

Discussion on application of EPON communication technology in smart distribution networks

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Abstract. With the development and innovation of science and technology in China, a greater number of advanced technologies have been developed in response to the proper time and conditions. Ethernet Passive Optical Network (EPON), with the low-cost characteristic, can give full play to certain roles. In this paper, the practical application of EPON communication technology in smart distribution networks would be studied and discussed.

Keywords. EPON communication technology in smart distribution networks, application, discussion.

EPON communication technology in smart distribution networks can save optical fiber resources and play a vital role in the optical access network. Through years of development, EPON communication technology has completely ruled the LAN, and it can fully meet the actual demand of the users. Later, the authors would discuss the technology in terms of the current situation of distribution communication networks, and the practical application of EPON communication technology in smart distribution networks [1].

1. Current situation of distribution communication networks

In recent years, the scope of application of communication networks has been expanding, and the communication network technology has been continuously improved and enhanced. However, there are still many problems in the actual operation of optical fiber communication networks, and they may pose higher requirements for network maintenance. In some areas, the 10kV distribution systems still use some outdated equipment, whose application is likely to cause many problems during the operation of grids. For example, if a piece of equipment is used for a long term, without being updated in a timely manner, it is likely to suddenly interrupt during operation. The serious aging of equipment would directly affect the speed of operation and renewal of distribution systems, and the supply of electricity would exceed the demand. In addition, the old power equipment would have the most potential hazards. After long-term use, they would cause safety accidents and their safety cannot be guaranteed. At the same time, the backwardness of grid technology would make it hard to guarantee the operation of distribution network systems. In the case of any problem, the re-maintenance would increase the input of power capital and greatly affect people's lives.

2. Communication technology in smart distribution networks

2.1. EPON technology

With the progress of technology, a great number of new technologies have been developed. Especially, the EPON technology (Ethernet passive optical network technology) has been successfully developed. It is a data transmission tool that can realize real-time sharing according to the time-sharing procedure. With the broadcast technology in the process of transmission, it can obtain the address from the received information, and extract the useful signals. This technology mainly focuses on the design of the system, and controls the system with MAC of the physical layer and Ethernet model. MAC is extremely critical, because all the key technologies play their roles at this layer, mainly including the distance-measuring technology, receiving technology of burst data and agitation technology. Several key technologies would be analyzed as follows.

2.1.1. Receiving technology of burst data

The uncertainty of the uplink data would make OLT receive ONU signals with different signal strength. Therefore, we must make real-time adjustments according to the strength of each ONU signal, to correctly restore the data sent by ONU. The uplink and downlink of the single-fiber system adopt different wavelengths. Typical uplink wavelength is 1,310nm, and downlink wavelength is 1,490nm, with the transmission distance of 15km. The dual-fiber system consists of two optical fibers, which adopts the multi-mode fiber following the IEEE802.3ub standard, with the transmission distance of only 2km.

2.1.2. Agitation technology

Agitation solution applied in the EPON technology can fully ensure the security and reliability of information, and prevent the users from forging OAM frames through the data transmission channel for damaging or changing the system configuration.

2.1.3. Technology for synchronous reception

EPON is a system technology synchronizing with the network. It can realize synchronization between ONU and OLT, to ensure the correct transmission of information.

2.1.4. Distance-measuring technology

Distance-measuring technology is mainly used to measure the distance between OLT and ONU. As studied, in the point-to-multipoint topology, there is a certain gap in the logic distance between OLT and ONU of EPON, which can effectively enable the remote terminal of ONU receive the useful signals, and complete the sorting. In addition, for the signals that can reach the OLT through sorting, the distance in between can be measured in the process of sorting, and then the useful signals can be sent. As a result, the logic distance between OLT and ONU can be determined. The technology can guide OLT and ONU to regulate and send the signals, effectively avoiding the signal sending delay. The measurement of the distance can ensure accurate sending of the signals.

2.2. PON technology

Passive Optical Network (PON) mainly refers to ODN consisting of passive devices, rather than other electronic power and electronic equipment. One advantage of PON is that it only needs to process the signals with in-house equipment and switches, rather than more expensive active equipment. Although its transmission distance is not as long as the active optical fiber access system, and its coverage area is small, it has the advantages that active devices do not have, such as convenient maintenance management and low cost. As for PON, the uplink and downlink signal transmission methods are different. Uplink signal transmission mainly relies on back transmission of TDMA unfolded data, while the downlink signal transmission refers to the transfer of data to the users in the form of broadcast by OLT. The current PON technology mainly consists of EPON technology and PON technology. The EPON standard is more complete and less expensive, making it an important technology for current application [2].

PON technology, mainly referring to Gbit passive optical network technology, is a new broadband access standard proposed by ITU-T according to the requirements for business expansion of Internet operators, with the main advantages of long-distance transmission, high bandwidth and high security. Therefore, it has been widely applied all over the world. The application of broadband access with PON technology mainly relies on its performance advantages in the following four aspects: 1. Compared with other technologies, the broadband access of PON technology belongs to net broadband. 2. The broadband access of PON technology has better expansion performance, and flexible and simple service configuration. 3. The broadband access of PON technology has a higher transmission rate. 4. Compared with the traditional copper cables, the broadband access of PON technology has the main advantages of better transmission performance and low signal loss. Comparing the broadband access of PON technology with the traditional access technology, GPON technology mainly has the advantages in terms of the construction of line equipment. Copper cables used in the traditional access technology would increase the cost of the construction of line equipment. However, PON technology mainly uses optical fiber, which is cheaper and can save the cost of the construction of line equipment.

The planning of broadband access optical line terminals with PON technology generally consists of the planning of coverage distance and the planning of deployment locations. Firstly, as for the planning of deployment locations of broadband access optical line terminals with PON technology, optical cables should be used to meet the demand of power-free long-distance transmission. If the terminals of PON broadband are installed in equipment rooms of communities, the later maintenance and power supply should be comprehensively considered. Secondly, as for the calculation of coverage of broadband access optical line terminals with PON technology, it is necessary to fully consider the locations of optical line terminals, the existing network, the effective coverage and the investment cost, so as to comprehensive plan the PON broadband access technology.

3. Comparison of technologies

EPON technology and PON technology have something in common, both of which adopt optical fiber transmission. They also have separate characteristics: in terms of rate, EPON can provide the fixed uplink and downlink rate of 1.25Gbps. As studied based on 8b/10b line encoding, the actual rate is 1Gbps. In comparison of technologies, EPON technology has a higher shunting ratio, and its control protocol can support more ONUs. Although PON has multiple options, its application cost is relatively high. Compared with EPON, PON can support asymmetric uplink and downlink rate, and can also determine the uplink and downlink rate according to the actual situation, so as to improve the rate-price ratio of optical devices. It is studied that PON is superior in performance indicators, but EPON is superior in cost saving.

4. Conclusion

Since the reform and opening up, China has made a great progress in the field of science and technology. With the significant development of network technology, EPON technology has become the hottest technology widely used in various fields. EPON technology can meet the demand of modern users for high-speed Internet access, and it plays a vital role in various fields in China, providing the Chinese people with convenience and economy in daily life.

References

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