Application of a Mobile Passive Optical Access System

Zenghui Zhao

School of Intelligent Science and Information Engineering, Xi'an Peihua University, Xi'an, 710125, China

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Abstract: Aiming at the blocking problem of real-time transmission of information caused by various major emergencies, a flexible mobile emergency optical access system is developed. Based on the hardware, software and interface technologies, the key technologies of system management software are designed, and the link testing process is described and the networking application is carried out. The test results show that the throughput from source to destination is 75.47Mb/s (TCP) and 20.56Mb/s (UDP). By selecting transmission distances of 8 km, 13 km and 18 km in different geographic locations, voice, data, image and video services are tested, and the signal transmission is normal and the network runs steadily.

1. Introduction

In view of the problem of voice, data, image and video multi-service information access and transmission after emergencies, document [1] proposes the development of a mobile passive optical access system with emergency characteristics, and describes the technical scheme, specific technical indicators, main hardware technology design, interface fusion technology design and organization and operation simulation of the system. This system is based on the following standards: technical standards for equipment of regional communication network; fixed optical fiber communication technology standards (G. 703); computer network technology standards (IEEE802.3). The design is based on EPON technology, summarizes the shortcomings of traditional access mode, fully takes into account the actual emergency and future business expansion needs, mainly used for flexible networking in mobile emergency environment, to provide communication security services after emergencies. On the basis of literature [1], this paper introduces the design of system management software for self-developed mobile passive optical access system (J-EPON), describes the process of equipment link testing and carries out field prototype network application [1~3].

2. Technical Design of System Management Software

The structure of J-EPON system is huge. The design of management software technology can effectively enhance the operation ability only when it is considered in a comprehensive way with the design of hardware technology, interface integration technology and software technology of the system. OLT hardware mainly consists of AT91RM9200 chip, PAS5001-NM3 chip and its peripheral devices. The chip effectively supports extended DBA algorithm, VLAN service and IEEE802.3ah protocol. AT91RM9200 is connected to the remote management client through RJ45 interface, and the JEPON system is controlled and managed by the administrator. The OLT and ONU management information of AT91RM9200 is communicated through 16-bit Local Bus Bus and PAS5001-NM3. Considering the application software such as network management and DBA control, AT9200 microprocessor is specially used in the hardware part, and PAS5001NM3 is taken as the core. The main system interfaces are Host processor interface, GE-PON interface, Host processor interface, core network interface and External Memory/Flash interface.

Interface fusion takes into account the interconnection of different types of devices. For this reason, a multi-functional interface of link fusion is specially set up, aiming at the forward and backward compatibility of device connection and the convenient and fast networking. Link fusion

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interface is used to connect all kinds of peripheral mobile devices to fixed optical transport network. The functions of optical terminal E1 interface, group A interface and ET interface are converted and switched on the interface [1].

The architecture of J-EPON management system designed in this paper is shown in Figure 1. J-EPON Network Management System Protocol: SNMP is an application layer protocol, which requires loading IP protocol stack on the device. Operators have difficulty in implementing it. OAM is a link layer protocol, which runs without IP and can provide operation-level maintenance and management for access network. J-EPON management system uses the combination of OAM protocol and SNMP to achieve the mutual cooperation of the two protocols and complement each other.

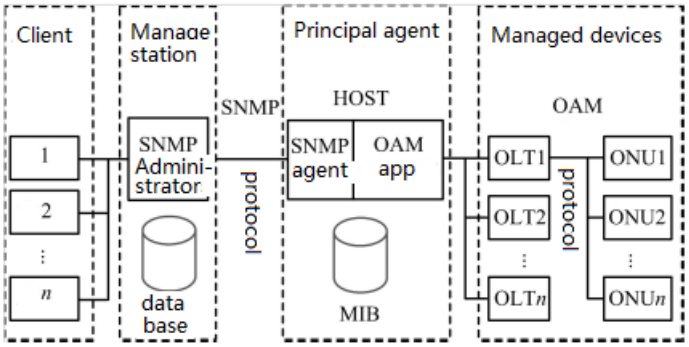

Fig.1. J-EPON Management System Architecture

Through resource integration, multiple OLTs in one area are integrated on the backplane of the equipment. They are selected according to the actual needs and managed by a principal-agent. Only one OLT can bring 32 ONUs. The information interaction between ONU and OLT depends on the principal-agent and the management station. J-EPON network management system working process: the client is connected to the management station, and the management client is observed and modified by the administrator; the principal agent provides parameters to the SNMP Manager of the management station, sends information reports, and records relevant information to the local database; the SNMP Manager of the management station records information to the local database; the principal agent uses the OAM protocol; Information is collected and stored in MIB for management station to query or modify. The parameters and information set by the principal agent are received by the hosting device and reported to the principal agent in case of abnormal events.

Figure 2 is the function module of J-EPON management station. Its working process is to use TCP/IP Socket channel, SNMP communication module to communicate with the principal agent, receive and send SNMP messages, obtain the information of Trap events and corresponding information in MIB, or set it up. Data management module completes the task of data processing, analysis and storage, part of the data is directly displayed and used by the client; part of the collected data is processed and then sent to the client for display; if some data do not need to be displayed for the time being, it is stored in the database for subsequent queries. As the management function module of the center of the management station, it realizes the five main management functions of SNMP. It transfers the SNMP message to the communication module and receives information from the client, or delegates the performance parameters and Trap information, and maps it to the local database through the relevant sub-modules.

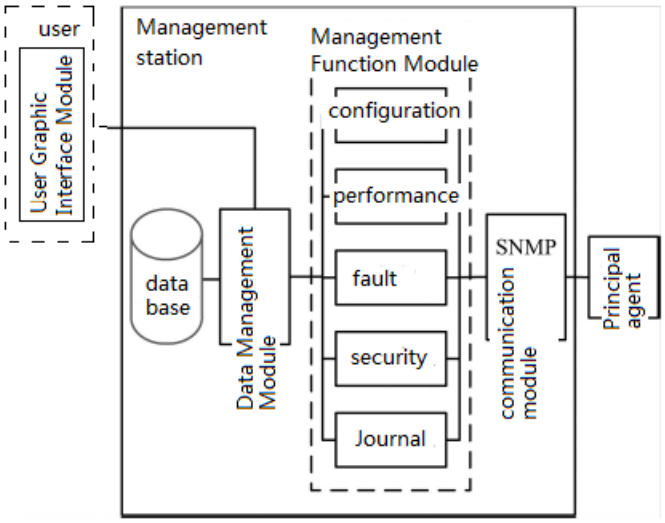

Fig.2. J-EPON Management Station Function Module

The principal-agent functional module structure consists of SNMP communication module, MIB management module and OAM protocol communication module (schematic). Using Berkeley database (BDB) to implement MIB management module, BDB is an embedded database, which is simple to operate, powerful in function, and has a large amount of management data. It is suiTable for the development of JEPON network management system MIB. The interface functions of BDB are: open/close the BDB environment; initialize and create the database; open/close the database; write, lock and read the data. SNMP and OAM programs access MIB through interfaces.

3. Link networking application

J-EPON equipment link networking scheme focuses on simplicity, rapidity and applicability. Emergency link networking is located in steep mountainous areas or in areas of natural disasters that are irresistible. In this environment area, there are six command posts, namely, General Command (A), Support Command (B), Support Group (C), Front 1 (1T), Front 2 (2T) and Front 3 (3T). Usually the frontal distance of emergency link is 10-15 km and the depth is 20 km. In the organizational operation scheme, OLT is placed in the pre-set emergency front-end computer room or the office (station) computer room near the core network. The command posts at all levels access the optical access point through POS in the optical fiber junction box, and then transmit information through the pre-set optical cable and the mobile backbone network. According to the information requirement of emergency deployment and site topographic conditions, the approximate distance between each ONU and OLT is determined. Link networking is shown in Figure 3. OC-1*4-U POS performance standard is selected for network configuration in equipment links. The splitting ratio of POS is 1:4. By allocating users for fiber-optic connection command, the system can cover up to 20 ONU users in the initial stage. With the development and needs of the situation, the relevant configuration can be added to complete the access of ONU at any time. Each group only provides data solutions, through the FE interface of ONU, the LAN services organized by the regional exchanges of the command posts are connected to the core network; the users of the command posts are directly connected to ONU, which can provide both data services and voice services.

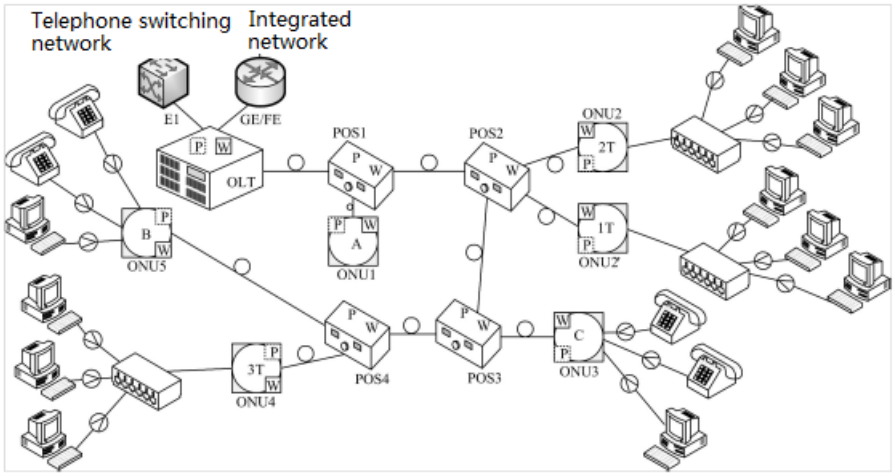

Fig.3. Device Link Networking

Link networking takes into account various business needs in emergency field. Different networking methods and multi-functional interface technologies are used to construct links. In the commissioning of mobile equipment, various connection modes are used to test their performance and interface functions. Through multi-service and multi-time application in different areas, the signal transmission of the system is normal, the functions are sTable, and the technical indicators of the system meet the design requirements.

4. Conclusion

From the point of view of real-time transmission of emergency demand information for major emergencies, based on document [1], this paper improves the previous J-EPON and makes a prototype of the equipment. The system management software technology we developed is integrated with the hardware design, software design and interface integration technology design of the system. The system management functions are coordinated and coordinated. Through the link performance test and link networking application, the expected design requirements are achieved. From the actual link test results, we can see that the technical indicators have strong competitiveness. The application of access links in different areas, different geographical locations and different distance environments shows that real-time information transmission of multi-service and signal transmission are normal. This research fully meets the actual needs in networking applications, technical advantages and performance indicators. As long as the cost is reduced, the technology and application can be promoted.

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