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MIPv6 Secure Fast Handover Research Based MPLS

Lin Zhang, Shuwei Qiu [+], Jian Huang

Anhui Institute of Architecture and Industry Information &Network Center, Hefei, China

Abstract. The MIPv6 has already became a hot spot of the research of the wireless network.This paper has first analyzed the secure problem which existed in the based MIPv6 handoff scheme.Then one kind of high security and effective MIPv6 handoff scheme was proposed.The communication scheme based-MPLS protocol combine MPLS and MIPv6 in a good way,Promote the MIPv6's handoff efficiency,enhanced the security of the MIPv6 handoff process. The simulation results show that this mechanism cut down the switching process of switching delay time,Optimized the handoff process,make the communications safely and reliably.Strenthened the MIPv6 to the secrecy of the high wireless application adaptation.

Keywords: MPLS, MIPv6, Security, Fast Handover.

1. Introduction

Currently, with the development of the IP technology and wireless Communication technology, many customers need to use the internet based on their personal willingness. And these needs keep increasing. Mobile wireless networks have become a hot research area. On November, 1996, the IETF (The Internet Engineering Task Force) Organization published the first MIPv6 (Mobile IP version 6) Draft Protocols. And the version had been improved and revised many times. On June, 2004, the MIPv6 formally became the industry standard in the field of mobile wireless networks [1]. The MIPv6 protocols are based on the IPv6 protocols, and they are the standards that designed to meet the needs of mobile computing. They not only can support the massive IP addresses of IPv6 protocols, but also can meet the needs of the mobile networks. But the MIPv6 protocols are the Routing Protocols in network layer; they only solve the problem of how to keep the mobile nodes connected in the movement, they ignore the potential safety hazard, for example, the access authentication safety and data transmission safety [2][3]. On the other hand, the MIPv6 protocols has not considered the performance optimization in mobile switching process and this limits some mobile services to apply in mobile internet, because these services has high demand for real-timing[4]. This thesis will analyze the bottled-neck factors and potential safety hazard of MIPv6 which affects the performance of mobile switching process and then design a secure access and switching system to optimize the mobile switching process based on the MPLS (Multi-Protocol Label Switch) protocols. Under the help of the NS-2 simulation study, the design in this thesis shows that it can make the communication process more secure and reliable and the switching process also can be optimized. This enhances the adjustability of MIPv6 in wireless application when the confidentiality is highly required. The safe and fast switching of mobile nodes in roaming process is one of the important research topics of MIPv6. The safe and fast switching has very important meaning for the mobile networks' integrity and availability and also has far-reaching significance in promoting its practical application.

2. The Switch Security Analysis of MIPv6

The IPv6 inherited the advantages of the IPv4 and solved the problem of insufficient address very well. And meanwhile, it made some modifications, optimization and expansion to the IP protocol. As for the

[+] Corresponding author. Tel.: +86 0551-3828131; fax: +86 0551-3828131.
E-mail address: qsw@aiai.edu.cn

aspect of mobility, the IPv6 supports the function of hot plug and play; this is a great convenience for the mobile device. It enables the mobile device to obtain the IP address and to access the network quickly. As for the aspect of security, the IPv6 is compatible to the existed IPSec (IP Security) function in IPv4. It through the AH (Authentication Header) and ESP (Encapsulation Security Payload) to ensure the information transferred safely [5]. MIPv6 proposed a series of mobile solutions to adapt to the mobility of MN, but these solutions also lead in some potential safety hazard. Between MN and CN there lacks effective security, so there are safety risks in MN [Mobile Node], CN (Care Network), HA (Home Agent) and Home Network [2]. The basic safety risk of MIPv6 is the illegal tampering of the bound cache entry and the flood attack which causes the HA's inability to provide service to the MN. And there is risk that the broadcast message be intercepted illegally.

3. The Revised MIPv6 Communication Mechanism Design Based on the MPLS

When any IP host in network sending the IP data packet to the MN, the HA will directly send the data packet to the MN if the MN is in the home network; if the MN roams to the outside of the home network (the MN can free to move), the data packet will firstly arrive at the HA and the HA will transfer the data packet to FA (Foreign Agent) based on the CoA (Care-of Address) of MN. Then the FA will transfer the data packet to the MN finally [6]. This process is easy to form a triangle routing and will cause security risks. Under the standard MIPv6 Protocols, when the MN roams to the outside of the home network and plans to communicate with random IP host in the network, the MN will need to obtain the proxy address and then through the FA to connect to the HA's host; finally the HA will be able to transfer data message with any IP host. As illustrated in Fig. 1.

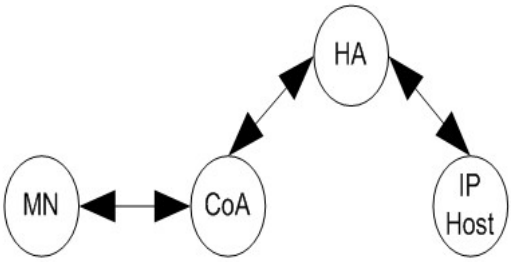

Fig. 1 the Communication Process of the Roaming MN Communicating With the IP Host

MPLS is a data transmission technology which used the label to conduct. The MPLS technology can apply to any network layer's protocols, so it can be easily combined to any open communication networks. It is available to build a connected network in the connectionless network under the help of the MPLS technology; the networks' complexity will be reduced effectively. It can ensure the networks' QoS and security as long as providing the IP service. As for the MPLS technology can apply to any network layer's protocols, the data packet is labeled before dividing into groups and the process of choosing the routing is then quickened [7]. The picture of the MPLS data packet is illustrated in Fig. 2.

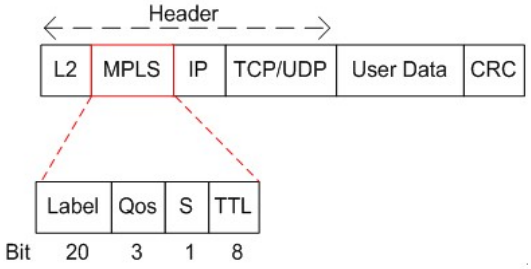

Fig. 2 the MPLS message segment form

With the advantages of the MPLS, this thesis proposes a MPLS-based communication mechanism called MIPv6. This bands together the MPLS and MIPv6 very well, and improves the switching efficiency and safety of the MIPv6. Arrange MPLS CE (customer edge) on MN and arrange MPLS PE (provider edge) at the part of the AP routing. The modified switching process of the MIPv6 as illustrated in Fig. 3.

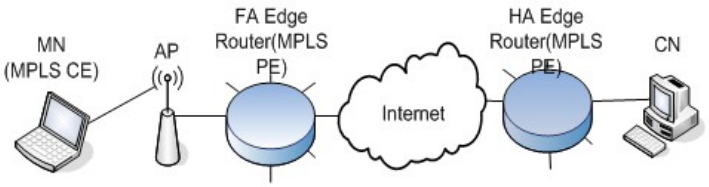

Fig. 3 the modified MIPv6 networks

When the MN roams to the outside of the home network and plans to communicate with random IP host in the network, the MN will need to obtain the proxy address and start the MPLS CE support, then the link layer will add the MPLS header and through the MPLS label to bind the CoA address to the MN.

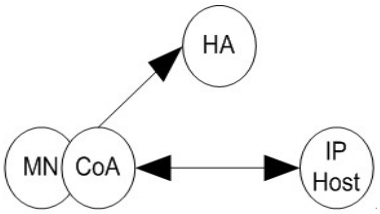

Fig. 4 the process of the modified MN communicates with random IP host when it is roaming

The secure communication process exists between the modified MN and the random host. As illustrated in Fig. 4, algorithm is as follows:

Initialization;

MN registers to enter the home network;

MN keeps the readiness or working state in the home network;

Establish the CoA address HASH; // *Used to quickly find*

While(MN accepts the broadcast message from AP)

{

If the MN moves to the outside of the home network;

{

MN gets the CoA first;

Update the CoA address to HASH;

MN starts the MPLS network module, binds to the CoA address through the link layer label;

Sending the registration information packet to the HA, achieving the NAT through searching the CoA in MPLS labels, communicating with the target IP host directly;

MN binding new CoA;

Switch is complete;

}

}

Else MN moves in the coverage area of the home network;

{

Use the exsiting COA and target IP main-machine communication directly;

}

In the modified MPLS labels, the fourth and fifth use the 00, 01 and 11 to distinct the registration information, inside information and outside information. The MPLS PE provides the extended label processing module. The modified MIPv6 could form 3 secure channels. The 3 secure channels are: the secure channel between MN and HA; the secure channel between MN and FA; the secure channel between MN and the random IP host.

4. Simulation Experiment

Under the operating system of Ubuntu9.04, we add Hierarchical MPLS patch into the simulation environment of Ns-allinone-2.31 to simulate. The topography of the simulation network as illustrated in Fig. 5, each node of the bandwidth and delay in the link graph has been marked. The media access control layer applied the 802.11 access technology. The moving node MN can rotate in MAP (mobile anchor point). The experiment will analyze the switching performance of the modified MPLS labels and the switching performance of the basic MPLS.

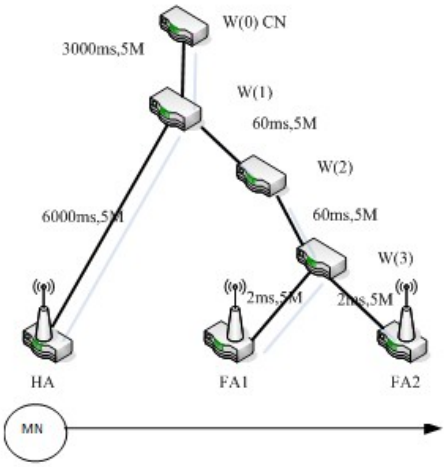

Fig. 5 Simulation network topology

As illustrated in Fig. 6, the switching delay in this thesis is around 240ms, lower about 160ms than the basic MPLS switching delay. This is due to the modified MPLS safety switching algorithm advanced the mobile node MN switching and ahead complete building the LSP of TAR and CR through the MN and HA and the secure channel between them. Thus the switching time is shortened greatly. In Fig. 7the fraction lost of the solution in this thesis is 1% lower than the basic MPLS switching. The slower the MN moves, the more obvious the fraction lost. This is because the LPS building is completed before the mobile node made the MN switching through the secure channels between MN and the random host.

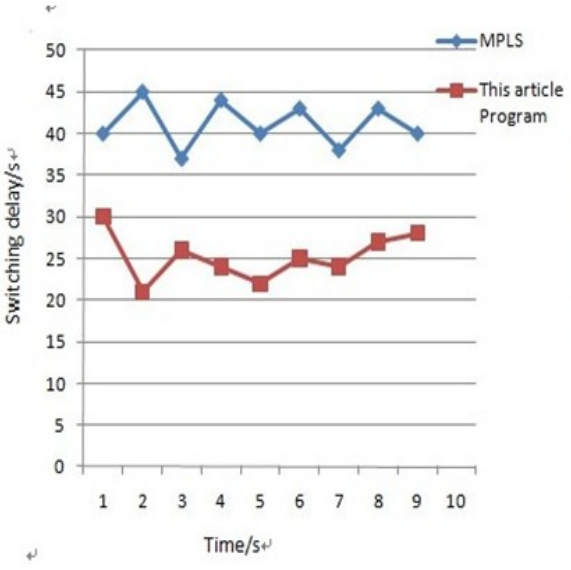

Fig. 6 Switching delay

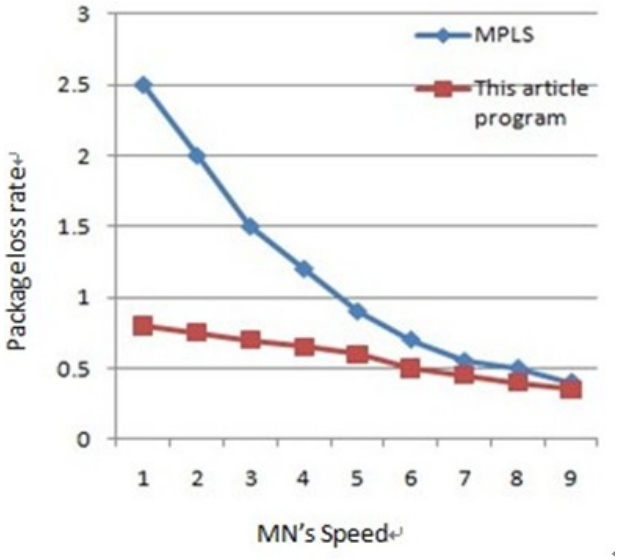

Fig. 7 Switching packet loss rate

5. Conclusion and Outlook

The wireless mobile network has the characteristics of openness, thus must consider its safety. The mobile switching efficiency is the security of the wireless mobile network to support the real-time applications, therefore, the mobile switching efficiency after the integration of the security mechanisms must

be considered. Wireless mobile network security and the resultant switching efficiency are the two important research problems that must be solved in wireless mobile networks' implementation.

The MPLS uses the short and fixed length (4 byte) labels, and applies the accurate path-finding way to replace the traditional router's longest path-finding way. This thesis proposes a MPLS-based communication mechanism called MIPv6. It bands together the MPLS and MIPv6 very well, and it improves the switching efficiency and safety of the MIPv6. Through the simulation study, this mechanism lowers the switching delay of MIPv6 in the switching process and optimized the process. It makes the communication process more secure and reliable, and this enhances the adjustability of MIPv6 in wireless application when confidentiality is highly required. This article received support for the Education Department of Anhui Province, the Key Project of Natural Science(KJ2009A61), and Anhui Province College Young Teacher research projects(KJ2011A059).

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