

Application of OTN Technology in Railway Transmission Network

Wang Lin

School of Railway Communication and Signal, Wuhan Railway Vocational College of Technology, Wuhan
430205, Hubei, China

wanglinhb@126.com

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Abstract: With the rapid development of network technology, railway communication has become the main artery of Railway Transmission system. Railway traffic safety and transport organization must rely on railway communication network to achieve. In recent years, railway has not only introduced OTN technology in large quantities, but also achieved extensive coverage and adoption. Therefore, this paper will analyze the application of OTN technology in railway transmission network from the aspects of overview, technology and network structure.

1. Introduction

With the rapid development of railway and the improvement of communication technology, OTN technology plays an important role in Railway Transmission network. The so-called OTN technology, in fact, is the transport network networking technology, which is put forward in the context of many key technologies are not mature enough. According to the network layering of OTN technology, it can be divided into optical channel layer, optical multiplexing fault layer and optical transmission section layer. In order to help customers solve the problem of digital surveillance of communication signals, the optical channel layer also includes optical channel transmission unit and optical channel data unit. So, technically, OTN technology is the inheritance and combination of SDH and WDM technology. As we all know, the network structure of railway optical transport network is mainly divided into backbone layer, convergence layer and access layer, and the construction of transmission network at each level will have different requirements. How can OTN technology be applied in Railway Transmission network?

2. Application of OTN technology in backbone layer

2.1 Clearly adopt ring network structure

In the railway backbone transmission network, OTN is based on wavelength division multiplexing technology and organizes the transmission network in the optical layer, which can not only meet the needs of users for the continuous growth of breadth, but also solve the problems of poor wavelength service scheduling and weak networking ability of traditional WDM network. Firstly, the OTN technology can be applied in a ring network structure. This requires the technical personnel of the railway transmission network to organize the existing railway transmission network. Then the route of the network should be along the trunk railways of the railway bureaus, taking into account the high-speed railway, passenger dedicated line and existing trunk railways.

On the one hand, equipment level protection, OTN technology protection, OTN technology layer protection and SDH self-healing mechanism protection should be integrated and rationally utilized so as to realize the stability and reliability of railway optical transmission system. [2] Taking the protection of optical wear section as an example, OTN system uses the concurrent receiving function of OMSP disc to realize 1+1 protection of service fault signal, and provides protection for all wavelength periods between two OTM stations. The SDH transmission system of each railway trunk

can also form a ring network in this way to meet the needs of large bandwidth interconnection of nodes above the new convergence layer of the data network.

On the other hand, we should pay attention to two problems in the node setting. One is that the node setting should meet the needs of business development. The other is to select suitable reserved facilities for the important business convergence points along the line and the important stations along the road network in combination with the setting of convergence nodes in the data network planning. Many railway transmission backbone networks show two different coexistence relations in the process of establishment, namely, independent relationship and customer-service relationship. The so-called independent relationship is that the OTN network and SDH network run independently when they are set up, and each carries different types of services. The OTN network mainly carries large granular services, while SDH mainly carries small granular services. The so-called customer-service relationship refers to the situation that the OTN line rate is higher than the SDH line rate, which can improve the utilization of link resources. At the same time, the scheduling and protection ability of OTN network can improve the survivability of SDH system.

2.2 Clear link scheme

After the completion of the backbone OTN ring network, some services of the existing WDM network can be reversed to the new OTN network. It should be noted that two schemes can be adopted when linking. The first one is to organize SDH system by using OTN electric crossover, and to connect to the OTN network by using OTN device branch connection rate multiplexing combined with SDH network elements. Its advantage is that SDH level can be managed and dispatched uniformly through OTN system, and the number of channels can be saved for railway transmission network. Scheme 2: On the basis of existing WDS, SDH systems are connected to OTN devices independently through optical fibers. Compared with the scheme, this access mode has some shortcomings. For example, when the OTN equipment is connected independently, the OTN system only provides wavelength connection, and the cross-function of network management and SDH can not be effectively brought into play, and occupies many channels at the same time.

To sum up, scientific and rational use of OTN technology in the backbone layer of Railway Transmission network, that is, to build a suitable ring network structure, and to adopt a reasonable protection system, according to different railway backbone network environment, to make a scientific analysis of different OTN technology access methods, so as to enable the service function of Railway Transmission network. To achieve maximum, and then meet the needs of users. At the same time, the optical signal-to-noise ratio (OSNR) redundancy of 2dB should also be considered when making the scheme to calculate the non-linear effect of OTN technology, so as to help technicians adopt the most reasonable access scheme.

3. Application of OTN Technology in Convergence Layer

3.1 clear overall objectives

In 2001, the OTN core standard G709 was officially released [4]. At this stage, many long-distance railway transmission networks adopt OTN technology. The main reason is that the backbone network of long-distance railway transmission network is a convergent business of large particles. As we all know, the basic network adopted by railway transmission network has certain requirements for the bandwidth and distance of network transmission. The application of OTN technology in the convergence layer of railway transmission network should first achieve the following four objectives: first, the transmission bandwidth should meet the various needs of railway bureau, trunk lines, along-line and high-speed railway users; second, considering the current situation of Railway Transmission network, a reasonable idea is given to the setting and structure of each node of its IP. Road, and play a guiding role in the construction of optical cable network; Third, the transmission of the network should not only meet the needs of various railway services under non-operational conditions, but also meet the needs of high transmission efficiency under operational

conditions; Fourth, the topology structure can be diversified, not necessarily rigid in the ring network; Fifth, OTN has. Strong dispatching function, therefore, the use of OTN technology in Railway Transmission network, it is necessary to achieve the purpose of improving business flexibility.

The application of OTN technology in the convergence layer of railway transmission network is different from that in the backbone layer. Therefore, when using OTN technology, we should pay attention to the specific analysis of specific problems, especially in the convergence layer, so as to adapt to circumstances, local conditions and time.

3.2 Clear up the allocation ideas of each link

After defining the goal, we should clarify the allocation ideas. Firstly, we should clarify the idea of OTN network and node planning. With the railway transmission network continuing to twist the zoning, taking the Railway Bureau as the core, the trunk lines are divided, and the zones are divided into stages, topology and node planning. First, zoning. According to the characteristics of Railway Transmission network, with each Railway Bureau as the core, the main railway lines are dispersed and the optical cables of convergence layer are built. After the completion of the construction, each transmission network of the convergence layer is networked to improve the transmission efficiency of the high-speed railway network and enhance the security of the network construction. Secondly, every step of railway transmission network construction should be fully coordinated. In order to reasonably dispose of funds, manpower and other resources, according to the operation of each region and the use of optical cable resources, priorities can be separated, unified planning can be made, so as to achieve effective and profitable investment. Third, network topology. OTN technology in networking, as far as possible to form a mesh network, according to the results of partition, for example: in the central node area can install more routes, to solve the long loop network line, you can give priority to the division of the loop network lines. Fourth, plan each node. It should be noted that the following three nodes need to set up OTN nodes, that is, nodes with large traffic, optical cable convergence points, and nodes with cross-regional railway transmission optical cable routing.

Secondly, the system configuration of OTN network should be clarified. Firstly, to fully connect the overall capacity of OTN network, the purpose of this is to lay a good foundation for subsequent expansion. Because the optical cross-over technology of OTN system is not mature enough at present, we should consider adopting the "back-to-back OTM" type. Second, we need to understand the OTM configuration. On the one hand, all transmission network channels should be coordinated and planned reasonably. When multiple loops share one OTM system in the same time period, channel resources of OTM system will face the problem of strain, which requires expansion space.

Finally, the idea of OTN network equipment configuration should be clarified. In order to save investment, different OTN networks are configured according to different nodes. In order to improve the flexible dispatching function of OTN technology in the convergence layer, the "trunk separation" mode can be considered to achieve the purpose of high efficiency and low cost investment.

3.3 Summary

The effective application of OTN technology in the convergence layer of railway transmission network should not only pay attention to the related matters in the early stage of construction, but also pay attention to the related matters in the later stage.

First of all, we should pay attention to the related matters in the early stage of the construction project. As we all know, China is a country with a vast territory. Railways are in all directions. Different climatic conditions and other factors have their own characteristics. Taking the eastern region as an example, the climatic characteristics of the eastern region of China are monsoon climate, high temperature and rainy in summer, cold and dry in winter. So when using OTN technology, we should pay attention not only to geological conditions but also to climatic conditions. When these external conditions are very bad, before the OTN project starts, it is necessary to test the various indicators of the proposed optical fiber. On the basis of the actual measured values, the residual is estimated, and the final results are used as the basis of system configuration. At the same time, the optical power, dispersion, OSNR and other indicators of the whole system should be tested according

to the regional conditions.

Secondly, we should pay attention to the later use of related matters. Although OTN technology has certain advantages in use, the application of railway transmission network after its establishment can not rely entirely on OTN. Therefore, we should pay attention to the rational use and allocation of OTN system resources, learn to use the channels and ports of each OTN system scientifically and rationally, and do not blindly open for uncertain business needs. Circuits, when encountering railway-related business, need to be urgently dispatched, should fully consider the use of OTN system status quo, and then make reasonable use of each limited resource in the system, formulate emergency plans, effectively do a good job of pre-channel through, tail fiber pre-connection and other operations.

4. Application of OTN Technology in MAN Level

4.1 Make clear the metropolitan area network in the railway transmission network.

As we all know, the so-called metropolitan area network refers to the computer communication network established within a city. Then the railway transmission network also has its own MAN, which is the same as the urban MAN. It uses optical fibers as the carrier, and can serve data, voice and video functions. It also carries out multi-media communication network with high transmission efficiency and multiple communication services at the same time. Its characteristic is that the communication network used has certain regional characteristics. The metropolitan area network (MAN) of railway transmission network can be further divided into core layer and convergence layer, which puts forward high requirements for the technology of transmission network. It can be said that OTN technology is the best choice for metropolitan area network (MAN) of Railway Transmission network, because the greatest advantage of OTN technology is that it can provide dispatching and transmission of large particle bandwidth for railway MAN. At present, the main particles of MAN dispatching are usually Gb/s and above [5]. Using OTN technology, it can be better realized. Expand.

4.2 Define the application direction of OTN technology.

OTN technology plays an important role in metropolitan area of Railway Transmission network, mainly in business convergence and business scheduling. In recent years, the rapid development of Internet technology has also promoted the rapid development and improvement of Railway Transmission network, which requires higher and higher carrying capacity of metropolitan layer of Railway Transmission network. At the same time, the service of transmission network is increasing. At this stage, more and more IP packet services appear in Railway Transmission network. At present, many railway transmission networks still adopt SDH/MSTP technology, which leads to a great lag in the service functions of Railway Transmission network. The introduction of OTN technology undoubtedly solves the existing problems for metropolitan area layer of Railway Transmission network. As far as OTN technology is concerned, IP packet switching core has become an important development direction. Taking 10G and 40G high-speed network transmission service as an example, using OTN technology in metropolitan area network can not only effectively alleviate the shortage of optical fiber resources, thus avoiding the constraints caused by the shortage of light resources, but also can quickly and reliably open up some cross-regional services, thus achieving the decline. Low material consumption.

4.3 Problems needing attention

Although OTN technology has been widely used in metropolitan area layer of Railway Transmission network, there are still many problems to be noticed.

First, because the metropolitan area layer is very different from other levels, the relevant standards need to be further refined and differentiated. Although the main standards have been basically perfected in the early 21st century, the application standards of OTN technology in metropolitan layer of railway transport network need to be further refined in order to ensure that OTN technology can be

fully developed.

Secondly, OTN equipment needs further improvement. As we all know, it is difficult to achieve the same stability between railway MAN and urban MAN, especially when high-speed railway runs at the highest speed, it is difficult to meet the needs of users. At present, the mainstream transport equipment providers of railway transmission network generally support one or more types of OTN equipment, which requires further improvement of equipment in technology research and development, so as to improve the stability of equipment.

5. Conclusion

In today's network era, the rapid development of network technology has brought many convenient conditions to people. This not only improves the production level and enriches people's spiritual life, but also realizes people's dream of mobile office, further improves people's office conditions, and helps users to improve their office. Efficiency. As a new type of network transmission technology, OTN can play an important role in railway transmission system and greatly improve the quality and function of railway communication. The introduction of OTN technology can promote railway transmission network to build a more efficient and economic network platform, which is also the best choice in the process of railway smooth construction of transmission network.

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