

Application of optical access network technology in railway communication field

Wu Ting

School of railway communication and signal, Wuhan Railway Vocational College of Technology, Wuhan
430205, China

wutingwh@126.com

Keywords: Optical fiber; Access Network; Railway; Communication; Application.

Abstract: The development of modern economy promotes the continuous development of high-speed trains and quasi speed trains. In order to ensure the stability of train man-machine control and improve the efficiency of train transportation, it is necessary to upgrade the railway communication system with the support of the improved railway communication network and the use of wired and wireless communication transmission technology and access technology. This paper analyses the application of optical fiber access network technology in railway communication field, studies the integration of optical fiber access network technology into railway communication system, and provides a powerful reference for strengthening railway communication.

1. Introduction

The railway transportation industry promotes the development of regionalized economy in China and connects people in all regions closely. Today, with the increasing speed of railway operation, in order to strengthen people's safety and realize effective control of trains, a stable railway communication system should be established under the application of modern science and technology. The emergence of optical access network technology meets people's needs. This paper makes an in-depth analysis of optical access network technology in railway communication, aiming at laying a solid foundation for promoting the stable development of railway industry.

2. Optical access network

Optical access network technology is a remote digital program-controlled telephone technology developed in recent years. People use optical fiber as the medium, integrate the information transmission of access network, connect with the main body of communication, and get the technology of optical access network [1]. At present, access network is the main carrier of communication services in railway stations and depots. It undertakes different forms of information services, takes unified and standardized data as the actual norm, and executes in the integrated digital network of switching and multiplexing. The progress of science and technology has greatly reduced the cost of optical fibre. The cost of optical fibre access network is an important form of railway communication development in the future. Before the optical fibre access network of railway is put into practical use, its regional communication takes browsing digital transmission system as the channel. PCM and D/I add-and-drop devices are used to separate the lines at train stations to realize business access. The actual access to the audio business is automatic telephone for station phone, water service and station telephone. CTC, infrared axle temperature and power far east belong to access low speed business.

In railway communication, optical fiber access to our network is divided into special and public. In professional business, optical access network technology includes dispatching telephone, special telephone, interval telephone, transportation information management, dispatching command, ticket sales, power detection, remote detection and so on. In the media, mainly cable TV, television conferences and other content [2].

2.1 Optical access network topology

The topology of optical fiber access network is the actual transmission line and node arrangement structure. It displays the location and layout of different nodes in the network. Network topology has a direct impact on network structure, cost and reliability. The topology of optical access network includes bus, ring structure and star structure.

2.1.1 Bus structure

Bus structure takes optical fiber as bus (common bus), and different user terminals connect bus with coupler to form the whole access network communication system.

2.1.2 Ring structure

The ring structure is that each node uses a single optical fiber link together. The optical fiber link forms a closed loop in the first place, integrates the network structure, and achieves effective communication between different terminals.

2.1.3 Star structure

Star-shaped structure, but the different user terminals are located in the central node, which integrates control and exchange, and communicates with star coupler, that is to say, the communication network is arranged in parallel.

2.2 Advantages and disadvantages of optical fiber access network

2.2.1 Advantages of optical access network

Optical fiber access network can meet the actual needs of users for different services. Its own material characteristics can overcome the restrictive factors in traditional copper wire and cable. It is free from electromagnetic interference and has high overall communication signal quality. Using optical fibers instead of traditional copper wires and cables can solve the problem of congestion and congestion of underground communication pipelines near railway transportation. In the context of the continuous progress of the times, the performance of the optical access network itself will continue to improve, and the use cost will be greatly reduced. Compared with traditional copper wires and cables, copper itself is a non-renewable resource, the price of copper wires and cables will continue to rise, and the development prospects of optical fiber cables are relatively broad.

2.2.2 Shortage of optical access network

Optical fiber access network provides data service support for railway train operation. With the support of complete monitoring and digital management system, it meets the needs of broadband integrated service digital network and ensures the high speed and reliability of information transmission. Compared with other access network technologies, there are still some problems in the optical access network. The main problem is that the optical access network technology needs a lot of capital investment, high cost, and a lot of money to promote its use.

3. Application of optical access network technology in railway communication field

3.1 Urgent demand of railway communication for optical access network technology

In modern communication technology, including wireless and wired access technology, in railway operation, its own movement speed is faster and its operation has special characteristics. In order to adapt to the high-speed characteristics of railway transportation, wireless access network technology is widely used in railway trains. However, in the actual railway communication work, professional personnel survey and analysis found that the application of wireless access technology in railway operation, only 400 MHz train dispatching system, which mainly provides communication services for station attendants and train drivers, and provides stable communication links in the train yard of the duty area [4]. In short, only when the train enters or leaves the station, can the on-duty personnel

establish communication with the train driver. In order to take into account resource saving and interference factors, there is no communication during the train operation. Nowadays, with the continuous development of railway industry, 400MHz train dispatching system can no longer meet the basic needs. Therefore, in railway operation, it is necessary to use optical fiber access network as the auxiliary work of modern communication technology, and advocate the establishment of new communication functions by two-way data communication.

3.2 System function access

In the practical application of optical fiber access technology in railway communication, the combination of system functions is the basis and core content of the work. The system functions need to meet the requirements of railway specific mobile communication and railway automation telephone communication network. We should also meet the needs of the mass automatic telephone network interconnection and interoperability, realize the fixed voice communication needs of the entire railway line, create convenience for trains and stations, trains and the masses, the masses and the masses, ensure that dispatching telephone can smoothly access the whole system, promote the completion of network management of the system, and hang up information in your standard. Real-time interaction provides stable content of communication network management, which enables the access system to achieve reasonable transmission of voice, image and data in the interval, and accurate and efficient reception and processing of signals. In addition, the function of access system should be able to realize the connection of ONU and VFW 2/4W, and lay a solid foundation for efficient data transmission.

The access network is the basic content of communication. It adopts optical fiber access and faces users directly. Railway access network involves system and transmission content mainly including STM/ATM, optical fiber transmission and cable transmission (ADSL/HDSL). Its system structure is shown in Figure 1.

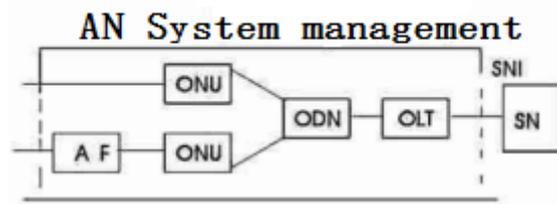


Fig. 1 Schematic diagram of basic structure of optical access network

Among them, ODN is the optical distribution network; ONU is the optical network unit; OLT is the optical path terminal; SN is the service node; AN is the access network; SIN is the corresponding interface of the service node; AF is the adaptive function. The railway communication network has a lot of characteristics of line length, and belongs to chain structure.

3.3 Railway station optical fiber access network technology bearer business content

The optical fiber access network of railway stations can be divided into two parts: the public network and the private network. The private network contains the following parts.

3.3.1 Dedicated railway communication

Railway special communication includes dispatching Dina telephone, special telephone, section telephone, inter-station telephone and blocking telephone. Different telephones are indispensable for the safe operation of trains. By carrying railway special communication technology through optical fiber access network technology, dispatching orders can reach the train in time, and the corresponding staff can be timely. Receive the signal and make corresponding response.

3.3.2 Private data

The private data service belongs to the business of railway private network. Railway transportation management information system TMIS passenger ticket issuing and fixing system,

railway transportation dispatching command TDCS, dispatching centralized CTC and dispatching supervision, infrared axis temperature remote monitoring, power system remote monitoring, intermediate station power supply equipment and actual environment monitoring all belong to special data content. The safety control of train operation is realized by optical fiber access network technology. Once the temperature of train components is too high or the illumination system and power system are abnormal in operation, the alarm can be given in time, and the correct dispatching measures can be taken to ensure the safety of train operation.

3.3.3 Other multimedia services

On the one hand, other multimedia services provide rich and diverse ride experience for train passengers, on the other hand, they provide strong support for centralized management and dispatch of train staff. In the train entertainment multimedia business, cable television (CATV) as the main form of business, so that passengers can feel the humanized train settings. On the other hand, with video conference system as the main form of expression, through the video conference system, the important and collective information technology needs to be transmitted to train staff, so as to avoid the impact of the unified concentration of personnel on the normal operation of the railway.

3.4 Station optical fiber access network design

According to the actual carrying capacity of the railway station, the optical fiber access network of the railway station is classified and designed.

3.4.1 Automatic access switching network

Railway communication network has the characteristics of multi-point and multi-line length. Some exchanges are set up more, and the automatic telephone of small stations is not widely used. In the design of station optical access network, this problem should be fully considered. New lines should be set up in large stations in different sections, and automatic telephones in small stations should be placed through large stations to achieve scientific communication.

3.4.2 Data exchange network

Data exchange network provides unified services for CTC, infrared axle temperature detection, train invoicing, scheduled system, TDCS, TMIS and other information management systems in dispatching centralized system. It realizes remote control by electrification technology. Data exchange network can realize reasonable monitoring of the environment of small stations, manage power supply, and timely alarm when abnormal power supply is found. Abnormal location.

3.4.3 Dispatching communication network

The traditional train dispatching, freight dispatching and power dispatching systems of Railways adopt the concept of collinear dispatching, and the main work content is composed of solid cable routes. The digital dispatching switchboard of optical access network can be used alone, and it can be put into use in conjunction with current SPC switches. Its dispatching extension will become an ordinary automatic telephone user, facing users directly, and introducing the access network from each small station to realize the point-to-point data communication of the extension and the total. The station's own optical fiber access network integrates the dispatching extension interface of each station and the automatic telephone subscriber extension, and derives from the subscriber board to achieve efficient communication.

3.4.4 Design of multimedia service network

Railway should take into account the particularity of railway benefit television system when improving its own conference and television system. It should satisfy not only the real-time nature of information signal, but also the accuracy and reliability of information transmission. In the design of cable television (CATV), the source of CATV program is set in the OLT of the starting and ending position of railway line, and the transmitter of CATV is set in its corresponding position, so as to

realize the stable transmission of CATV signal by ONU along the way. The multimedia service is implemented in the railway train, and the multimedia TV service can also be enjoyed in the train running.

3.5 Optical fiber access network system equipment construction

3.5.1 Wiring installation

In wiring installation, according to the requirements of documentation and specification of actual equipment, according to the stipulated wiring of equipment, attention should be paid to the reservation of side door rack in space. In wiring cables, resistance tests must be performed. The optical access network has higher requirement for distribution cables, and it is not allowed to be poor. If the wiring needs to be clamped, the professional tool card should be used. The resistance of the ground wire itself should meet the design requirements. Before the machine is powered on, the inside wiring should be separated by a reasonable chip. When the wiring is installed, it can be tested by a single computer and the audio interface can be tested.

3.5.2 Software and equipment electrified

Before the equipment is added, check the key points strictly and confirm that the equipment will be energized without exception. Ensure that the equipment is not loose, the circuit board is installed correctly, the power supply index meets the requirements, the test is qualified, and the ground wire installation meets the specifications. After adding 30min to the device, the optical access network can be debugged correspondingly.

4. Conclusion

To sum up, under the background of the development of the new era, advanced science and technology continue to progress, providing greater convenience for people's lives. In railway communication work, in order to ensure the stability and safety of railway communication, advanced optical fiber access network technology can be applied to railway communication to achieve high-quality and high-efficiency railway communication signal transmission and improve the economic benefits of railway operation. To analyze the application of optical access network technology in railway communication field, we need to understand the content of optical access network. On this basis, we analyze the topology structure of optical access network, the advantages and disadvantages of optical access network, and study the application of optical access network technology in railway communication field, so as to provide strong support for the practical application of optical access network. Promote the sustainable development of the railway industry and promote the overall economic development of our country.

Acknowledgements

The Scientific Research Project of Hubei Institute of Vocational and Technical Education <Research on the Joint Training Mode of "3+2" Higher Vocational Colleges and Universities for Communication Professionals in Railway Industry> No. ZJGA201613.

References

- [1] Ding Peng. Application of optical fiber access network technology in Railway Communication Engineering [J]. China new communications, 2016 (2): 89-90.
- [2] He Lili. Application and Quality Management of Optical Fiber Access Network Technology in Railway Communication Engineering [J]. Communication Power Supply Technology, 2016, 33 (4): 160-161.
- [3] Chen Yang, Li Jinfeng. Application and Quality Management of Optical Fiber Access Network

Technology in Railway Communication Engineering [J]. Excellent, 2016 (4): 97-97.

[4] Zhu Xiaojun. Application and Quality Management of Optical Fiber Access Network Technology in Railway Communication Engineering [J].Scientist, 2016,4(3): 31-31.