Applied Mechanics and Materials *Online: 2011-09-27*
ISSN: 1662-7482, Vol. 103, pp 578-582
doi:10.4028/www.scientific.net/AMM.103.578

Ethernet Private Line Access Design Scheme

Hongfang Tian [1, a], Yanhua Liu [2,b], Yinghong Li [3,c]

[1] beijing, North China University of Technology

[2] beijing, North China University of Technology

[3] beijing, North China University of Technology

[a] thf@ncut.edu.cn, [b] 1122liuyanhua@163.com, [c] lyh427@ncut.edu.cn

Keywords: Ethernet Private line access

Abstract: With the development of Internet, IP has already taken the leading position of any kind of terminal utilization. In order to satisfy consumers' growing requirements of broadband services,and make up for insufficiency of IP MAN in business management efficiency, data throughput, stability, maintenance difficulty and so on, improve information security of banks and governments, the article introduces a method of achieving Ethernet private line access to improve the information security and the quality of service of big consumer.

Introduction

With the surge of broadband and digital service, transmission technology of Ethernet experiences the high-speed developing period again. Previously, signal transmission of Ethernet was done like the Fig.1 (a). If conduct signal transmission of Ethernet in that way, the cost is very low, but the plan is bad for the expansibility when it comes to increase the business, all facilities need to be replaced, and the plan is very bad for managing. Meanwhile, Ethernet signals are converted to E1 signal that need to undertake protocol conversion, converter manufacturers are numerous and no unified standard technology, therefore the interoperability relatively poor. In order to meet the expansion of Ethernet without replacing facilities, and to avoid signal transmission link in the process of protocol conversion, improve system interoperability, developed as shown in Figure 1 (b) shows the design. Such solutions used Huawei production metro500/1000 transmission equipment that has solved the problem with the expansion of business communication. The project can make Ethernet signal through the optical transceiver, carries on the photoelectric convert, Ethernet was converted into electrical signal by Huawei equipment accessed SDH (Synchronous Digital Hierarchy) network.

Although some manufacturers' equipment can solve some of these problems, the price is high, functionality is not perfect. For example, some operators are using Huawei's product, which can solve the problem of device interoperability, improve scalability and so on, but many operators can't afford the price of equipment. Therefore, this article provides a design plan as the Fig.1(c). The plan costs less and is fine with expansibility and management. These kinds of design not only enrich the high bandwidth product system, outspread network value chain, but also improves the network support ability.

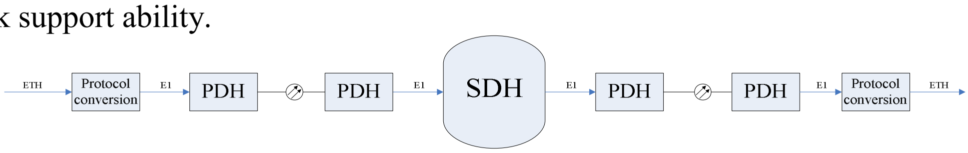

Fig.1 (a)

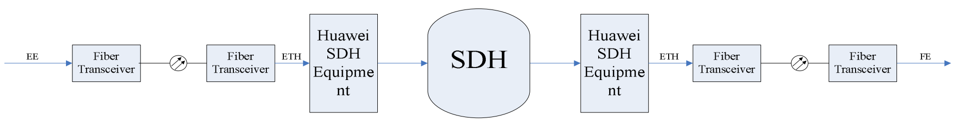

Fig.1 (b)

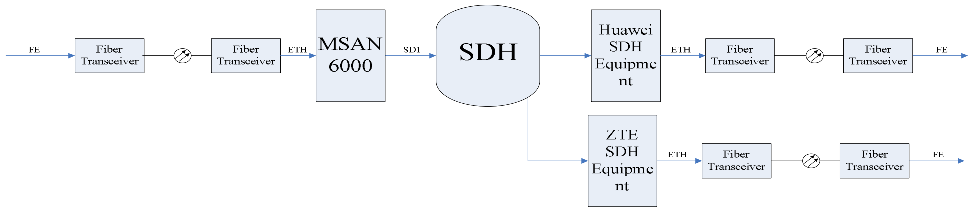

Fig.1 (c)

Fig.1 The development of Ethernet access

This paper designs Ethernet optical slip devices for IP MAN, located in the optical digital broadband network and broadband network access system. When the Ethernet signal is accessed, the device of the user side which just has link layer function is working in the MUX (multiplexer) mode, all users in the physical layer and link layer isolated from each other to ensure the security of user data. In addition, the device of the user side can change its port speed dynamically under the control of the device of local side, thus ensuring the minimum access rate of the users, limiting the maximum access speed of users, and supporting for QOS guarantees of businesses. In order to ensure the safety of equipment, we can use the independent internal management channels by the logic between the local side and the user side. The device also has powerful network management capabilities. With the same of other access network technologies, the Ethernet can handle configuration management, realize performance management, fault management and security management by its network.

Ethernet private line access overview of design basis

The design of Ethernet private line access is based on the design of the new generation of SDH-based transmission/access equipment MSAN6000 provided by LTN company. This equipment is based on the SDH transmission/access equipment for large user access, optimization design is accomplished, and offers a variety of business of access and transmission. MSAN6000 equipment as a multi-service access platform that designed by the definition of functional module in G.783 have the functions of overseeing and switch-in and protection and internet management which SDH facilities possess, and it also possess the adaptation function that MSTP facilities require.

MSAN6000 devices can provide a variety of service accesses, which can provide up to 4 STM-1 or STM-4 interfaces and down to 48 optical interfaces. The machine adopts plug-in structure, according to actual needs can be equipped with different number and different types of branch CD, which can reduce the initial investment, also facilitate future expansion, upgrade and maintenance.

MSAN6000 equipment as a multi-service access platform is mainly completed data communication network access layer business access and transmission. The XVIEW of LTN company can be used for its network management platform, provided based on server/client mode and classification of the powerful management ability. In addition, MSAN6000 equipment can build a built-in multi-channel gateway protection of DCN, realized the unified management of DCN and business channel for users to save a lot of DCN network investment.

A general scheme for hardware design of Ethernet private line access

With the rapid development of Ethernet, each user does not want their information can be received by others. So it's important to isolate users' data (the frame only transmits address) physically to ensure it only can be received by certain users themselves. This private line access could guarantee the security of user data, isolate broadcast message which carrys user personal information and DHCP(Dynamic Host Configuration Protocol) message to prevent attacks targeted to critical equipments. Figure 2 is the specific design scheme. This scheme can be applied to IP Metropolitan Area Network, fiber digital broadband network, accessing system for broadband network. For sufficient bandwidth, stable and powerful performance, it can provide carrier IP MAN with solutions. It is mainly used for digital communications between 100Baee-TX and STM-1, which can simply realize interconnection among a server, repeaters, hubs, switches, terminals and SDH.

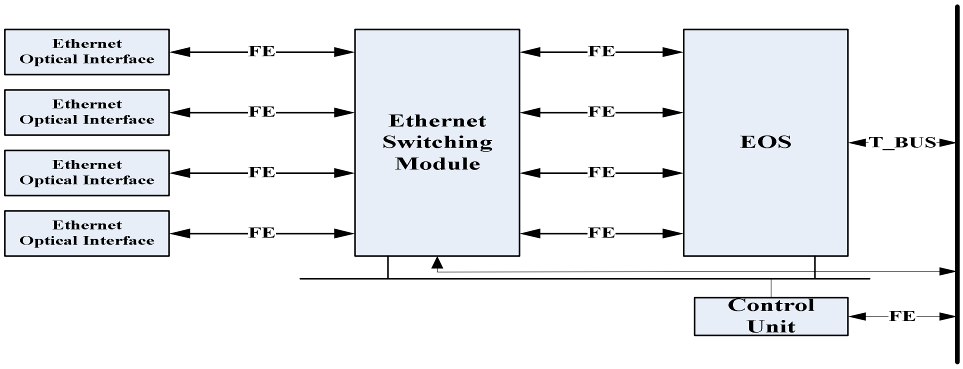

Figure 2 Ethernet private line access hardware basic structure diagram

Ethernet access device basic working principle of the main modules

The design consists of three parts:the Ethernet interface module, switch module,EOS mapping mod ule and these three modules are described as follows:

Ethernet interface module. This module completes the Ethernet physical layer (PHY layer) and m edia access control layer (MAC layer) processing.

Ethernet signal receiving direction. Through four SC optical interface , receive the signal sent by optical fiber, and processed by PHY layer, and then sent to the MAC module. After the CRC check and other treatment, the signal in the MAC module sent to switch module through the bus.

Ethernet signal sending direction. In the MAC layer, the data received from switch module was added preamble and CRC check, and then send to the PHY layer through the MII interface, after coding and scrambling in the PHY layer, send the data to the line.

Ethernet switch module. The main function of this module is maintenance for 2k MAC addresses table and forward or broadcast data packet according to the address. It can complete the division of 16 VLAN. In this design, Ethernet switch module is used the way of Ethernet transparent transmission. In most cases the Ethernet traffic is sudden each, if each user to occupy a separate virtual concatenation channel, so easily lead to the average channel bandwidth waste by the low utilization rate. Each Ethernet service occupy a device, will increase the operator's operating cost, therefore, use the second layer switch in the MSTP, different service isolated by VLAN, and then statistical use in the WAN port transmission. And so it reduces operator's cost in a very large extent.

The interchange contents of the second layer switch include: address learning, VLAN isolation, data aggregation, VLAN priority and so on.

EOS mapping module. The main function of the module is completed Ethernet data packets encapsulated into GFP. Packet in the mapping of GFP reconciliation mapped to the VCG group. Each VCG group is composed of 1 to 48 VC12. Finally, by tele-bus to the SDH transmission system.

Including all kinds of business signal multiplexing into STM - N frame process have to undergo mapping (equivalent to pack), positioning signal (equivalent to pointer adjust), multiplexing (equivalent to byte inserted between small-grained) three steps. Although a signal multiplexing into the STM - N signal SDH are various, but the route to a country or region is must make multiplexing of route only. China's light synchronous transmission network with technology system provides 2Mbit/s signal based PDH series as the effective load, and AU-4 the multiplexing of the selection analyzing route

In the low-speed tributary signals multiplexed into STM-N signal to go through three steps: mapping, positioning, multiplexing.

Mapping is a boundary in the SDH network (e.g. SDH / PDH boundary), will slip into the virtual container signals the process of adaptation. As we will often use a variety of rate (140Mbit/s, 34Mbit/s, 2Mbit/s) signals to go through code rate adjustment, were loaded into their corresponding standard containers, together with the corresponding low or high the path overhead to form each corresponding virtual container. In order to adapt to a variety of different network applications, there are asynchronous, bit synchronous, byte synchronous mapping method and the three floating TU VC and lock modes.

Positioning refers to adjust, through a pointer to the value of the low moments pointer pointing in the first VC frame net load TU in starting the high-order VC frames or net load in analyzing the starting position, make the specific charge in the separation of the corresponding VC correctly.

Relatively simple concept of multiplexing, multiplexing is a more low-level access layer to fit into the high-channel signal level or the number of high-end channels into the multiplexed signal adaptation layer over layer. Multiplexing is staggered by byte interleaving manner TU organized into higher order VC or the AU organized into STM-N process. Because after the TU and the AU pointer of the VC after the slip signal is phase synchronization, so that the reuse process is synchronous multiplexing, multiplexing, and string theory and the data transformation is similar.

Ethernet interface and access

100Mbps Ethernet protocol defines three kinds of physical layer interface, but this design uses the 100BASE-TX. 100BASE-TX is a kind of fast Ethernet technology that uses category 5 data-grade unshielded twisted-pair or shielded twisted-pair. It uses two pairs of twisted-pairs, one pair for transmit, one pair for receiving data. The 4B/5B encoding method is used in the transmission mode, the signal frequency is 125MHz. It meets the 5 classes wiring standards for EIA586 and SPT1 class wiring standards for IBM. It uses the same RJ-45 connector with 10BASE-T. Its maximum transmission distance is 100 meters. It supports full-duplex data transmission.

The Ethernet line uses the fiber access technology. The maximum advantage of the kind of access is the available bandwidth is wider than other access technologies (such as copper twisted pair, coaxial cable, class 5 lines, wireless, etc.). At the same time, the great potential can be developed, as the other technologies can't be compared to it. Optical access network has the characteristics of good transmission quality, long transmission distance, anti-interference, network reliability and saving pipeline resources. In addition, the standardization degree of SDH and APON equipment is higher, as will reduce production and maintenance costs.

Conclusion

Previously, the Ethernet signal take PDH and protocol conversion as primary transmittal mode), interoperability is difficult with this approach, it also feature not conducive to business expansion and other shortcomings. Every E1 transaction needs conversion equipment, as many converters are difficult to manage when there are too many access points, even worse, they can't be managed. In addition, there is no a uniform technical standards for many converter manufacturers, poor intercommunity, and business expansion is difficult. PDH and Ethernet protocol converter is generally a fixed design, business support is very not flexible. When opening business, if you want to conduct business expansion, usually, it need to replace the equipment and easy to cause the operators investment waste. Ethernet protocol converters function is simple, it can't meet users' various requirements. Although there is some products can solve some of these problems, but the price is high, also functions not perfect. The design is based on multi-service access platform MSAN6000, provides dedicated, easy to upgrade the access equipment for banks, enterprises and governments. It is a good cost-effective network infrastructure. In addition, this design, which can run trans-regional office automation system for enterprise and various institutions well, realizes the integration and management, improving the management and work efficiency. Enterprises and institutions can run their business on the equipment. Ethernet private line access's performance, scalability and special characteristics of bandwidth can meet all kinds of requirements, such as high real-time and safety. When it needs to increase bandwidth, enterprises and public institutions can upgrade from low bandwidth to high bandwidth smoothly without replace equipment, the operation did not require interrupt business, and is very convenient. The hope is that this paper will be referenced when design Ethernet access system design.

References

[1] Hideaki Furukawa,Naoya Wada,Hiroaki Harai et al. Demonstration of 10 Gbit Ethernet/Optical-Packet Converter for IP Over Optical Packet Switching Network [J]. Journal of Lightwave Technology, 2009, 27 (13/16) _12

[2] D'Ambrosia, J. THE NEXT GENERATION OF ETHERNET [J]. IEEE CommunicationsMagazine,2008,46(2)_8 .DOI:10.1109/MCOM.2008.4476163

[3] A. S. M. Delowar Hossain,R. Dorsinville,M. Ali et al. Supporting Private Networking Capability in EPON [A]. 2006 IEEE International Conference on Communications (ICC 2006), vol.6[C]. 2006 .6

[4]Seung-Woo Hong,Byung-Ho Yae.Constructing the Channelized Interface on the Next-Generation SONET/SDH System [A]. 8th International Conference on Advanced Communication Technology (ICACT 2006), vol.5[C]. 2006 .5