

The Research on Design of Homeplug AV Low-Frequency EoC System

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Abstract. For the existing two-way cable network access technology business single, limited bandwidth, weak anti-interference ability and other characteristics, we proposed a Homeplug AV technology which is based on low-frequency EoC. By EoC comparative analysis, we found EoC technology network adaptability, strong anti-jamming capability, which is designed EoC system hardware and software components, the system mainly through CLI, SNMP, Web and other modules to implement features that make the system easy to manage maintenance personnel Network equipment. Experimental results show that, EoC system is feasible in the application can it can meet the actual needs.

Introduction

According to national requirements, starting in 2006, two-way cable network transformation, our two-way cable television network, before the main two-way access in two ways: based CMTS + Cable Modem technology and fiber optic + LAN technology HFC network. Network-based CMTS HFC + Cable Modem technology has been developed for many years, although more sophisticated technology, but there is a big drawback of this technology in our applications, the bandwidth is limited [1]; China's power grid interference more serious, while electrical equipment EMC also strict control, will be coupled with the cable television network in a funnel effect, making anti-interference ability is not strong. Since the issue five lines, fiber optic + LAN technology, high costs, property rights, does not show the characteristics of cable television networks, while the technology cycle is longer, a larger amount of construction, the higher the difficulty of households, two-way transformation of the whole network cannot fast forward [2]. Both traditional two-way cable network access technology, focused on solving the client's problems and to provide a single business. Effective operation of two-way network service, we need a simple, easy to expand, build, manage and maintain, and can carry two-way network of integrated services [3]. EoC (Ethernet over Coax) refers to Ethernet data transmission on coaxial cable technology collectively, based on low-frequency EoC Homeplug AV system, in favor of two-way network designed to meet the requirements of the times, only the first to build such a network, in order to the increasingly fierce competition in the market and the development of triple play network technology in a leading position.

Overview of Homeplug AV Low-Frequency EoC System

Homeplug AV and HomePlug technology are based on power lines and copper Internet technology. Homeplug AV standard uses the same modulation and WLAN technology (OFDM), MAC layer protocol (CSMA) and WLAN similar technology to work in low frequency band (2-28MHz), a front end with 64 terminals, good network adaptability, mature technology, cost-effective, but because the MAC protocol (the CSMA) in a multi-terminal, the terminal rate drops quickly [4].

The current EOC technical points passive and active EoC, there are many standard, in terms of size, maturity, implementation, structure and implementation of relatively large differences between sub-passive and active EoC. Active EoC based modulation techniques, mainly HPNA, Moca, WLAN down, Homeplug BPL, Homeplug AV technology. In the embodiment of the whole network bidirectional transformation, should select the active modulation EoC technology, and now only one form of passive EoC technology, the core technology is the choice of switch or switch chips.

Active EoC, high frequency program has: wifi, MOCA, wifi reduced frequency, low frequency program has: Homeplug AV, homeplug BPL, HomePNA. EoC technology program is to choose a high-frequency or low frequency programs, should meet existing HFC network environment, first, to be able to support a large number of link loss in order to adapt to the existing home network users and network structure, a second, we cannot interfere with the positive use of radio and television signals. 87 ~ 860MHz is mainly coaxial network frequency resources used for various television signals to downlink transmission at the user terminal, the network in the endmost TV (STB) reception level, a high level signal with respect to the uplink sent EoC terminal (120dBuV), the signal power difference may be as large as 60dB, the presence of strong signal interference is possible, in order to avoid interference of the two services, one is to reduce the transmit power and reduce link loss, and second, require network port or network related equipment a high degree of isolation between the uplink signal spectrum can make EoC away from the TV signal spectrum.

Table 1 EoC technology comparative evaluation table

Item	Passive EOC	MoCA	HomePlug AV	HomePNA	WLAN
Spectrum	0-20MHz	0.9-1.5G Hz	2-30MHz	4-20 MHz	2.4GHz/900 MHz
Modulation	Baseband coding	OFDM	OFDM	FDQAM	DSS,OFDM
MAC layer protocol	CSMA	TDMA	CSMA/TDMA	CSMA	CSMA+S-TMDA
Channel bandwidth	Baseband	50	26	16	20
Dynamic Range	5	75	90	48	50
The number of supported users terminal	There are number of ports determines exchange	31	64	32	32
Access Media	Coaxial Cable	Coaxial Cable	Coaxial cable or power line	Coaxial cable or phone line	Wireless or coaxial cable

According to Table 1, after analysis and comparison shows that, based EoC technology of bandwidth sharing rate HomePlug AV can reach 200Mb / s, the actual throughput of more than 100Mb / s, it works in a low frequency band, the signal can be transmitted through the branch splitter, network it does not need to replace the cable can make full use of existing resources, and the transformation of cable network agreement to build two-way network, branch splitter does not require the use of high-quality, anti-interference ability; ability to adapt better.

Design of Homeplug AV Low-Frequency EoC System

Development based on the Homeplug AV equipment EoC system infrastructure software, is based on Council premises equipment Marvell DB-88E6218 CPU and Intellon INT6400 MAC-PHY transceivers and operating environment software is uCLinux 2.4 operating system. The software system can Homeplug AV network for the overall management and operation of real-time monitoring of the entire network system [5].

Hardware Structure of EoC System. According to the requirements of the EoC system development of the hardware structure of frames, central office equipment and terminal equipment into two parts (Fig. 1).

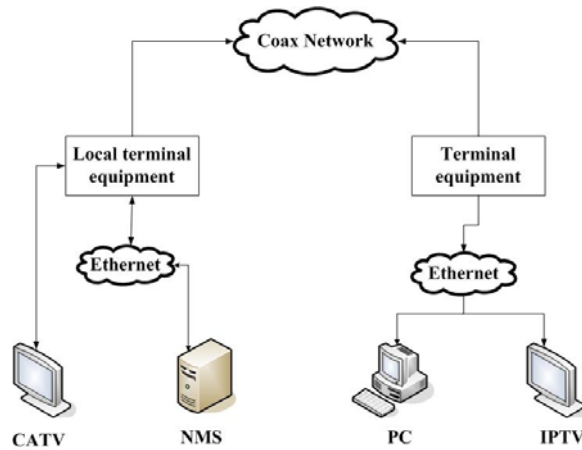


Figure 1 The frame diagram of Homeplug AV low-frequency EoC system hardware structure

Based on EoC system design requirements, in the design of EoC system hardware circuit, we spread the main chip 88E6218 CPU processing chip, INT1400, SDRAM, FLASH, RJ-45 Ethernet modules and other components outside the EoC. The power supply by the power supply hardware module supply, Linux operating system environment depends SDRAM modules, FLASH used to store different types of documents, including various programs and technical parameters; RJ-45 Ethernet module is responsible for handling network communication data; INT1400 coupling section is responsible for converting the analog signal into a digital signal input Cable, and then transferred to the EoC master chip for processing [6]

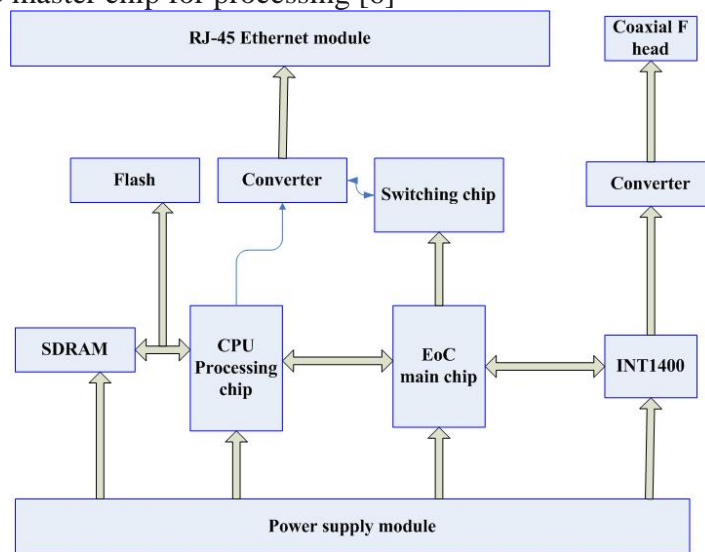


Fig.2 The block diagram of Homeplug AV low-frequency EoC system hardware

Software Structure of EoC System. Part EoC system equipment software system consists of four main parts, the interaction layer, data layer, management, communication layer. The main function of each layer as follows: (1) Interaction layer. Interactive layer is divided into two modules module CLI and SNMP agent module main function is the management of remote host Homeplug AV EoC central office equipment. (2) The data layer. The main data is cached data layer packet, storage-related instruction maps, records related logs. (3) Communication layer. Communication layer protocol is based on UNIX Domain Socket IPC technology and it is mainly responsible for the management and the interaction between the layers. (4) Management. Management is mainly connected to the management of the network and related Homeplug AV terminal; configure related environmental infrastructure, and to do the work of gathering of relevant information.

EoC software system process: (1) EoC system implementation and maintenance personnel by sending commands to the interaction layer. (2) Create a message, via the data layer and return information to the interaction layer. (3) Interaction layer to send information to the communication layer, (4) Communication layer after receiving the message to management. (5) The cache

information to the data management layer. (6) After processing the data layer, return the information to management. (7) Management of information processed by the communication layer to send. (8) After the communication layer, and the results to the interaction layer, (9) Interaction layer will display information to the EoC system implementation and maintenance personnel.

Realization of Homeplug AV Low-Frequency EoC System

The realization of the functions of Homeplug AV low-frequency EoC system is via the CLI module, Web module, SNMP agent module.

SNMP Agent Module. EoC entire system must have a network management station (NMS) and composed of multiple agents. Through SNMP messages to communicate with each other, often use UDP SNMP packets to be transmitted between the agent process and the management process.

Net-SNMP software is open source, followed by the C-based language, easy to transplant, you can write your own simple SNMP Agent program, developed under the Linux Agent, you need to modify some of its source code. From its official website to download the source code package, in view of compatibility and stability, the system uses version 5.3.3 for development.

Before running the Net-SNMP environment must first be set up, or it may not be a normal operation. Environment configuration file is usually generated by the interaction after `snmpconf` command, you can manually write. After running `snmpconf` command, there are three documents: `snmpd.conf`, `snmp.conf`, `snmptrapd.conf`. `Snmpd.conf` usually used communication parameter configuration management side and the Agent, such as simply communication, set two parameters can be a normal operation. First, the community name, the other end of which is `snmp` agent network segment, its structure is a network number / length of mask table. `Snmp.conf` configuration `mib` library use, generally only need to manage end. `Snmptrapd.conf` used to process messages in the trap, is only useful for administration side.

In the Net-SNMP package, the frame SNMP Agent has been achieved, the conventional step SNMP agent development are: the preparation of the MIB, write C code, compile the source code, with the conventional C language development different is the need to write your MIB file, then according to MIB file to write C code, because they have to provide the overall framework of the package, we only need to control the structure of a single module.

CLI Module. CLI program module is based on `libcli` open source framework, including Telnet sub-modules and user authentication module. Telnet sub-module is complete telnet remote login user password authentication, the customer enters the instruction, the program through interactive output level instruction with the management information corresponding to the command through telnet remote link to a central office equipment, to manage work-related equipment, Telnet with remote login feature, which can run on different operating systems host. Telnet servers and clients through consultation mechanisms between the two sides to determine the functional properties of the link can provide.

Web Module. In the interaction layer, the central office equipment and terminal equipment can be managed through the Web interaction Authority terminal equipment, such as: CPU, disk, memory, remote monitoring, NTP, HTTP, FTP and other network services monitoring, IP Configuring address, gateway and other network parameters. Management terminal device, such as: network traffic and transmission signal quality monitoring, remote device is turned on and off and the like. EoC system central office equipment is usually installed outdoors, outdoor equipment is unlikely to manage, you need to network to remotely manage and maintain the device through the appropriate network management system, the interaction layer, CLI and Web binding, network management can realize the system monitoring and management.

EoC system mainly through the gateway interface (CGI) to manage the system, CGI programs are written in C language to compile the program, the host application server system is the underlying performance function, the network administrator to access the data underlying performance function generated by the Web page of EoC-based monitoring and management. Through system testing found that the administrators by a simple instruction to complete system configuration, network management personnel to facilitate system administration.

Conclusion

This design of the system can be highly operational, the interface design is reasonable, function expansion is very convenient, very efficient operation, network management can be a good remote management device, as the Internet continues to expand the scope of application, EoC technology as the three networks important technology integration, is now in use parts of our country, the future will be all over the country, become a part of life, this EoC system design through testing, indicate it is feasible in the application to meet the actual needs.

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