4 WDM-PON System Performance and Device Analysis

In the working process of the transmitter, a series of laser sources with different wavelengths comprise a pre-amplifier, a trunk amplifier and an amplifier, and the user amplifier can ensure that the signal strength received by the user is firstly separated by an optical demultiplexer,And then perform interference suppression on that receiver. Finally, the corresponding wavelength is sent to the user through the demodulator[11].

3.4.1 Optical Amplifier

Optical amplifier is a subsystem of optical fiber communication system, and its working principle is mainly based on the working principle of optical amplifier in the 1920s. In order to solve this problem, optical fiber amplifier must be added to the current situation of optical fiber transmission system to ensure the transmission power.

3.4.2 Optical Multiplexer

The function of the optical multiplexer is to separate the signals of the different users from the mixed distribution. In the WDM-PON system, multiplication can be performed by dividing a wavelength as long as a specified wavelength signal is not output. WDM is optical multiplexing/multiplexing in WDM systems. It separates the mixed transmission signal from the current signal according to the wavelength and sends it to each channel.It is then sent to the corresponding ONU client. In the uplink, the uplink signal of each ONU is integrated into the wavelength division multiplexer through its channel, then passes through the uplink fiber and returns to the CO. Filtering and fiber interference interference is suitable for users of small WDM systems. For a wavelength division multiplexing system with a small wavelength spacing and more than 16 users,A matrix waveguide network is typically use.

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3.4.3 Optical Receiver

The optical receiver is mainly used for photoelectric conversion and telecommunication signal transmission, among which the most common one is the optical sensor. The transmission part of the optical sensor includes a PIN avalanche photodiode optical transmission element, and its upstream feedback telecommunication signal is converted into an electro-optical signal by laser and transmitted by laser.

3.5 Current Challenges for WDM-PON

For a long time, optical wavelength switching technology has provided high-power and high-speed data in the backbone network, and has provided practical resource services for global network users.]. However, with the rapid development of IP network and mobile Internet, the power of backbone network is becoming more and more diversified. Therefore, in order to transfer many precision services into a fixed network for demand management, it is necessary to multiply and integrate smaller precision services in many wavelength division multiplexing systems. There is no doubt that this link will have a significant impact on the quality of the lighting system.And will also bring a series of challenges for controlling the WDM-PON. Next generation optical networks face challenges in the following areas:

(1) The transmission scale of optical network has been expanded step by step, and this series of expansion also brings great challenges to the management of the network. Whether in optical transmission systems or wavelength division multiplexing systems, intelligent automatic control plane and unified control plane are needed. With the development of new technologies, there is a need to improve the communication mode of WDM-PON under multiple constraints.Improve the corresponding protocol, so as to achieve the purpose of effective configuration and management of network resources.

(2) When establishing the required channel for the relevant signal, the optical network cannot allocate the resource reasonably and effectively according to the actual needs of the service. Once the bandwidth required by the service exceeds the available wavelength bandwidth, the related service should be divided into multiple wavelengths for transmission. Because the complexity of network debugging and management will be greatly increased.When the service granularity has no wavelength bandwidth, the public bandwidth will cause the waste of bandwidth resources.

(3) As the network continues to expand, the number of nodes and links begins to increase significantly, which enhances the rapid growth of network operating costs and energy consumption. Therefore, operators need to optimize costs and promote the development of network technologies while ensuring network portability and service reliability.

3.6 Development of WDM-PON

Wavelength Division Multiplexing (WDM) technology is a powerful communication transmission medium. In addition, it also has a series of characteristics, such as large bandwidth, small signal attenuation and so on, which makes it rapidly become the most important transmission mode in the field of communication. It is everyone's favorite and has yet to be challenged. Market demand, technology maturity,Both system cost reduction and government policy guidance have become the driving force for the development of FTTX and the basis for large-scale operations.

4. Simulation of WDM-PON System Structure based on RSOA

4.1 Introduction to Optisystem

On May 14, 2008, Optical Systems launched Optical Systems Version 7.0 software. Happily, there are other new uses for this version. In addition, the Optical System Version 7.0 software package uses 64-bit operating system technology to support complex computational simulations. The optimized software structure can improve the computing performance and memory utilization. These new features make the optical system 7.0 software can carry out the simulation of optical network on a larger scale. Including the semiconductor optical amplifier RSOA [12].

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On May 14, 2008, Optical Systems launched the 7.0 software Optical System. New features such as OCDMA-PON network emulation have been added. OCDMA-PON has become a relatively inexpensive referral center and a multi-purpose support system platform. In addition, Optsystem 7.0 uses 64-bit operating system technology, which adds to its complexity. A well-designed structure can improve computer performance and memory usage.These features enable the software to support a large number of networks. Interestingly, the new software can also support new devices, including semiconductor (RSOA) vision adjusters.

The optical system can simulate various optical communication systems. Therefore, the 7.0 software is a new type of optical communication simulation software. Among them, Optisystem is an innovative optical communication system simulation software package, which has the components, performance and optimization of various optical network virtual optical connection functions[13]. Optisystem has a good simulation interface and simulation effect. This has led to a wide range of applications, and it can also be extended by other devices[14].

4.2 Simulation Design

Reflective optical network unit (ONU) based on optical amplifier (RSOA) is the only advanced choice of wavelength-independent ONU for wavelength division multiplexing passive optical network (WDM-PON) applications. They provide the simplest structure for single fiber access, avoiding stable laser use [15]. The system operates in bidirectional single-wavelength mode and may be affected by Rayleigh scattering crosstalk. This crosstalk can be mitigated by broadening the spectrum of the optical signal and employing a broad spectrum modulation format. The performance of FEC can also improve the power budget, which has been shown to provide effective coding gain in Rayleigh crosstalk limited systems.The linear rate and wavelength range are mainly determined by the fabrication process of the RSOA. The modulation rate of commercial devices can reach 1.5g B/s in the 50-100 nm band. Recent SOA developments can cover up to 10 CWDM channels.

4.2.1 Basic Structure

Figure 6 [16]The basic bidirectional single-fiber single-wavelength scheme for FTTH networks is described. Laser cladding at the optical line terminal (OLT) provides the transmission wavelength and establishes a point-to-point connection to each ONU. Flexible WDM/TDM can also be used to establish the protocols proposed in point-to-multipoint connections [17]. The wavelength routing of the RN can be realized by using the AWG. In the ONU, the reflecting structure is used for downstream signal detection and upstream data modulation. In this scheme, the RSOA uses the downlink optical signal to mark the uplink data, and the signal is reflected back to the OLT.

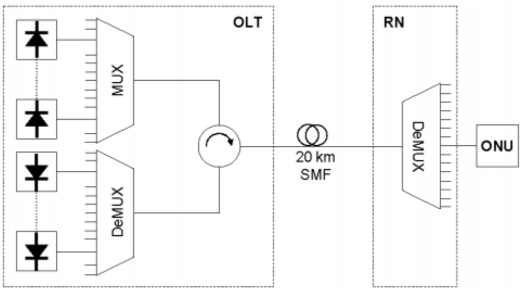

Figure 6. Common Access Network

4.2.2 Optical Network Unit based on RSOA

Amplitude shift keying data modulation for link transmission is implemented. To avoid overlapping, simple time division can be performed using half-duplex. Another possibility is to add a constant power offset to the downlink modulated signal, which can be remodulated by an RSOA (offset operating in the saturation region) request, to obtain full-duplex communication with limited distortion. In the second case,FSK and FSK-ASK are used for downstream data. Finally, subcarrier

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multiplexing (SCM) in the electrical domain is used for uplink and downlink channels. A full-duplex transmission system is perform in that latter two time domain. In order to improve the application of FEC in these systems, its benefits are quantified as shown in Figure 7 [18].

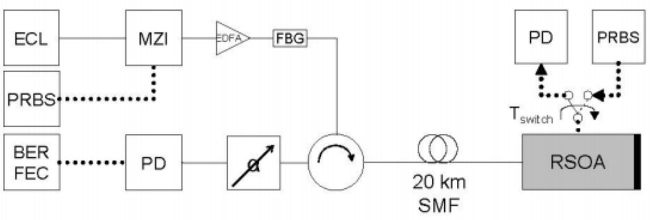

Figure 7. Setup and Bit Error Rate Measurement for RSOA Scenario

4.3 WDM-PON System based on RSOA Technology

Communication networks can be divided into the following categories: basic networks, access networks, and client-side networks. The primary function of an access network is to connect users to the primary network. In contrast to the basic network, the access network is in a "bottled" mode throughout the network. Because the spine network completes the transition to high speed and high power.Therefore, the wavelength division multiplexing technology is applied to the access network, i.e., the WDM-PON[19]. It has the advantages of available bandwidth, information security and transmission distance. It is the best choice for the next generation broadband access network[20].

WDM-PON facilities using RSOA technology mainly include unit optical link (OUT), optical fiber transmission, remote network (RN) and optical unit network (ONU).

RSOA-based WDM-PON System Architecture [21]. As shown, the light source is at the end. The non-optical source at the end of the ONU uses RSOA to maximize and measure performance, replace previously expensive lasers, and reduce the cost of the WDM-PON system. The operation procedure is as follows: the data sent by the OLT to each ONU is added to each carrier and transmitted using the amplitude variable, and then many carriers are added to the fiber for transmission through the RN.The demultiplexer is divided into two parts, the first part is fetched by the same members, and the second part is merged into the RSOA.

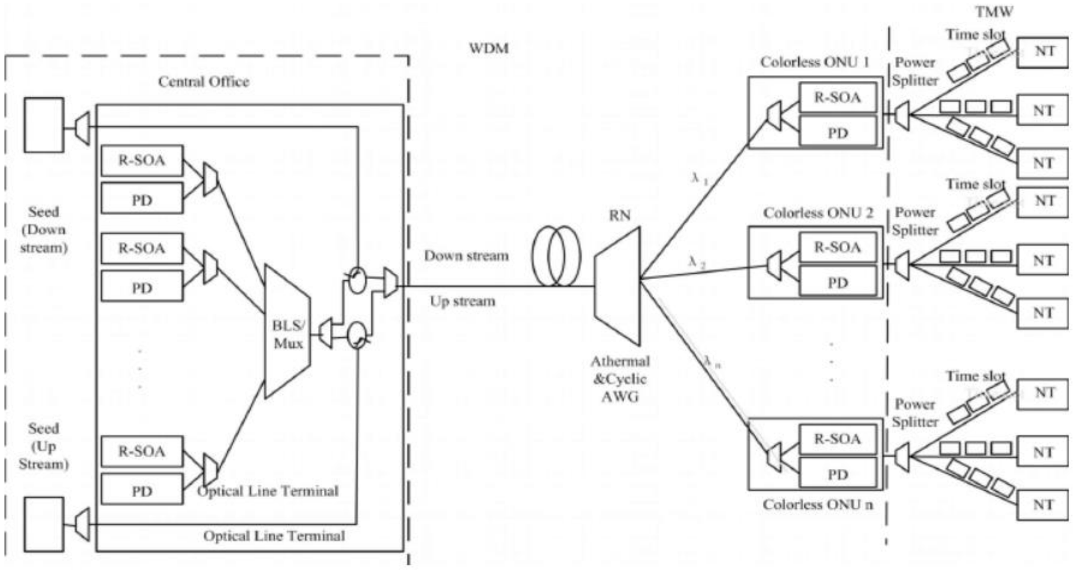

Figure 8. WDM-PON system structure based on RSOA

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4.4 Simulation Results and Analysis

The design block diagram of the optical system is as follows. In optical systems, we can customize the transmitter and receiver components or provide integrated transmitters and receivers. We first designed the RSOA system, as shown in Figure 9. The system comprises a spectrum analyzer, an optical time domain visualizer, a Gaussian optical pulse generator, a self-defined bit sequence generator and an optical fiber.

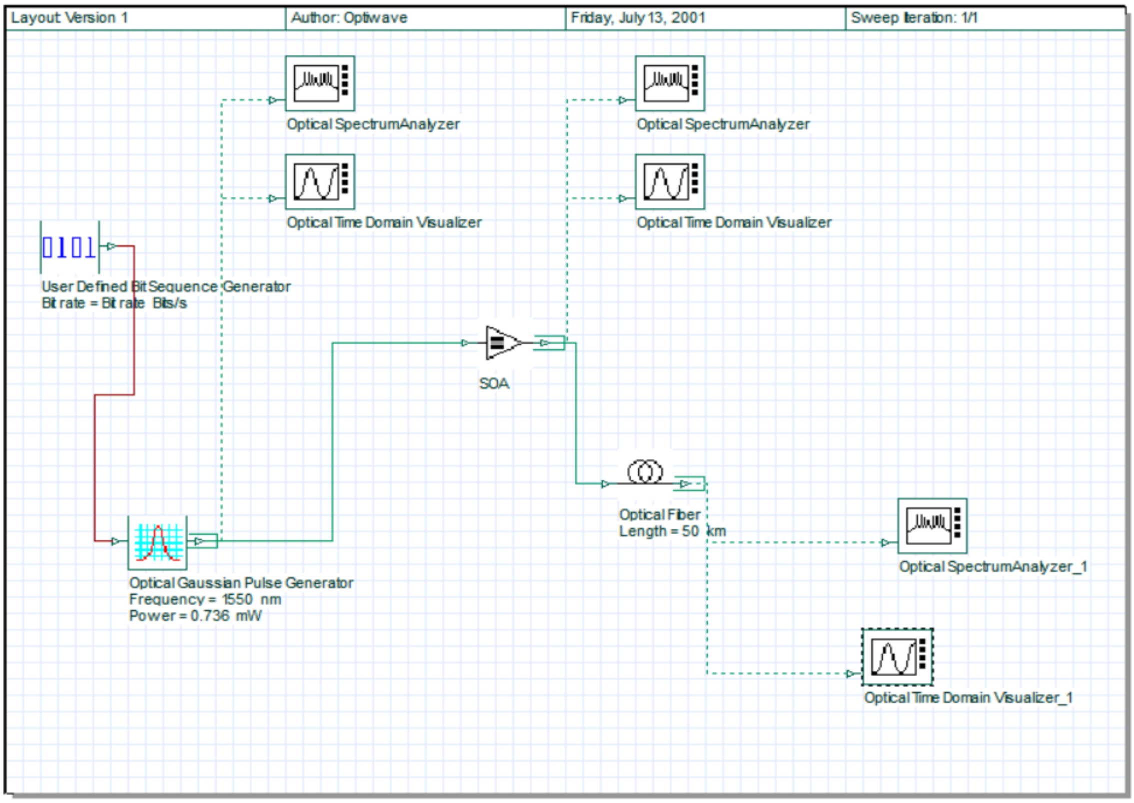

Figure 9. system with RSOA

4.4.1 Functions of Each Device

(1) Optical spectrum analyzer: It is based on the existing optical spectrum as the working principle. The current spectrum analyzer generally refers to the classical spectrometer, and the classical spectrometer mainly uses the spectrometer to work. The spectrometer used now is a non-spatial spectrometer, which can generate different analyzers according to the principle of dispersion.

(2) Optical time domain visualizer: Its principle is the principle of light scattering and propagation path. Based on this principle, the optical time domain visualizer was produced. When light propagates, it will produce reflected waves in different paths to obtain relevant propagation information. It can be used to detect the evolution of the signal and the location of the signal failure point, and it can also be found along the length of the fiber [22].

(3) Optical Gaussian pulser: It is a device that can generate signals, mainly transmitting the required pulses from the transmitting end.

(4) Optical fiber: It is a kind of glass fiber or plastic fiber. It can be used as a light guide tool and can be bent without breaking by wrapping it over very thin fibers with a plastic sleeve. Typically, one end of a fiber optic transmission device transmits a light pulse to a fiber optic valve or laser beam.

4.4.2 Simulation Results

This is the image without magnification, which is formed by spectral analyzer and optical time domain visualizer. It can be seen that the opening of the image without magnification is small.

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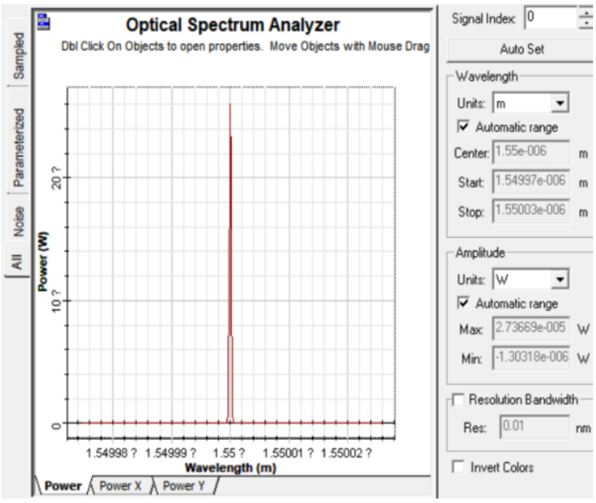

Figure 10. image of spectrum analyzer without amplifier

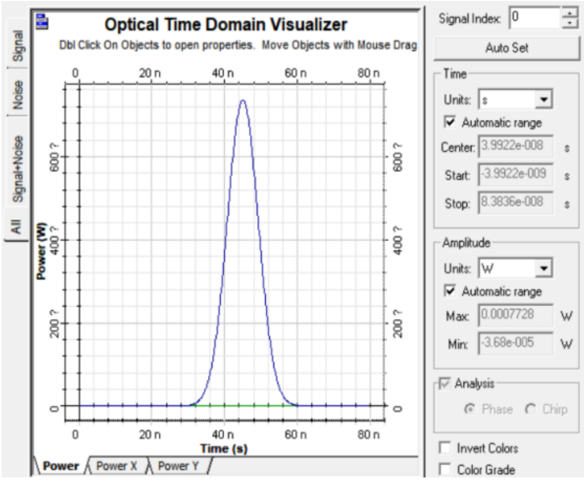

Figure 11. image of optical time domain visualizer without amplifier

This is an enlarged image formed by spectral analyzer and optical time domain visualizer. It can be seen that the enlarged image has obvious amplification effect. It can be clearly seen from the opening at the bottom. It shows that SOA has obvious amplification effect.

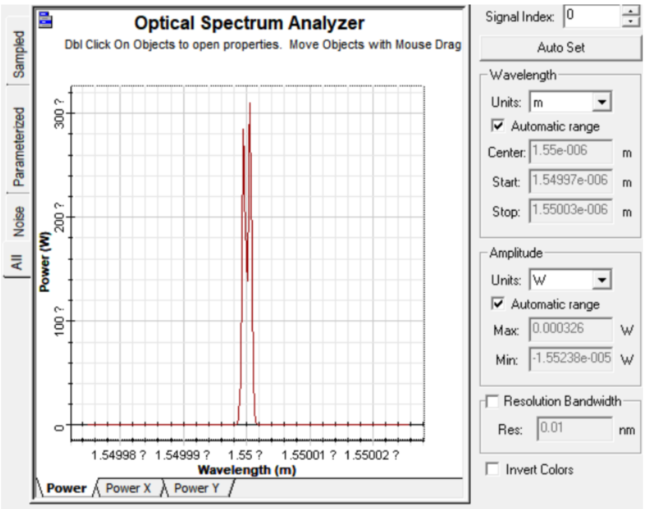

Figure 12. enlarged image of spectrum analyzer

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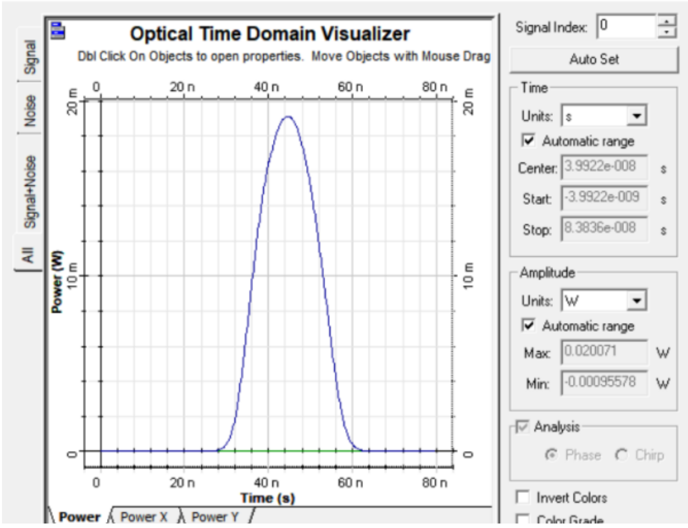

Figure 13. image of optical time domain visualizer passing through amplifier

4.4.3 Influence of Transmission Distance

In order to test the influence of transmission distance, after passing through the amplifier, optical fiber is added for comparison. From the images formed by spectrum analyzer and optical time domain visualizer, it can be seen that the image amplified by SOA and then transmitted by optical fiber has a more obvious amplification effect.

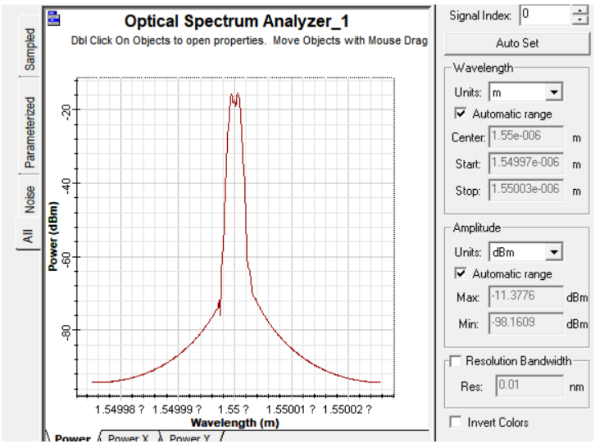

Figure 14. image of spectral analyzer after amplification and then passing through optical fiber

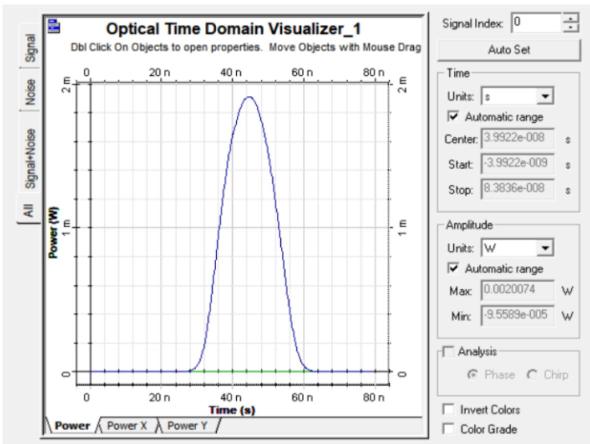

Figure 15. image of optical time domain visualizer passing through amplifier and then optical fiber

4.4.3 Result Analysis

In this paper, a wavelength division multiplexing system based on SOA is designed and simulated. In the design, there are three cases: no amplification effect, amplification effect and amplification effect with optical fiber. The main difference between the three cases is that different numbers of optical carriers are used. Each case is analyzed. According to the situation reflected by spectrum analyzer and optical time domain visualizer, the quality of WDM system with amplifier can be analyzed. The clearer the spectrum analyzer image (the larger the opening), the better the transmission performance. In addition, two different transmission distances are analyzed. Through the simulation results, it can be found that under the same amplification setting, the effect of optical fiber transmission is better and more suitable for practical application.

5. Conclusion

In this paper, based on the structure of WDM system based on optical amplifier, the simulation is carried out with optisystem software, and the relevant results are obtained, and appropriate graphics appear, which proves the originality and feasibility of the design scheme. Compared with other access networks, WDM - PON has the advantages of less investment and low price. In the long run, with the maturity of various equipment, the reduction of machine cost, the continuous improvement of WDM - PON technology and the rapid development of broadband applications, WDM - PON will become the best and promising scheme in the new optical network.

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