ISTANBUL UNIVERSITY –
JOURNAL OF ELECTRICAL & ELECTRONICS ENGINEERING

YEAR : 2006 (205 - 209)
VOLUME : 6
NUMBER : 2

MOBILITY MANAGEMENT STRATEGIES OF MOBILE IP NETWORKS

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ABSTRACT

In this paper, we give an overview of wireless Networks. Wireless networks provide voice and e-mail. In addition to these interactive multimedia and video conferencing. All of these technologies need large amounts of bandwith to achieve the demanded quality. There is a great demand for multimedia services. The next generation wireless Networks support these broadband multimedia services. In this article the classification of IP and Mobile-IP is given. We explained network layer (Layer 3) deeply. We compared the macro-mobility and micro-mobility structures. We present micro-mobility solutions which are Cellular-IP and HAWAII. And new solutions such as Hierarchical Mobile-IP protocol, Dynamic Hierarchical Mobile-IP (DHMIP) is explained briefly. Also Dynamic Hierarchical Mobile-MPLS (DHMM) is proposed.

Keywords: *Mobile-IP, Cellular-IP, HAWAII, DHMIP*

1. INTRODUCTION

In our century, there are many wireless technologies are introduced for providing different requirements of mobile users. Such as, for wide-area communications , next generation (NG) cellular networks are presented. For high data rate local area access, wireless LANs (WLANs) are proposed.[1]

Internet users are increasing in every minute.Today, there is great demand for wireless access to Internet applications . The main reason of this fact is the affect of the remarkable success of wireless communication networks. The users access the Internet applications that are based on Internet ptocol (IP) with wireless laptops, cellular phones and palm pilots which are user mobile devices.The main function of an IP adress is the identification of an end system in the network.And it is also used while finding a route between the end system.The packets arrive the end system by this adress. But if that end system is mobile then that system can not take the packets with this way. That kind of end systems need Mobile IP. The Mobile-IP extends IP. This system allows a mobile node to use two IP adresses. One of these adresses are for identification and the other one is for routing.[2]

Mobile-IP protocol support mobile computing. The scheme of Mobile –IP is produced by the IETF for standardization in IP version4 (IPv4).[3]

The paper is organized as follows. Section II presents the network layer mobility management structure. In Section III and IV macro and micro mobility technologies are briefly explained. And the widely used approaches which are Cellular-IP and HAWAII is explained deeply. In the V, VI and VII th sections we describe the

Received Date :*12.02.2004*
Accepted Date: ***24.05.2006***

Hierarchical approaches which are Hierarchical Mobile-IP Protocol , Dynamic Hierarchical Mobile-IP Protocol (DHMIP) and Dynamic Hierarchical MPLS Protocol (DHMM). Finally, our conclusion is presented in Section VIII.

2. NETWORK LAYER MOBILITY MANAGEMENT

There are many protocols are presented for Next Generation all-IP wireless systems.
These protocols are classified as ;

- Network Layer Mobility Management (Layer 3)
- Link Layer Mobility Management (Layer 2)
- Cross- Layer Mobility Management (Layer 3 + Layer 2)

Network Layer Mobility Management are about mobility related features at the IP layer. Link Layer Mobility Management are interested in mobility related features in the underlying radio systems.And the Cross- Layer Mobility Management are produced for handoff management.

Network Layer Mobility Management is classified into two categories: Macro-mobility and Micro-mobility management.[1]

3. MACRO-MOBILITY MANAGEMENT

Mobile-IP, provides terminals to move from one subnetwork to another while sending their packets , without any interruption. A mobile node (MN) can change its attachment point from one subnet to another without changing its IP adress. Here, the HA is an Internet router on the MN's home network and the FA is a router on the visited network. In figure 1, the correspondent node sends packets to the MN . At first, the packets come to the MN's HA. Then HA forwards the packets to the FA. And the FA transmits the packets to the MN.[5]

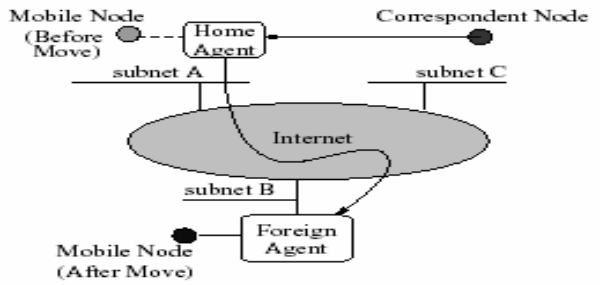

Fig. 1. *Structure of Mobile-IP*

When the mobile users move from one domain to the other one this is called as Macro-Mobility.[1]

4. MICRO-MOBILITY MANAGEMENT

When the mobile users move from one subnet to the other one in a domain this is called as Micro-Mobility.

A. Cellular-IP

CIP supports local mobility and handoff for moving hosts. In figure 2 the packet flow in CIP is shown. In the figure there are different wireless access networks.These networks are connected to the Internet over gateways (GW). When a packet is sent to a Mobile Node (MN), at first the packet reaches at the gateway. And the gateway forwards the packet to the MN by the help of the host-specific-routing path. In CIP, for location management and routing, distributed paging cache and distributed routed cache is used. Distributed paging cache finds an idle MN's place not exactly but coarsely. By the way the distributed routed cache finds an active MN's place up to its subnet.[1]

B. Hawaii

In a domain, mobility related works are done by gateways which are called as domain root router in this approach. Because Hawaii is a domain-based structure. In figure 3 the architecture of Hawaii is illustrated. The coming packets are routed by IP routing, when the MN is in its own domain.But if the MN is in a foreign domain then the coming packets are firstly taken by the HA. Then they are sent to the domain root router which forwards the packets by the host-based-routing entries to the MN.[1]

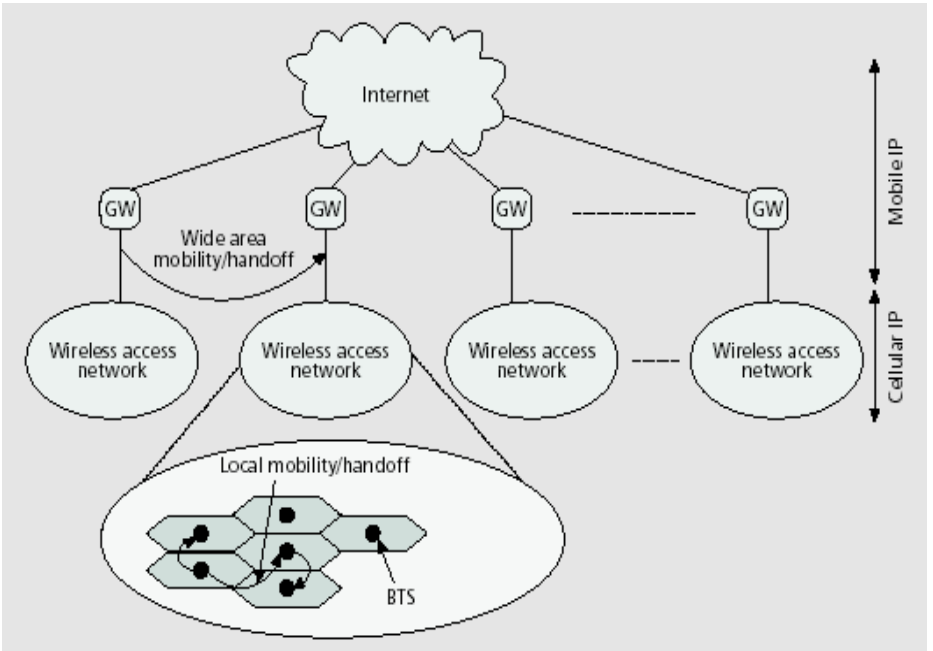

Fig. 2. *Cellular-IP Structure*

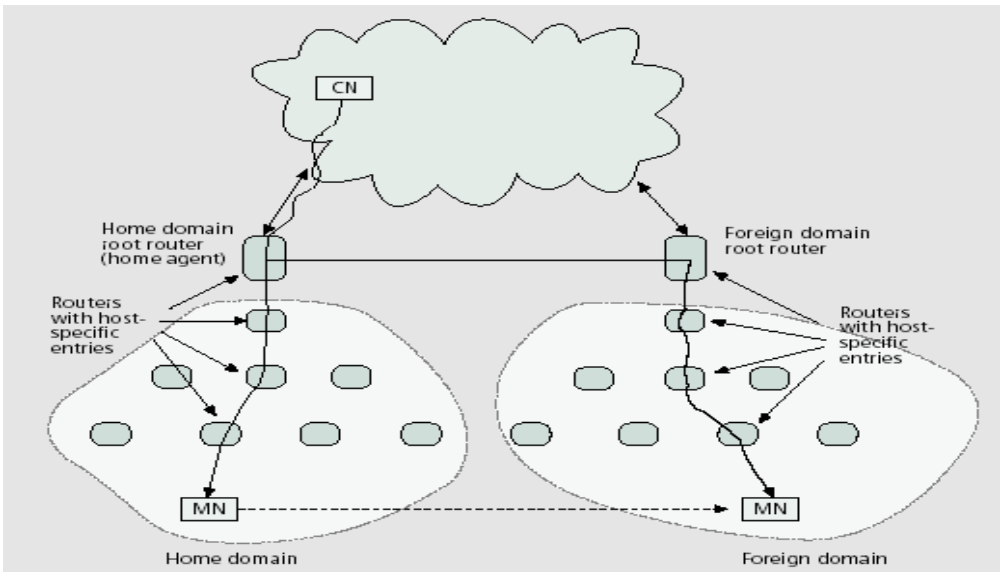

Fig. 3. *The structure of Hawaii*

5. HIERARCHICAL MOBILE-IP PROTOCOL

Hierarchical Mobile-IP Protocol forms an hierarchy between the foreign agents (FA). The first level of the hierarchy is constructed at the connection points of FA and Gateway FA (GFA). The main reason for constructing a hierarchy is localizing the registration traffic. As soon as a MN comes to a foreign domain,it makes a home registration. But if the MN moves from one FA subnet to another under the same GFA, then the MN should make a regional registration. By the help of these regional and home registrations, all of the coming packets to the MN are forwarded from HA to the MN over the MN's GFA and FA. [4]

6. DYNAMIC HIERARCHICAL MOBILE-IP PROTOCOL (DHMIP)

In this scheme, the main aim is to reduce the location update messages which goes to the HAs. To overcome this disadvantage, a hierarchy of FAs is set up. The coming packets are forwarded along the FA hierarchy to the MN. But during this process, service delivery delay occurs. For overcoming the delivery delays, a threshold is used.The threhold is computed according to the informatins of every user's traffic load and mobility.

In figure 4 the scheme is presented detailly. In fig.4 the movement of the MN from subnet_1 to subnet_6 is followed and the threshold value is decided to be three. The MN updates the new CoAs to the previous FAs, if the user is in subnet_2, subnet_3, subnet_5 or subnet_6. Because of the previous FAs are close to the new ones, the cost of the update is lower than the cost of the update to the HAs. As soon as the user reaches the subnet_4, the MN set up a new hierarchy. Because the threshold level is also reached. Then the update process is done with the HA. By the way, there are some packet arrivals at the subnet_3 and subnet_6. These packets are intercepted by the HA firstly and forwarded to the FA which the user updated last time.[2]

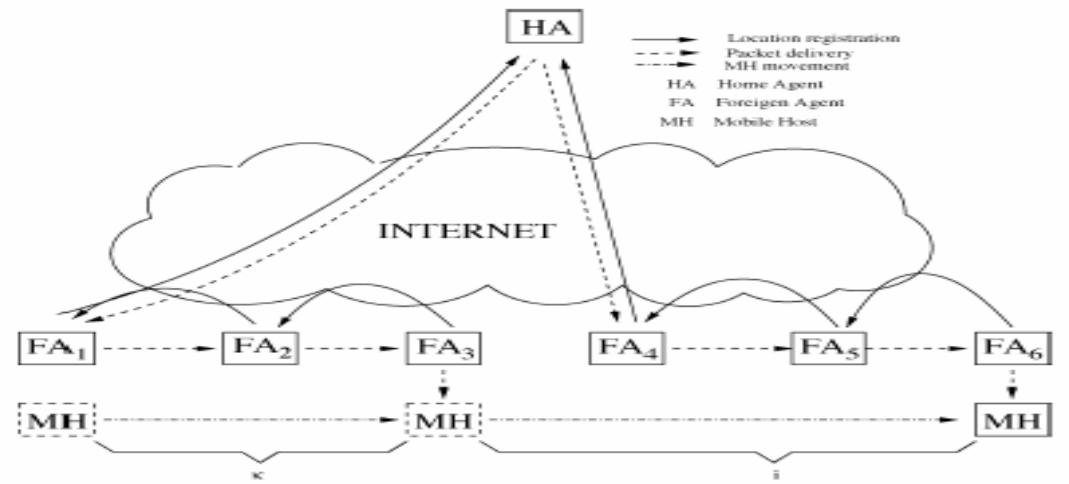

Fig. 4 *DHMIP structure*

7. DYNAMIC HIERARCHICAL MPLS (DHMM)

MPLS is combined with the Mobile IP in the DHMM protocol for managing the micro mobility. MPLS combines the label-swapping with network layer routing. Every packet includes a label in MPLS.[3]

In DHMM protocol, a MN listens the Agent advertisement messages to notice that if it is in the home domain or a foreign domain. If the MN notices that it is in a foreign domain then it takes an CoA from the FA.During the roaming of MN the first visited FA is an Anchored FA.MN registers that CoA to its HA with its registration request message (R-Req). Then HA sends a Registration Reply (R-Rep) message to AFA. During this process, labelling is also done along the path.So,during the travel of the R-Rep message from HA to AFA, a label switched path is established. And after that time,all of the packets which destined to the MN, will follow this path. [4]

8. CONCLUSION

In this article, we give a brief summary of mobility management techniques. We focus on the micro-mobility techniques. CellularIP, HAWAII, Hierarchical Mobile-IP is explained briefly. And the new technologies such as Dynamic Hierarchical Mobile-IP (DHMIP) and Dynamic Hierarchical MPLS (DHMM) is also given. DHMIP is more adventageous than static

hierarchical Mobile-IP but it has some disadventageous too.

The path From AFA to FA which is established along the hierarchy of FAs might not be the shortest path.And DHMIP may support IP mobility but not support traffic engineering. By the affect of these reasons the DHMM protocol is produced. The advantages of the DHMM are: the LSPs are established from AFAs to FAs dynamically and for this reason the traffic load is balanced. In DHMM, for every forwarding step shortest path and MPLS routing is provided.[4]

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