2.1 Introduction

Current versions of the Internet Protocol (IP) assume that the point at which a computer attaches to the Internet or a network is fixed and its IP address identifies the network to which it is attached. Datagrams are sent to a computer based on the location information contained in the IP address.

Mobile IP is an Internet Engineering Task Force (IETF) standard communications protocol that is designed to allow mobile device users to move from one network to another while maintaining their permanent IP address.

Mobile IP is an enhancement of the Internet Protocol (IP) that adds mechanisms for forwarding Internet traffic to mobile devices (known as mobile nodes) when they are connecting through other than their home network.

If a mobile computer, or mobile node, moves to a new network while keeping its IP address unchanged, its address does not reflect the new point of attachment. Consequently, existing routing protocols cannot route datagrams to the mobile node correctly.

Permanent IP address is one solution. Here emergency communication and quick reachability is possible via the permanent IP address.

Second solution is dynamically adapting the IP address with respect to current location. But the Domain Name System (DNS) has to update the new IP address to the logical name. For millions of nodes frequent updates is not possible.

Another solution is updating the routing table of the router. If the IP address of the receiver is changed, the router will route the data through the new port to which the receiver is now connected. But fast and frequent updating of the router is not possible.

A TCP connection is established using IP addresses of the source and receiver. The change in IP address breaks the existing TCP connection. Next one new TCP connection has to be established.

Using the previous illustration's Mobile IP topology, the following scenario shows howa datagram moves from one point to another within the Mobile IP framework.

1. The Internet host sends a datagram to the mobile node using the mobile node's home address (normal IP routing process).
2. If the mobile node is on its home network, the datagram is delivered through the normal IP process to the mobile node. Otherwise, the home agent picks up the datagram.

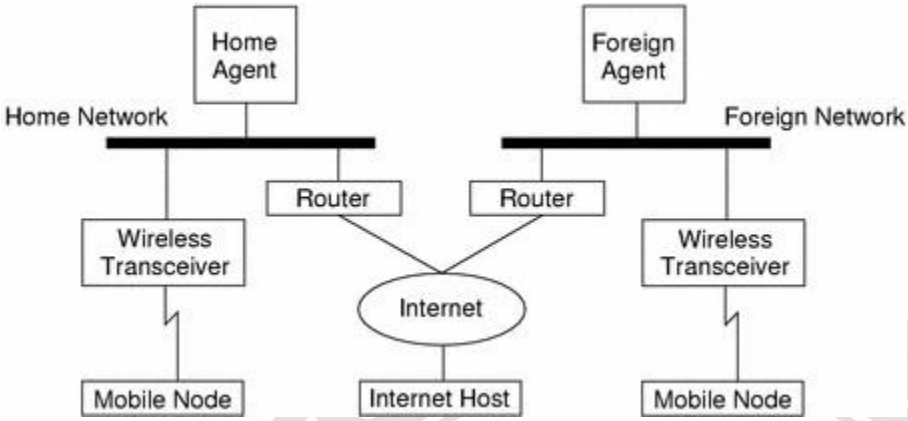

Fig.2.1 Mobile IP Topology

[Source: Text book- Mobile Communications, Second Edition, Pearson Education by Jochen Schiller]

3. If the mobile node is on a foreign network, the home agent forwards the datagram to the foreign agent.
4. The foreign agent delivers the datagram to the mobile node.
5. Datagrams from the mobile node to the Internet host are sent using normal IP routing procedures. If the mobile node is on a foreign network, the packets are delivered to the foreign agent. The foreign agent forwards the datagram to the Internet host.

2.2 Requirements

The quick solutions are not working properly. The mobile IP is designed as a standard to enable the mobility in the internet.
Requirements of designing mobile IP:

1. Compatibility:

   Mobile IP has to be integrated with the existing operating system, must usethe same routers, and network protocols. The mobile IP using device should be able to communicate the devices with normal IP.

2. Transparency:

   The problems with mobility are higher delay and lower bandwidth. The higher layer protocols should be mobility aware.

3. Scalability and efficiency:

   In wireless networks the important consideration is lower bandwidth. For mobility the flooding of the new messages should be restricted. Large numbers of devices are mobile devices. Hence the mobile IP should be scalable over a large number of devices.

4. Security:

Mobile IP managing messages should be authenticated. The IP layer is responsible for identifying the correct IP address and preventing the fake of IP addresses.

2.3 Entities and terminology of mobile IP:

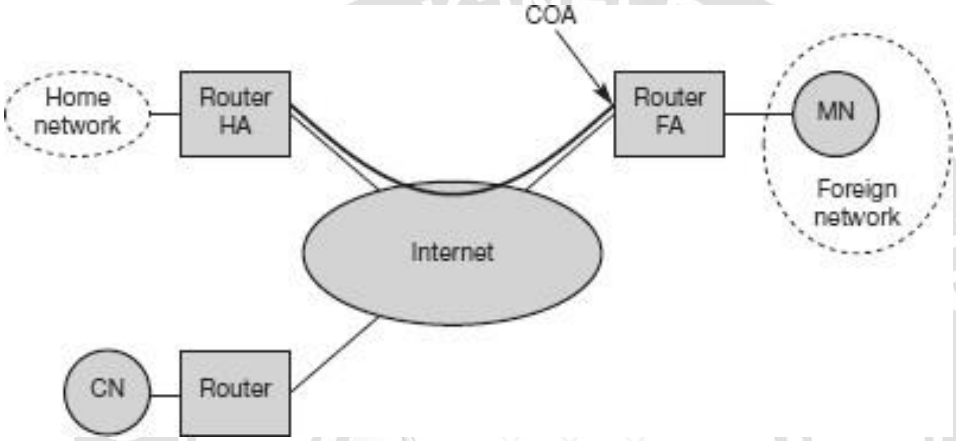

Fig.2.2 Mobile IP example network

[Source: Text book- Mobile Communications, Second Edition, Pearson Education by Jochen Schiller]

1. Mobile Node: It is an end system that can be laptops with antennas, mobile phones or routers.

2. Correspondent node (CN): The CN is either fixed or mobile node acting aspartner for communication.

3. Home Network: It is the network to which the mobile node is configured. Within this the mobile IP is not needed.

4. Foreign Network: It is the network at which the MN is currently present.

5. Foreign Agent(FA): It is a default router of the foreign network to the MN.

6. Care-of – address (COA): It defines the current location of the MN. The data isactually addressed to CAO not to the IP address of the MN.

i). foreign agent COA: It is the address of the FA which forwards the data to the MN. In this case, the care-of address is an IP address of the foreign agent. The foreign agent is the endpoint of the tunnel and, on receiving tunneled datagrams, de-encapsulates them and delivers the inner datagram to the mobile node. In this mode, many mobile nodes can share the same care-of address. This sharing reduces demands

on the IPv4 address space and can also save bandwidth, because the forwarded packets, from the foreign agent to the mobile node, are not encapsulated. Saving bandwidth is important on wireless links.

ii). Co-located COA: It is the temporarily acquired additional IP address in the MN itself. A mobile node acquires a co-located care-of address as a local IP addressthrough some external means, which the mobile node then associates with one of its own network interfaces. The address might be dynamically acquired as a temporary address by the mobile node, such as through DHCP. The address might also be owned by the mobile node as a long-term address for its use only while visiting some foreign network. When using a co-located care-of address, the mobile node serves as the endpoint of the tunnel and performs de-encapsulation of the datagrams tunneled to it.

7. Home Agent (HA): It is located in the home network. It maintains a location registry for MN. The tunnel of data transmission starts at here. The HA can be implemented ona router. This is best, because all the packets are passing through the router. The HA canalso be implemented on an arbitrary node in the subnet.