

Research on Security of Evaluation System Based on Embedded Ethernet for Electrical Engineering

Huang Liu-suo^{1,a}, Song Yan¹

¹Information Technology Department , Henan Institute of Education, 450046 ,China

^aEmail:huangliusuo1102@163.com

Keywords: Electrical Engineering; Embedded Ethernet; Security of Evaluation System; performance of processor communication

Abstract. The traditional firewall is usually implemented protection mechanism between internal network and external network, real-time monitoring through the input and output of the network data package, once found security threats will make a response immediately, with the data processing time is short, the efficiency higher characteristic, can satisfy most application procedure, but there are also disadvantages of high cost and hardly realized etc.. In this paper, aiming at the above problems, put forward a set of AMR processor based Embedded Firewall Security innovation mechanism, presents the general framework of Embedded Firewall hardware and software architecture design, selection of the embedded chip S3C2410X with good performance, a detailed study of the key technology of the embedded firewall network card driver and application program, the communication performance of Embedded Firewall Based on the AMR processor of the comparison test, the communication rate can reach 15.5Mbps, 2.15 times higher than the general performance of processor communication.

Introduction

Centralized firewall usually architecture between internal network and external network, for the inflow and outflow of the network data packets for real time detection, filtering the existence of security threat data information. Centralized firewall data information processing speed, low consumption, short delay has been widely used in network planning and construction. However, centralized firewall architecture is realized the need to waste a lot of money costs, security threats can only inflows on external networks to detection, can not guarantee the safety of internal network, and its structure is dependent on the network topology, the existence question and the malpractice of more. The distributed firewall can solve many problems in the process of realizing centralized firewall.

The realization mechanism of distributed firewall including hardware and software two, distributed protection wall based on software is installed firewall software in the terminal operating system, to protect the purpose of an operating system, but the existence of functional paradox in the reality; distribution based hardware is a firewall can be terminal operating system and firewall are independent, then to protect the security and stability of the terminal.

Design of Embedded Firewall software architecture based on ARM processor

The NIC driver module is one of the core components of the modular operating system, and it has a close relationship with the core network operating system subsystem, network card driving module is responsible for providing the function of data communication network to the operating system kernel. The NIC driver module on the hardware device drivers is operated directly, the location in the lower layer network architecture. Linux network card driver module comprises a network protocol, network equipment, network device driver layer functional layer and the network medium layer, as shown in figure 1.

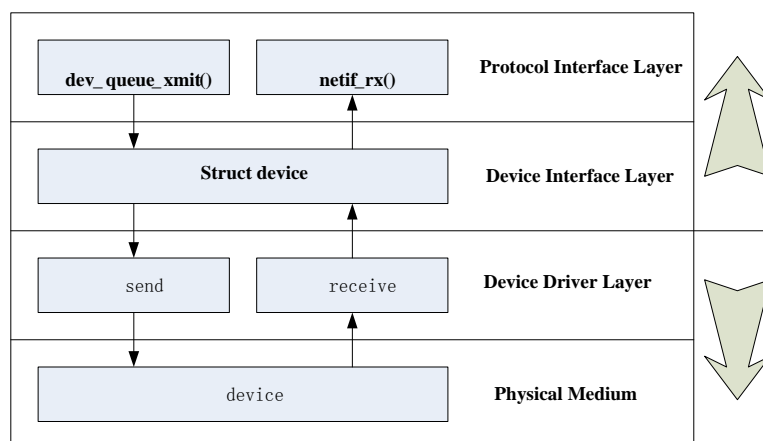


Fig. 1 the NIC Driver Architecture

The network interface is not a permanent presence in the file system, and character is different, the network interface is a process of receiving and transmitting the data in the kernel layer of operating system, a file is not in the process and application of connected together. When the operating system core loading a Linux NIC driver module, the driver may register a card equipment in the operating system kernel control initialization function. The name of the network equipment and network card driver structure module variables corresponding to each other, due to a variety of network equipment, application software may not compatible with all hardware devices, therefore, connected by a network device layer interface, independence can be achieved with the underlying network equipment. However, the network device driver function layer is closely related to the underlying device, mainly consists of three parts, respectively is the frame sending, receiving and hardware frame of loading and unloading.

The Embedded Firewall is embedded operating system customization to firewall, related to the application of Embedded Firewall System can be developed and convenient, flexible use, convenient for the future development of application of expansion. This paper takes the packet filter application as an example, the embedded firewall computer terminal is in accordance with the policy rule scheduled packets of data filtering detection, when receiving and transmitting the data packets, to each data packet to judge, determine compliance with rule conditions. Embedded firewall can be grouped and destination IP address, source end to command, command and protocol type information is extracted, and then by the application of the data packet filter filter information of detection, the detection of data packet by packet filter way similar to traditional centralized firewall. After the application of packet filter that intercepts a data packet information to traverse its filtering policy rules, search packet according to IP address, destination IP address and protocol type policy rules, when the query to its matching rules, start should information policy rules for packet data information in the release or discarding operation. The development of other related network security applications can be realized based on the platform of embedded firewall.

Communication performance test and comparative analysis of Embedded Firewall

The Embedded Firewall is a security platform, therefore, the performance of the hardware of communication of Embedded Firewall is one of the key indicators of performance evaluation. In this paper, the hardware of communication rate performance of Embedded Firewall test, software test system adopts the solution provider IXIA company research and development of the Ix Chariot test software for America test, namely the capability test of application layer software, Ix Chariot is the network address and the equipment application layer a industry standard test software, in order to carry out performance test and stress test on the network, to evaluate the performance of network. Thus obtains the network in different applications, the throughput, delay time and the response time and the number of packet loss performance parameters. Ix Chariot test software includes a control end and the remote end, can be conveniently configured on a computer terminal and server terminal, and the control end need to be configured in the Microsoft operating

system.

Embedded Firewall Performance testing indexes include the throughput and response time, but each performance index of the measured parameters need two pairs of the computer terminal common function complete, is the end of 1 (endpoint1) and the end of 2 (endpoint2).

(1) in running the Ix Chariot test software for computer terminal 1.

(2) in running the Ix Chariot test software in endpoint computer terminal program 2.

Ix Chariot test software to the communication performance of Embedded Firewall for real-time display, figure 2 is a computer terminal 1 and the computer terminal throughput parameters for peer-to-peer communication between the 2, figure 3 is a computer terminal 1 and the computer terminal response time parameters of peer-to-peer communications between 2.

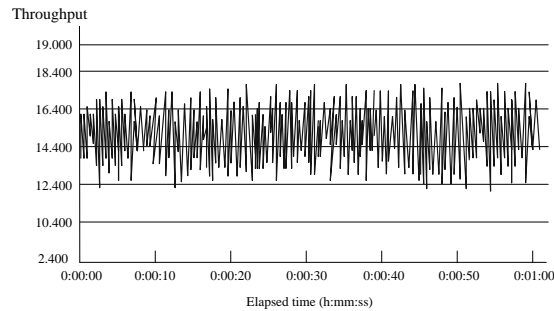


Figure 2 Embedded Firewall throughput performance test

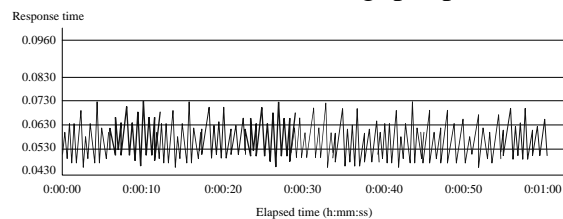


Figure 3 Embedded Firewall response time performance test

From Figure 2 and figure 3 can be seen, after the Embedded Firewall using external hardware, data communication rate of network application layer obtained by the Ix Chariot test software is about 15.5Mbps, the response time test obtained is about 50.5ms.

At present, most of the firewall related products produced in China is mainly belong to the boundary firewall, usually achieve safety protection function by using network processor, this kind of Firewall Based on network processor and Embedded Firewall Application in different boundary firewall, need to have better throughput, response time is needed to minimize, and need to be able to send to a plurality of user requests are processed. Therefore, the choice of Embedded Firewall Performance testing contrast is ARM processor based on firewall products, were tested and contrasted to the performance parameters, data information processing development board and routing board thus test comparison of selected P780 routing in S2410 development board produced by Samsung Corp and industrial production company.

S2410 development board Samsung Corp production is based on the ARM processor to achieve, can support embedded system, including Linux and so on, also has an Ethernet interface, but not the use of Ix Chariot test software performance testing, performance testing can only be carried out through the network transmission protocol and data communication rate of the network application layer is 7.2 Mbps.

P780 routing in norcro company production is based on the ARM processor, with three Ethernet interface, also equipped with two wireless network card, wireless card is placed in the Mini PCI slot, the two interfaces Ethernet is respectively connected with two computer terminals, performance testing in the use of Ix Chariot test software, data communication rate the network application layer is 7.5 Mbps.

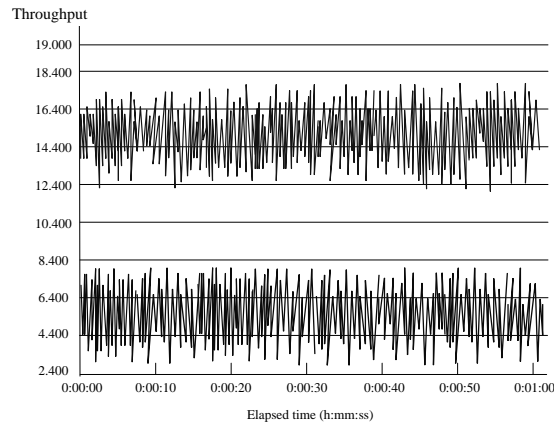


Fig. 4 Comparison of the Embedded Firewall and communication performance of norco routing board

It can be seen from Figure 4, this paper presents the communication performance of Embedded Firewall Based on AMR processor can reach about 15.5Mbps, 2.15 times higher than the general performance of processor communication.

Conclusion

The distributed firewall usually includes two kinds of realization mechanism, one is to achieve safe protective effect by configuring the firewall software, which belongs to the security protection of the client operating system, but the distributed firewall based on the software implementation of the existing security protection, who as a subject who exist as a paradox situation object security aspects of protection. In this paper is the mechanism of implementation of Embedded Firewall Based on hardware, based on Embedded Firewall Architecture are given, respectively, the design of hardware architecture and software architecture, hardware architecture including overall layout design of embedded chip selection, hardware, software structure including the key technology of network card driver, applications, and finally the communication performance of Embedded Firewall, namely throughput and response time performance of the actual test, carries on the contrast, the communication performance development board and production and common manufacturer and routing board results show that, the proposed data communication rate of Embedded Firewall network application layer based hardware can reach about 15.5Mbps, response time can reach about 50.5ms, the future can be on the the related improvement and perfection, to optimize the communication performance, to meet the higher demand of communication. In this paper, the design of hardware is based on the distributed firewall can be used as a security platform, can be extended to the relevant safety application in the foundation, including the invasion of identity authentication system, detection system, data encryption system and so on, the future is very wide application prospect.

References

- [1]Y. Geng, J. Chen, K. Pahlavan, Motion detection using RF signals for the first responder in emergency operations: A PHASER project[C], 2013 IEEE 24nd International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC), London,Britain Sep. 2013
- [2]S. Li, Y. Geng, J. He, K. Pahlavan,Analysis of Three-dimensional Maximum Likelihood Algorithm for Capsule Endoscopy Localization, 2012 5th International Conference on Biomedical Engineering and Informatics (BMEI), Chongqing, China Oct. 2012 (page 721-725)
- [3]Y. Geng, J. He, H. Deng and K. Pahlavan, Modeling the Effect of Human Body on TOA Ranging for Indoor Human Tracking with Wrist Mounted Sensor, 16th International Symposium on Wireless Personal Multimedia Communications (WPMC), Atlantic City, NJ, Jun. 2013.

[4]Y. Geng, J. He, K. Pahlavan, Modeling the Effect of Human Body on TOA Based Indoor Human Tracking[J], International Journal of Wireless Information Networks 20(4), 306-317