Research on Security Threats and Protection Strategies of Optical Fiber Communication

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***Abstract*—Natural factors, human factors and technical factors have many security threats to optical fiber communication with the improvement of informatization. The security threat factors of optical fiber communication is analyzed. The integration of military and civilian, the combination of field and fixed, the improvement of the equipment performance, and the establishment of standardized guarantee mechanism and operational procedures need to be strengthened is proposed to improve the protection capability of the optical fiber communication network.**

Keywords- Optical Fiber Communication, Security Threat, Security Protection

I. INTRODUCTION

Optical fiber communication is one of the communication systems as an important part, which is used to ensure high-quality, high-reliability and low-cost information transmission. However, threats and challenges to security of optical fiber communication have got more and more concerns from academics, governments and businesses. In addition to suffering from all-round stereoscopic reconnaissance, high-intensity destruction and high-density strikes, it is also necessary to overcome environmental and natural conditions and other factors. Therefore, the security issues of optical fiber communication should be pay attention to earlier and the corresponding security protection strategy should be carefully researched to ensure the secure information transmission and prevent information eavesdropping in optical fiber communication.

II. CHARACTERISTICS OF OPTICAL FIBER COMMUNICATION

Optical fiber communication has become critical infrastructures of digital society, with enormous bandwidth, high anti-interference and overlong transmission distance. It plays an important role in modern Internet.

A. The wide communication and large communication capacity

The wide communication and large communication capacity is the most remarkable feature of optical fiber communication, which can effectively avoid the problems of message transmission errors and user confusion when the traditional cable transmits messages. Due to the large capacity of optical communication, the user can be connected to the line in a targeted manner. An optical fiber with only hair thickness can transmit 100 billion voice channels at the same time, which is tens or even thousands of times higher than traditional cable wires, coaxial cables, microwaves. Therefore, while providing convenience to users, optical fiber communication also reduces the confusion of distribution and regulates communication transmission rules.

B. Low transmission loss and long relay distance

Quartz has a very low loss factor as the raw material of the fiber, and optical fiber can be relayed for hundreds of kilometers or more if equipped with appropriate light transmission and light receiving equipment with no error in the way. Such long-distance transportation has realized the popularization of optical fiber communication.

C. Low signal crosstalk and good confidentiality

Optical fiber communication is mainly for optical transmission and use photoelectric as the main source of information transmission. The outer insulator of the quartz material can effectively avoid electromagnetic wave interference, and can resist the damage from rainy days or rats. At the same time, the insulator can automatically remove the interference components, can induce super strong wave vibration, and has strong ability to receive signals and maintain confidentiality. So Optical fiber communication plays a obvious role in the field of communication.

III. ANALYSIS OF FIBER COMMUNICATION SECURITY ISSUES

With the development of technology, there are problems such as the destruction of the optical fiber communication network and the eavesdropping and interference of transmission information in the optical cable during the optical fiber transmission process, which not only brings substantial troubles to daily communication, but also restrict the rapid and efficient development of the economy seriously to some extent.

A. Safety analysis of Environmental factors

Environmental factors mainly include electric shock, fire, flood, etc. The communication optical cable failure caused by these factors is difficult to predict, and maintenance also is difficult. Therefore, communication failure caused by natural causes is a key prevention scope.

1) Effect of Water

In the long-term use of the communication optical cable, the cable sheath will have rupture damage due to aging,

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scratching and other factors. Moisture may enter the inside of the optical cable in a humid environment, and the optical fiber drawn from the silica material is very brittle. When the temperature drops below zero and the water expands to form an ice, which causes the optical fiber to be deformed and bent, resulting in micro-bend loss and even fiber squeezing, which finally affects communication quality.

2) Effect of Terrain

The communication optical cable may face the threat of terrain at any time due to geographical uncertainty in the process of communication security. Especially when the communication optical cable passes through the hills with more stones, it is easy to be squeezed or rubbed by stones or other sharp objects because the cable is mostly routed along the ground , causing cable damage and blockage.

3) Effect of natural disasters

The first is the threat of floods, mudslides and earthquakes. When the communication optical cable routing or the communication hub is not properly selected, these three natural disasters will affect the communication cable lines and equipment, causing the communication equipment to be flushed, buried, or blocked. The second is the threat of fire. it is easy to point the cable in the process of firing in the field, causing communication to block, because the laid communication cable is temporary. The third is the threat of pests. It is easily bitten by animals such as mice and squirrels, or it is folded by the herd and sheep's feet near the cable, causing the cable to be blocked when the communication cable passes through the woods, the earth, and the grassland.

B. Safety analysis of Human factors

1) Unintentional destruction

the conceal ability of optical cables is poor and extremely vulnerable due to the lack of understanding of communication optical cables. The first is to steal the optical cable. Some unlawful person mistakenly believe that optical cables contains copper, which have very high economic value and steal optical cables for the sake of economic interests. Second is the threat of construction. In the construction process of some engineering projects, blind construction will lead to the interruption of the optical cable without knowing the route map of the optical cable because the optical cable is not protected. Third, the demand for local construction will increase and many constructions will affect the original fiber channel. The cost of relocating the optical cable line is high, time consuming and long. Therefore, the safety standard of the maintenance is lowered accordingly in order to reduce the maintenance cost of the optical cable line, thereby causing the cable to be interrupted.

2) Intentional vandalism

Some optical signals in the optical fiber are leaked out by using optical cable joints, micro-bends and damaged parts by means of technical methods, and optical signal eavesdropping is performed by installing an eavesdropping device. Furthermore the acquired information is analyzed to obtain useful content, or the original optical signal is interfered, and the cable routing is locked by injecting light source. The state of the transmission network cannot be monitored in real time and the security threat of information leakage is large because the communication optical cable lacks effective monitoring means

3) Threats of Technology

The professional quality of personnel can not meet the demand for communication optical cable line protection. Violations or errors in the design of communication optical cable lines and construction processes pose a threat to communication security due to the lack of relevant regulations and clear technical specifications for business personnel.

IV. SECURITY PROTECTION STRATEGY OF OPTICAL COMMUNICATION NETWORKS

In order to better protect the security of optical communication network, effective protection strategies and management and maintenance measures need to be adopted to ensure effective operation and provide a solid guarantee for normal communication.

A. Pay attention to daily maintenance and improve resistance to the destruction of natural disasters

The idea of prevention-oriented and comprehensive prevention should be established to ensure the dynamics of daily maintenance work and the cable line should be in a relatively stable state to improve the ability of fiber to resist natural disasters. Optical fiber can use the latest technology and materials to improve the resistance of optical cables to natural disasters at present. With the economic development of the times and the rapid development of science and technology, optical fiber materials have a broader prospect, and their transmission signal capabilities will also be strengthened.

B. Enhance signal transmission reliability with technology measure

In addition to strictly implementing various fault prevention measures, it is necessary to improve the maintenance and management level of the communication optical cable line by means of certain scientific and technological means in order to ensure the safe and reliable operation of the communication optical cable line and enhance the transmission reliability of the signal. Communication optical cable line resource management system can be constructed by using the geographic information platform to improve the efficiency and accuracy of communication optical cable line fault judgment, which can realize the graphical display and management of communication optical cable resources. The communication integrated network management platform can be improved, and the and comprehensive monitoring and management can be gradually realized to ensure the standardization, leanness and standardization of the maintenance and management of communication optical cable lines.

C. Focus on business needs and improve the professionalism of business people

Communication cable maintenance as a long-term and systematic project is the main way to enhance the reliability

of signal transmission. We should focus on improving the professional level of maintenance personnel. First, we should strengthen the training of professional knowledge and practical ability of professionals, learn emerging technologies in a timely manner, improve the attention of personnel on the development of new technologies at home and abroad, and employ experts with strong professional and practical skills to regularly train personnel. Secondly, corresponding responsibility mechanism can be formulated to constrain the maintenance management personnel, and urge the professionals to do their jobs through the system form. Finally, the work should be strictly carry out accordance with the formal maintenance standards of optical cable lines.

V. CONCLUSION

The security of fiber transmission in communication networks should be fundamentally guaranteed in order to ensure the safe and reliable transmission of signals. Due to the impact of natural disasters, human factors, and optical fiber factors, some faults will occur during the operation of the communication optical cable line. Effective measures should be taken in time to find out the cause and type of the fault when the communication optical cable line fails. and the fastest method should be used to fully guarantee the normal operation of the communication optical cable line. The safe and reliable signal transmission should be fundamentally realized to consolidate the main position of national economic development.

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