

Improvement of network efficiency by modified architecture for mobile IP

Dange Laxmikant Madhavrao¹, Shetiye Praveen Chhatanrao²

^{1,2}(Government College of Engineering, Karad, India)

Abstract: The proposed article address the issue of routing data to and from mobile network using a global IPv6 network. The authors have suggested network architecture for routing data for mobile nodes, connectivity and authentication for mobile nodes. The methodology proposed is self-advertising, self-routing IPv6 based mobile IP. The proposed routing protocol manages connections while moving mobile node from one network to another.

Keywords –Addressing, global connectivity, Mobile-IPv6, Internet protocol version 6 (IPv6), routing.

I. Introduction

The majority of internet users are the cell phone users, Wi-Fi users in the form of laptops and palmtops. Mobile wireless networks have been evolved to be integrated with IP-based infrastructure for multimedia applications where mobility support has become a key issue. The major issue in implanting these smart mobile devices is the routing in mobile network.

The evaluation of wireless access technologies can be summarized with Table-1 shown below. We can use the architecture with any of these technologies.

Table 1: DIVERSITY IN EXISTING AND EMERGING WIRELESS TECHNOLOGIES DEMANDS FLEXIBLE AND ADAPTIVE ROAMING DEVICES [1]

Network	Coverage	Data Rates	Cost
Satellite (B-GAN)	World	Max. 144 kb/s	High
GSM/GPRS	Approx. 35 km	9.6 kb/s up to 144 kb/s	High
IEEE 802.16a	Approx. 30 km	Max. 70 Mb/s	Medium
IEEE 802.20	Approx. 20 km	1-9 Mb/s	High
UMTS	20 km	up to 2 Mb/s	High
IEEE 802.11g	100 - 300 m	54 Mb/s	Low
HIPERLAN 2	70 up to 300 m	25 Mb/s	Low
IEEE 802.11a	50 up to 300 m	54 Mb/s	Low
IEEE 802.11b	50 up to 300 m	11 Mb/s	Low
Bluetooth	10 m	Max. 700 kb/s	Low

The article aims to provide an overview of routing for mobile IP clients. It also aims at the solutions to the problems while moving mobile nodes in different areas. IP mobility support is for second generation and onwards wireless technologies. The IPv6 provides sufficient addresses for mobile users. This article introduces advanced routing technique which overcomes mobility problem without addition of new hardware; this causes the reduction in cost for implantation of this network architecture.

II. Mobile IP

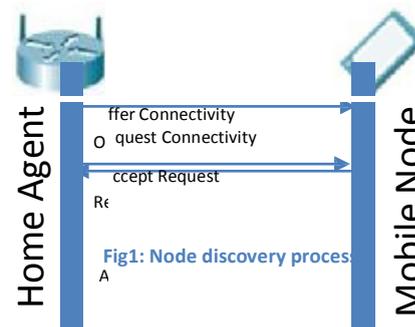
Mobile IP was designed to provide a way to support for mobile hosts. The mobile IP has following functional areas.

- Mobile node (MN) [2]: A host or router that can travel around Internet while maintaining any outgoing communication sessions.
- Home Agent (HA) [2]: A router that maintains a list of registered MNs. It is used to forward MN-addressed packets to the appropriate visiting network when MNs are away from home.
- Care-of address (CoA): It is the address of Home agent which MN uses for connecting to outer network.

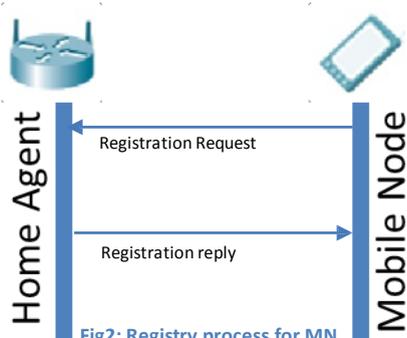
The mobile IP uses two addresses: (Permanent) Fixed Home address and CoA the mobility for MN.

The operation of mobile IP is based on the cooperation of three major concepts: node discovery, registration and routing.

1) **Node Discovery:** A process by which MN attaches to HA via wireless network. This process is done by three way secured handshaking protocols. Then after, the MN sends its own activity report to HA after specified intervals, if HA didn't get MN's activity report for specific times, then it mark it as disconnected. When MN connects to HA, MN registers itself at HA, the HA maintains record of connected MN's. The HA work as network address translation server for all MN's under it. HA uses one to many network address translation technique for outgoing nodes. Figure 1 shows how node is connected to HA. Here for user and network security and management, we can use SIM-based authentication which is more secure and easy to manage nodes.^[3]



2) **Registration:** A process when MN enters in the network area of any HA. This process involves registering hardware address of MN at HA. This process also involves requesting service for the MN from HA.

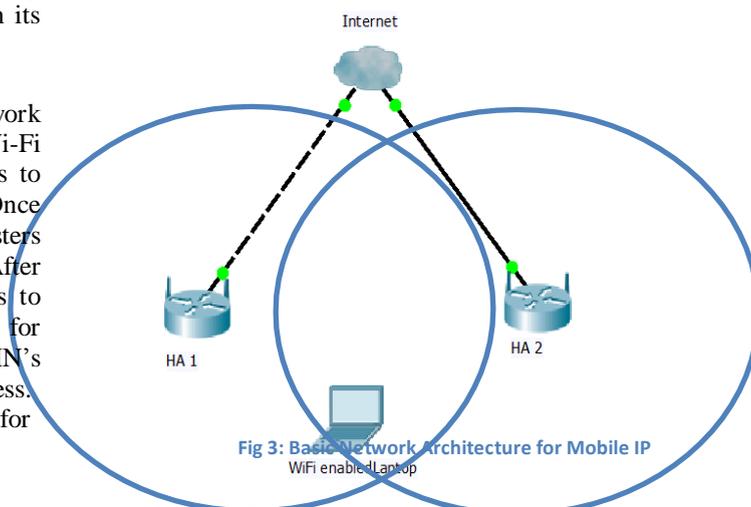


The registration process consist exchange of two types of messages: Registration request and registration reply between MN and HA. Figure 2 shows the registration process for MN.

3) **Routing:** The routing in mobile nodes is a complex job. The initial routing for the mobile node is same as normal routing; this routing uses same algorithms which are used for routing in WAN or LAN networks. But the problem occurs when the MN moves to another network from a network. At that time it is the challenging work to provide discontinued service to the mobile node. This is done by advanced routing technique specially designed for mobile nodes. In this technique, when the MN moves to another network, the new HA sends the connectivity report of MN to its older HA so that the older HA will route all traffic related to MN towards new HA, it also update the MN's new CoA to another end of the network i.e. the remote machine. While routing the data from old HA to new HA, the hop count is renewed so that the packet will not expire due to large hop count. A new field added to prevent loop between HA, the HA count, this field defines routing between HA's, when any HA routes the data packet, it increases this count, so that we can avoid loop between HA's. Mainly there are three functions of HA: maintaining MN's record, performing Network Address Translation on outgoing and incoming packets, routing for those MN's who are recently migrated to another HA's area. Every MN's wan address is its CoA. And Every MN is identified by its hardware address in its home network.

III. Basic Network Architecture

The figure-3^[4] shows Basic Network Architecture for Mobile IP users. Here the Wi-Fi enabled Laptop is Mobile Node it connects to HA1 or HA2 according to their priority. Once MN establishes connection with HA, it registers own hardware address at HA. After authenticating MN, HA gives IPv6 address to MN. This address is responsible for connectivity between HA and MN. The MN's IP address is based on its hardware address. Here we used IPv6's seamless IP facility for generating IPv6 address for mobile node.



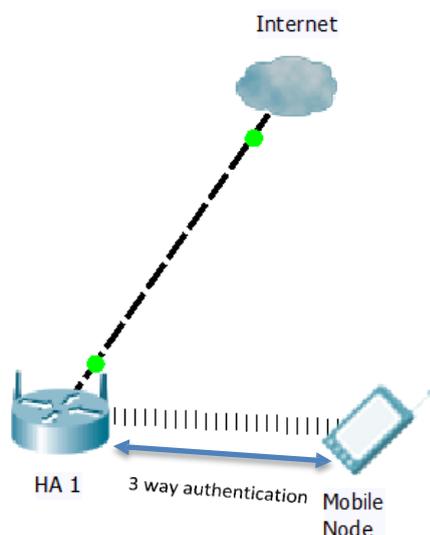


Fig 4: Authentication

IV. Establishing connection

When MN enters into any HA's coverage area, then discovers the HA for that area, then after HA offers the connectivity for that MN. This offer includes the CoA, authentication keys for connectivity. After that MN request for connectivity, this includes hardware address of MN, authentication credentials for that MN, and MN's public key. After receiving details from MN, HA registers MN at its database and accepts connection for that MN.

Now that MN can request for connectivity to WAN. HA is responsible to connectivity of WAN for every MN under that HA.

Figure-1 and Figure-4 shows the node discovery process using three way authentication. After this process, registration process is done. The figure-2 shows the registration of mobile node with HA.

V. Transferring Data

Accessing WAN via mobile node is very similar to access WAN via wired connection. Mobile node access

the outer network via home agent. Home agent creates a secure connection with MN so that packet monitoring will not work for it and the user data gets secure. By implanting advanced routing technique, MN can move from one network to another network easily. Each time when MN moves to another network, the MN needs to register itself to new network. The MN also contains CoA, i.e. IP address of HA; the new HA will send a notification to old HA of MN as MN is connected to it; and if any active connections are present, old HA routes the data to new HA for first time and forwards that notification to remote machines.

VI. Routing Protocol

Every HA has its own database containing list of its connected MN. Each HA shares its connected nodes database with a central node database. This database is responsible for establishing connection from any remote node or machine. The figure5 shows central database connectivity, it is present anywhere in the internet.

The Central Database contains list of all HA and MN, which represents which HA has which node. When any HA accepts

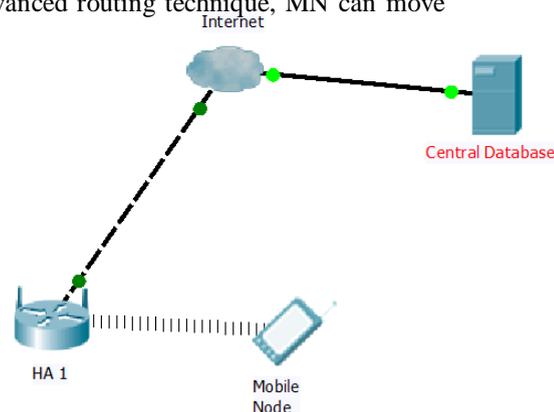


Fig 5: Central Database of MN

registration request for new node, at that time, it make an entry in central database. The remaining routing techniques are same as we use for wired communication. The position of central database is shown in figure 5.

VII. Advanced routing for Mobile Environment

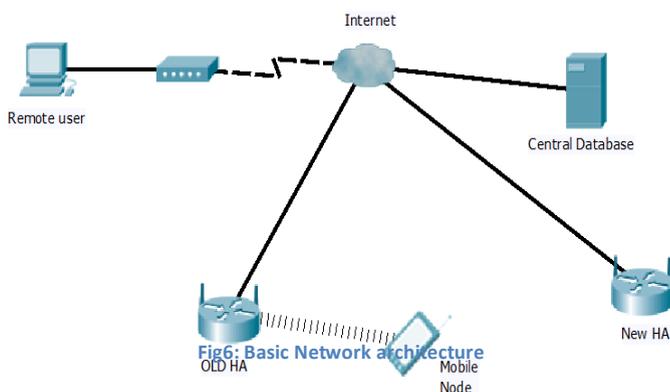


Fig6: Basic Network architecture

This type of routing is very similar to handoff support [5] in previous mobile IP technique. Here we proposed new routing technique, which routes the data in the special condition. The main problem occurred in routing data in mobile network is that, When any mobile node moves from one HA to another HA, how to maintain active sessions alive? Obviously it's a very difficult task to move

mobile node from one HA to another HA without disconnecting active sessions.

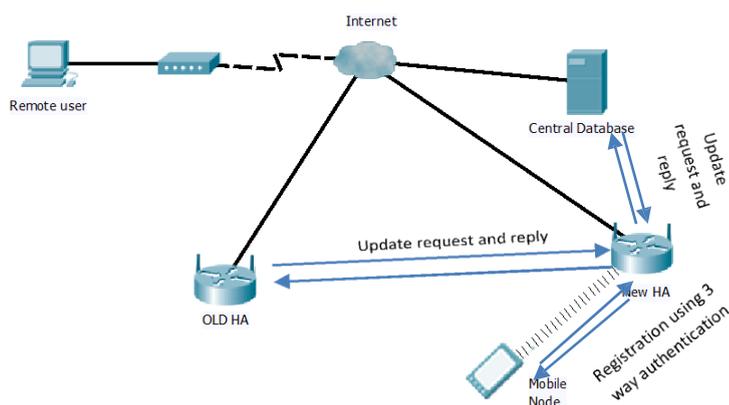


Fig 7: Registration process and update process

This is done by using advance routing techniques. As every HA maintains it's connected MN's database, this database has another field as its destination, whether it is connected locally or remotely. When any node moves from one network to another, the new HA sends a notification containing MN's hardware address. It also sends update request to central database server to update location of corresponding MN.

MN selects HA by using Nearest HA Algorithm [6]. This uses

some factors to determine priority for available HAs at that location. The discussion on this algorithm is beyond this journal.

Following steps are carried out when any mobile node moves from one HA area to another HA area.

- a) Node Discovery and Registration process for new HA. This process is similar as done for previous HA. This process only authenticates and registers MN to HA access outer network connectivity and other services. Figure 1, figure 2 and figure 4 shows connection and authentication process. For more security purpose, we can use SIM-based authentication method. [3]
- b) When any HA accepts registration process, it checks whether it is previously registered to any HA by querying in central database server. If any active connections are available, the active connection status is marked in MN. The MN notifies about active connection and previous HA's IP address to new HA in registration process. After getting active connection status from MN, new HA sends update status to old HA of MN to route

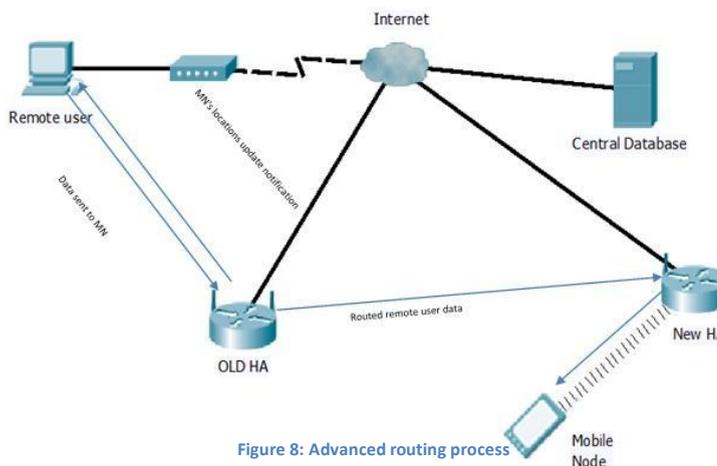


Figure 8: Advanced routing process

incoming traffic of MN to new HA. When old HA gets this update notification, old HA updates MN's location in routing table and sends update notification to MN's connected remote node.

c) New HA sends update request to central database, this update request packet contains MN's details including MN's hardware address and CoA for MN. When any remote user wants to make connection with any MN, then that remote user can get MN's exact location by this central database. Fig6 Shows network architecture before

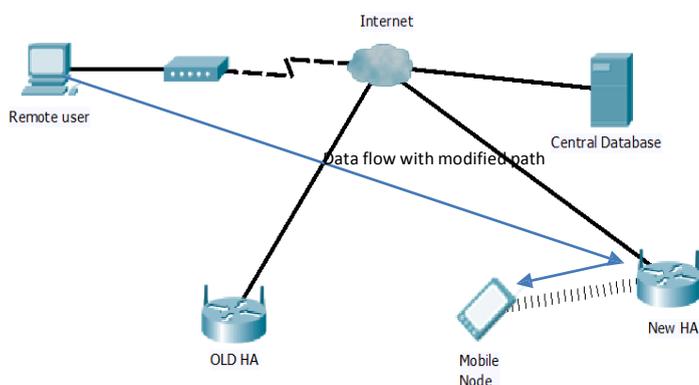


Fig 9: Data routing after updating new location of MN at remote user

moving MN. Central database is just like resolver database which replies with the CoA for corresponding node.

The basic architecture of mobile IP network is shown in Figure-6. It shows the initial position of MN in the network.

Figure-7 shows the update process of MN's location. The update process includes two phases: update in central database and update in old HA database.

Figure-8^[7] shows how the advanced routing takes place initially when any node moves to another HA; this advance routing keeps all sessions alive. Data routes from old node till the remote user update MN's location.

When the remote user gets updated location of MN, it updates it and sends upcoming packets with that new CoA. There after all data is routed with new route and it directly send to new HA. This type of routing requires less hardware effort and it is less network consuming.

VIII. Conclusion

In this article network architecture is developed to support new paradigm of IP mobility. A new routing technique is introduced to support data flow in mobile IP environment. This method reduces cost of network and provides seamless configuration with IPv6. The proposed network architecture is more efficient, cost effective, and hardware requirement is less. This architecture is universal, so it can be implemented with any type of wireless network.

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