Chapter XXXIX
Mobility in IP Networks

Sanjay Jasola
Wawasan Open University, Malaysia

Ramesh C. Sharma
Indira Gandhi National Open University, India

ABSTRACT

With the ever increasing use of portable and hand held devices for voice and data transfer, there is a growing expectation to access information anytime, anywhere. Today there are different technologies providing access to voice, data, and video. These need to be converged in all Internet protocol (IP) based network. Next generation telecom networks will be having convergence of voice and data traffic and use of IP based mobility solutions. Mobile IP is a TCP/IP-based protocol that has been standardized by the IETF (Internet Engineering Task Force) for supporting mobility. Mobile IP is part of both IPv4 and IPv6 standards. Mobile IP works at network layer (layer 3), influencing the routing of packets and can easily handle mobility among different media. This chapter discusses different technical operations involved in Mobile IPv4 and Mobile IPv6 and compares them.

INTRODUCTION

Wireless mobile devices are encountered almost everywhere i.e. at home, at work, on the road. These are being used to access the Internet and to provide data services in general. This leads to a growing expectation of the users to be able to access information anytime anywhere. Open, flexible architectures that can be adapted quickly to changes in communications standards or customer demands are being developed by the standards organization like IEEE and IETF. Separate networks that transmit voice, data, and video are converging into pipelines that are capable of delivering all three. The term "mobile" refers to connectivity and automatically maintenance of one or more Internet applications of the user despite the change of user's point of attachment. TCP/IP protocol (Transmission Control Protocol/Internet Protocol) is playing an increasingly important role in the mobility. Generic scenario of IP mobility is that when an IP node moves to a new network, it has to change its IP address to reflect the new point of attachment. Every time a mobile node moves to a new network, a solution to infrequent roaming is to change the IP address as seen by the transport and the application layers. This solution can not be used for mobility in general. This is because the IP address is known to the next higher layer in the protocol architecture. When a TCP connection is set up, TCP entity on each side of the connection knows the IP address of correspondent node. When a TCP segment is handed down to IP layer for delivery, TCP provides IP address. IP layer creates an IP datagram with that IP address in IP header and sends the datagram to the data link layer. If this IP address is changed, then the correlation is lost and the sessions need to be restarted. Mobile IP depends on giving the mobile node two IP addresses and managing the correlation between a changing IP address called care-of address and static home address. Transport and application layers keep using the home address, allowing them to remain ignorant of any mobility taking place.

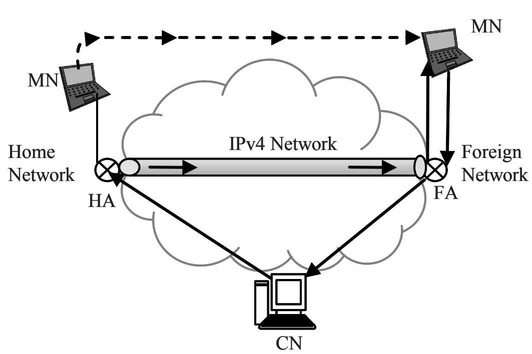
The rest of the paper is organized as follows. In section 2, the different operations involved in Mobile IPv4 have been explained. In section 3, features of Mobile IPv6 for supporting mobility in IPv6 based networks are discussed. The features of Mobile IPv4 and Mobile IPv6 are compared in section 4. The future directions are discussed in section 5. Finally section 6 summarizes the conclusions.

MOBILE IPV4

Mobile IP (Perkins, 1997) was originally defined for IPv4 through IETF request for comment (RFC) 2002 and finally through RFC 3344 (Perkins, 2002). The mobility support for IPv4 is an add-on, and the vast majority of IPv4 nodes do not support Mobile IP. Mobile IP for IPv4 is comprised of following four components, mobile node (MN), home agent (HA), foreign agent (FA) and correspondent node (CN) as shown in figure 1.

A MN is a node, for example, a PDA, a laptop computer, or a data-ready cellular phone. A mobile node is assigned to a particular network, known as its *home network*. A HA is a router on the home network of the MN that maintains an association between the home IP address of the MN and its *care-of address* (CoA), which is the current location of the MN on a foreign or visited network. A CN is a node which is communicating with the mobile node. A FA is a router on foreign network that assists the MN in informing its current CoA to HA. IP address of MN on its home network is known as home address and it is static. The address of home agent is known as HA address. While a mobile node is attached to some foreign link away from home, it is also addressable at one or more care-of addresses. The mobile node can acquire its care-of address through conventional IPv4 mechanism. Mobile IP includes four basic capabilities to support mobility operations which are agent discovery, registration, tunneling and de-registration.

Figure 1. General scenario of data transfer in Mobile IPv4



Agent Discovery

During agent discovery phase, HAs and FAs advertise their presence on their network by periodically multicasting or broadcasting messages called *agent advertisements*. MN uses discovery procedure to identify prospective home agents and foreign agents. Any home agent can also offer its services as a foreign agent for the mobile nodes that are visiting its area. The discovery process in Mobile IP is similar to router advertisement process defined in ICMP (Internet Control Message Protocol) (Perkins, 1998). Accordingly, agent discovery makes use of extended ICMP router discovery protocol (EIRDP). The extended router advertisement and router solicitation messages are known as agent advertisement and agent solicitation messages (Stallings, 2001). The *agent advertisement extension* follows the ICMP router advertisement fields and consists of the fields which indicate the CoA supported by this agent on the network, type of tunneling supported and lifetime, in seconds, to accept a registration request from a MN.

Mobile node listens to advertisements of the FA and HA and determines if it is connected to its home link or a foreign link. MN compares the network portion of the received IP address with the network portion of its own home address. If these network portions do not match, then the MN is on a foreign network. Because handoff from one network to another occurs at the physical layer, a transition from the home network to a foreign network can occur at any time without notification to the network layer. Thus, agent discovery for a MN is an ongoing process that lists one or more

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