CYBERSECURITY ANALYSIS IN OPTICAL COMMUNICATION NETWORKS

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Annotation: The following article is devoted to the safety issues in optical communication networks the American telephone inventor A. Bell, who realized the convenience of light in transmitting information over long distances, created an optical telephone (photophone) 125 years ago.

Key words: Telecommunication, optical fiber, satellite, information density, light transmission

Communication, especially optical communication, has played an important role in human development due to its high propagation velocity (vq3 * 1010 cm / s) and other features of linear propagation. For example, as early as the 18th century, optical telegraphs based on the use of sun-reflecting mirrors and semaphores capable of transmitting complex signals were created.

With the help of his device, he transmitted human voices through light at a distance of 200 meters. In this case, the sunlight returning from the vibration of the microphone served as a carrier of sound. Today, almost every home has a radio, television, and telephone, and a wide range of information is transmitted from space via Earth's satellites using cables laid between cities and squares. However, the development of communication technology, modern advances in electronics, the mastery of the cm and mm range of electromagnetic waves also do not meet the ever-increasing information requirements: practice imposes a number of requirements, such as information density, frequency increase . That's why experts around the world have repeatedly focused on the optical range. Also, the world's copper deposits are declining. However, almost half of this much-needed metal is used for cables. Scientists estimate that copper production will decline sharply in the 21st century. This means that if no solution is found, cable production will be in decline. Therefore, it was decided to abandon copper wires and switch to light transmission through transparent glass fibers. This means that the use of fiberglass has two positive advantages - a sharp increase in data rates and significant savings in expensive copper. It should be noted that after the perfect absorption of electromagnetic waves in the range UYUCH (q = 1-20 cm), the turn came to the optical range. Lasers invented in the 60s also did not have much effect. Because the transmission of information by laser light in an open atmosphere did not give good results. This is due to atmospheric temperature, air flow, dust, fog, and so on. was found to be unsuitable for use as an outdoor light-transmitting medium due to its constant fluctuations. The laser beam was transmitted through the tubes, but to no avail. It should be noted that light-transmitting glass fibers were known in the 60s. They were 100 μm in diameter and consisted of a core and a shell surrounding it. The refractive index of the core should be slightly greater than the refractive index of the shell. Attempts have been made to transmit laser light through such fibers, but such fibers have a very high absorption coefficient of about 1000 dB / km. The light emitted into such a fiber is almost completely absorbed after a few meters. However, in 1966, British scientists Kao and Hoxham analyzed the causes of light absorption in optical glass, and found that the main cause of light absorption was metal that He, Ni, Si, Sg and similar metals entered from outside (air, crucible) during glass synthesis. ions. The authors of the article proved that if the glass is cleaned of these ions, it is possible to obtain fibers with an absorption coefficient a <20db / km. Following this article, efforts have been made worldwide to obtain low-absorption light-transmitting fibers. Finally, in 1970, experts from Korning Glass developed light-transmitting fibers for light with a wavelength of qq063 μm and an absorption coefficient of less than 20 db / km. These fibers could be used in long-wavelength optical communication lines.Therefore, 1970 is considered to be the year of the birth of fiber optics. Since then, fiber-optic communications have developed at an unprecedented rate, with the use of telecommunications television, aviation and the navy, on-board communications, computer technology, process control systems and began to be used in hk. It was also found that light fibers are insensitive to external electromagnetic waves, are lightweight and compact. Thus, the basis of optical communication systems is a fiber made of transparent and clear glass, which serves well.According to the laws of optics, light emitted into a fiber can propagate without leaving it. The fiber may be in a straight line or wrapped around the drum. This is because as the light travels through the fiber, it reaches its boundary and returns completely inside. This light falls on the other end of the fiber and returns completely inwards, and so on.

This means that the condition for light to propagate is that it returns completely to the inner side of the fiber. This is a very simple and widely used phenomenon in optics. Suppose (Figure 1) that light propagates in a cylindrical medium with refractive index p1 and radius g. Let p2 be the refractive index of the external medium. In that case, the light refracts and partially returns when it reaches the boundary of the two media. The angles of refraction (q2) and descent (q1) obey Snellius' law: n1Sin a1qn2Sina2 or Sin a1qn2 / n1 Sin a2 If we increase the angle of incidence (q1), the angle of refraction a2 also increases and the second medium is towards the boundary of the refracted light fiber. 'prog begins to bend. When the angle q1 reaches a certain critical value, it becomes q2q90 °. In this case, the refracted light travels along the fiber boundary and does not pass to the second medium, there is a complete internal return.Although glass fiber is a very light environment, it has its drawbacks:

1) because it is in the open air (p2 <1), it is exposed to the external environment, on which dust settles and pollutes, which leads to the extinction of light; 2) Additional attenuation occurs at the contacts of the fiber support supports. In addition, fiberglass is brittle: It is very easy to break if no protective layers are laid on it. These shortcomings are eliminated at the expense of two layers. (2 (a -b) - picture). Because the glass fibers are stretched (qqT = about 2000 ° s) and wrapped around the drums, the trajectory of the light in such fibers is curved and has no clear return limit. The light directed to the side of the shell begins to bend towards the axis of the fiber, and it propagates again to the center of the core. Because information is transmitted through glass fibers, their extinction coefficient must be kept to a minimum, as optical communication lines can extend distances (1-100) km. To do this, their absorption coefficient should be qq01-1db / km. Only high-quality optical glass, especially glass quartz, meets such a great demand. Quartz differs from other glass by its homogeneity and low light scattering coefficient.

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