Key Technical Research of Maneuvering Optical Fiber Access Network in Emergency Communication

Hu Lei*
Xi'an fanyi university, Xi'an, Shaanxi 710105, China
505410068@qq.com
*Corresponding author

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Abstract. For the key technologies of maneuvering optical access networking in emergency communication, based on the existing communication network, this paper studies the ONU hardware, OLT power supply and reset module, OLT terminal integrated bandwidth allocation algorithm, OLT optical burst emission / reception module, HOST subsystem and OLT subsystems, structure of maneuvering fiber access networking, overall performance design of system and the organization method of mobile optical access system. Broadband access technology of maneuvering fiber access networking in emergency communication is realized finally.

At present, the NIMS of the United States the Disaster Prevention Center of Japan and the e-RISK of the European Union in foreign countries are with clear division of responsibilities, complete emergency response system and advanced communication means with being developed and perfected over the years. In particular, the EU e-RISK system, which makes extensive use of satellite-based communication technology, provides support services for the efficient and timely handling of public emergencies and natural disasters across national. After a major natural incident, it is effective to avoid situations where rescue personnel are unable to communicate with exports from the command centre in timely as the disruption of communications systems and the severe congestion of channels.

After the extreme natural disaster, it is very important to ensure communication between the disaster area and the outside world, to know the emergency situation of the disaster area and to provide the necessary information for the rescue work. Based on the existing communications networks, the technical standards for the equipment of mobile geographic communications networks and for fiber communications of fixed communication stations(G. 703), the technical standards for computer networks(IEEE 802.3) and the technical standards for passive optical access to the ether, as well as the problems of traditional means of access for the establishment of critical technologies for emergency communications network. In this paper, the structure construction, key technology realization, system performance realization and system organization application method of mobile light access network system(Y-EPON) in mobile and fixed emergency communication are studied, and the comprehensive information access of broadband is realized.

Key Technology of Maneuver Optical Fiber Access Network

The fiber access network system in emergency rescue is a network connection scheme which provides access to data, video, voice service and multimedia service on a platform. When the emergency happens, the mobile equipment is used to access the core network nearby, and the mobile communication network is connected seamlessly to the fixed communication network through the combination of short distance multi-rate information. The emergency maneuver optical fiber access network system should be sure of the real-time, reliability, stability, effectiveness and dynamic network system under the protection switching mechanism, so as to be easily connected with the different interfaces of the optical terminal or computer network, flexible in configuration and convenient in use to meet the needs of the information society.

System Design of Maneuver Optical Fiber Access Network

The Y-EPON device is designed with the core chip developed by PASSAVE, the OLT end with PAS 5001-NM3, the ONU end with PAS 6201-NM3, and the embedding board with at microprocessor 9200, with applications such as network management, DBA(dynamic bandwidth allocation) control, called HOST.

OLT hardware system mainly consists of PAS 5001-NM3 chip and its peripheral device, ONU hardware system PAS 6201-NM3 chip and its peripheral device. OLT and ONU hardware systems are connected with some of the same modules such as a 2 MB FLASH mainly used to store FIRMWARE(firmware) supplied by PASSAVE, a piece of 8 MB SRAM to support the running of the program in the chip. The difference of OLT and ONT is that the OLT system is connected directly with the serial port of PC through a RS232 interface, and the PC is used as HOST, so that OLT and ONU can be debugged without embedded board, provides a 1000 Mbps GMII uplink interface for access to the external network, and the downlink provides a 1000 Mbps PON interface to the ODN. The ONU system is provided a 1000 Mbps PON interface to the ODN on the upside, and a 10/100 / 1000 Mbps RJ45 interface to the user.

In the HOST hardware system, AT9200 is ATMEL's ARM9 processor, which is connected to PAS 5001-NM3 with a 16-bit local bus and a single ARM9 chip that manages eight OLTs. The BootLoader of the AT9200 embedded platform is stored on a 128KB serial FLASH chip. The embedded platform needs to run the LINUX operating system and build databases on OLT. The other FLASH connected by AT9200 is 32MB, 64MB SDRAM and 4KB EEPROM used to access some of the parameters of the network management system and embedded system. The AT9200 embedded platform provides a 100M RJ45 interface for network management, RS232 interface is used of system embedded system and software debugging.

Hardware Design of Maneuvering Optical Fiber Access Network

The hardware of the ONU is mainly composed of PAS 6201 and its peripherals, as shown in Figure 1. The function of PAS6201 chip integrates the Ethernet MAC dielectric layer can implement data mediation and data exchange rate adaptation of PCS layer encoding and decoding and LLID filtering and Ethernet MAC management.

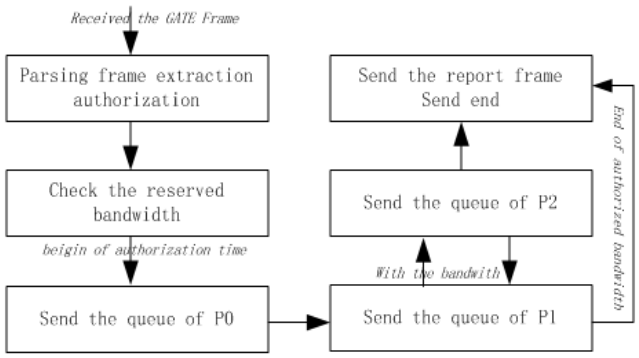

Fig. 1 Hardware structure diagram of ONU

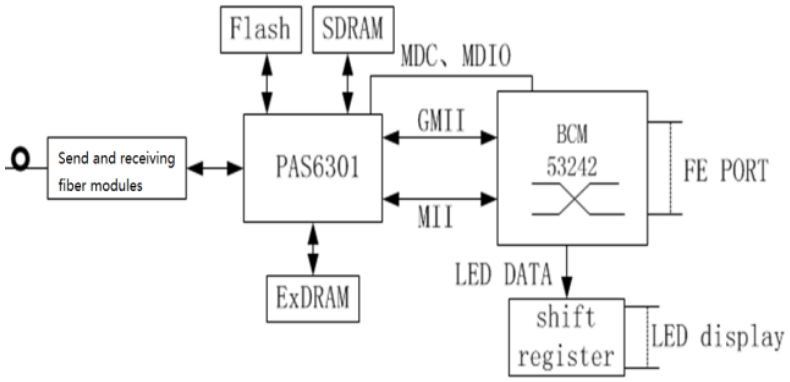

Fig. 2 OLT terminal pooling bandwidth allocation algorithm

The interface circuit of the ONU consists of the PON interface and the Ethernet port of the user. PON interface consists of SERDES module and optical module. PAS6201 is embedded with gigabit SERDES module, ftm-9412p-f10 is selected as the optical module, and the PHY chip LXT971ACL, which is the same OLT end, is selected as the interface of UNI side, so that PAS6201 chip works in the active mode of MII and only provides 100M Ethernet interface to the user side.

OLT hardware is mainly composed of HOST subsystem and OLT subsystem.

HOST subsystem is the control center of the whole system, including the management of the EPON network, including OLT subsystem, fault detection and fault handling. AT91RM 9200 is connected to the remote management client via the RJ45 interface, and the entire EPON system can be managed by an administrator. AT91RM 9200 connects with PAS 5001-NM3 via 16-bit Local Bus to convey management information to OLT and ONU. The AT91RM 9200 storage interface consists of SDRAM, BOOTROM and FLASH. The AT91RM 9200 control logic interface includes the interrupt control module and the reset control module, which realizes flexible and universal interrupt control through the programmable interrupt control(PCI) unit.

The OLT subsystem consists of PAS5001NM3 chip and peripheral devices. The PAS 5001NM3 core chip contains the GE-PON interface, the core network interface, the Host processor interface, and the External Memory/Flash interface. The GE-PON interface is based on the TBI(ten-bit interface) serial converter(SERDES) interface with a line of control for burst reception and burst clock data recovery(CDR). The Core Network interface has two modes of active and passive. The Host processor interface ensures that multiple PAS5001 devices can be connected to a host using the PAS5001 local bus interface, the external Memory/Flash controller supports RAM, ROM, Flash, and burst ROM, programmable bus loop, and external asynchronous wait control.

OLT Optical burst emission/reception module technology: A concatenation and conversion chip is used between the PAS 5001 chip and the optical module. The chip of AMCC S2060 can complete the concatenation of the 1Gbps EPON optical interface. The light module is selected for FMT-9712P-F20/K20, which is based on the technical expertise and maturity.

OLT power supply and reset module: In OLT system, there are many kinds of chip and interface equipment, which produce more current and many kinds of voltage are needed. Use APL 1084 and LD1117 chips in design. APL 1084 can complete 5 V to 3.3 V, LD1117 can complete 3.3 V to 1.8 V, 3.3V to 1.5 V DC voltage. SP 706T chips are used to manage reset signals.

The fixed polling cycle length is 2ms, and OLT sends an authorization frame to each ONU for a period, setting three different priority queues P0, P1, and P2 in each ONU cache. P0, P1, and P2 queues correspond to Voice, Video, and Data businesses, respectively.

A GATE frame includes the start time and length of four authorizations: Grant # 1 for the P0 of

ONU, Grant # 2 for the P1 and P2 queues and initial authorization of ONU, and Grant # 3 for the remaining bandwidth authorization of ONU.

Human Rights Application of Mobile Fiber Access Network System

In the organization operation scheme, OLT is placed in the preset front-end engine room, and each level of command is connected to the optical access point by the optical fiber junction box optical divider (POS), with the preset optical cable and the mobile backbone network. By assigning optical fiber connection command post users, the entire Y-EPON can cover up to 20 ONU users at an early stage. With the development of technology and need, the ONU access for emergency rescue can be completed by adding separator and related configuration.

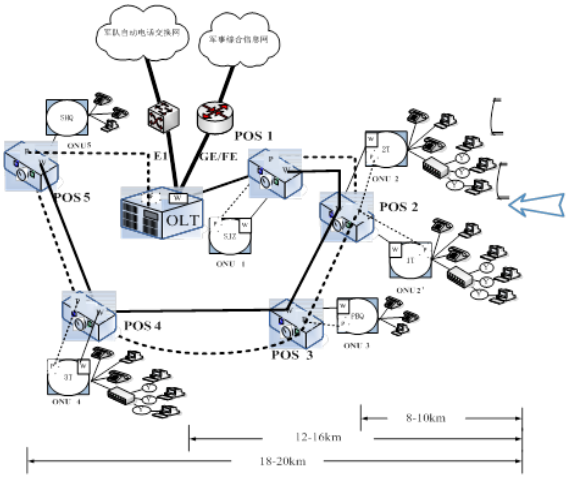

Fig.3 Maneuvering optical fiber access network

Y-EPON is used as a level command station access device. For non-command station, which is the lower level of the command station, the emergency communication stations only provide data solutions. For rescue systems, because ONU is directly to the home, it can provide both data and voice services. Therefore, on the user side of the ONU device, four electric FE ports and four POTS (Plain Old Telephone Service) ports are provided.

Conclusion

In this paper, the mobile optical access system in the emergency communication system has the function of mobile and flexible emergency communication, which combines the features of high bandwidth, low cost, extensible, standardization and commercial hardware and software support, and serves as a comprehensive access platform for data, video and voice services. The system of emergency communication mobile optical access network can implement large flow real-time data interaction, which is helpful to realize the real-time information transmission with large capacity under mobile condition, promote the planning, design and technical upgrading of mobile optical access network, and provide information guarantee service for emergency situation, which can be used flexibly under mobile environment.

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