

Towards A MOBILE INTERNET

By: AVESH AGARWAL AND NIRESH AGARWAL

—Avesh Agarwal works with Lucent Technologies.
Niresh Agarwal, Member IEEE, USA.

Mobile IP, a new, standardised version of the Internet Protocol (IP), promises to connect your mobile computing device with the Internet, even while you are travelling in a car, a train or in an aeroplane. So get ready to browse on the move!



Ten years ago, if you were on a train you would probably be isolated from the rest of the world. Today, you've got used to the idea of being connected even while being on the move, through your mobile and the Net.

But there is a small glitch here even today. While you can take a mobile phone along with you, you cannot yet browse the Net through your laptop sitting inside a car, a train or in a flight. This is because Internet technology today is still in a stage similar to our landline phones, and at best allows mobility only within a limited area.

Figure 1 shows an example of a typical Internet network as it exists today, where hosts are fixed and which is analogous to the landline telephone network. Company A and B have their networks connected through the Internet network. AL and AK are sub-networks within company A's network and represent local area networks present on one of its site locations. BC and BD are sub-networks within company B's network. Hosts connected to sub-networks AL, AK, BC and BD are all fixed to their location. Wireless LAN technology available today allows hosts to move within their sub-network. When a host is able to move within its sub-net, it

uses technology analogous to a cordless phone.

The Internet protocol (IP), which is used for communication between two computers connected to the Internet, does not support host or router mobility. It has been designed such that a node's point of attachment to the network remains unchanged at all times, and an IP address identifies a particular network. To support a mobile host with current versions of IP, the following two solutions are possible:

- Reconfiguration of the IP address every time the mobile host moves. This is an unacceptable solution because

it's time consuming and is error-prone.

- The IP address can be fixed with added host-specific routes throughout the Internet network. This solution is also problematic because it overloads routers with huge routing tables.

To address these problems, a new version of Internet Protocol (IP) has been standardised. This version of IP is called Mobile IP. Mobile IP can also help resolve address shortage problems and reduce administrative workload, because each device that needs to attach to the network at multiple locations only requires a single IP address. Figure 2 shows the network topology for mobile IP. 'A' is the mobile node. 'H' is the home network of mobile node 'A'. 'H.A.' is the home agent in 'A's' home network. 'F' is the foreign network of mobile node 'A'. 'F.A.' is the foreign agent in 'A's' foreign network. 'B' is another host inside another network, which is communicating with mobile node 'A'. All three networks are connected with each other through the Internet.

Terminology involved

Mobile node: A host or router, which moves across different networks.

Home network: A mobile

node is assigned to a particular network, which is considered the home network for this mobile node.

Home agent: This is a router in the home network, which forwards datagrams to the mobile node when it's present in the home network and to the foreign agent when the node is away from the home network.

Foreign network: When the mobile node changes its location from the home network to another network, this new network is considered as a foreign network for the mobile node.

Foreign agent: This is a router connected to a foreign network, which forwards datagrams to the mobile node obtained from the home agent.

Care of address: This address determines the mobile node's current location. It is assigned by the foreign network to the mobile node.

Home address: This is a fixed IP address assigned to the mobile node provided by the home network.

Tunnelling: The IP datagram containing the home IP address of the mobile node is encapsulated inside a new IP datagram containing a 'care of address' to forward packets to the foreign network. This process is called tunnelling.

Support services defined for Mobile IP

Discovery: This is a mechanism by which a mobile node finds out the prospective home agent and foreign agent. ICMP router discovery is the primary mechanism

used for discovery.

Registration: This is the method by which the mobile node communicates information on its reachability to the home agent. Using this method, a mobile node:

- Registers its 'care of address' with its home agent. This registration can be direct (without help of the foreign agent) or indirect (with help of the foreign agent);
- De-registers when nodes leave the foreign network; and
- Renews registration when it is about to expire.

Steps of communication involved between User B and Mobile Node A:

- Mobile Node A finds out through a discovery mechanism whether A is in the foreign network or the home network. If A is on the home network standard IP routing takes place. But if A is in the foreign network, it receives a 'care of address' and registers with the home agent through the registration mechanism.

- When User B wants to communicate to A, B sends IP datagrams (containing A's home address) over the Internet, and datagrams are routed to A's home networks.

- A's home agent forms the IP datagram (containing A's 'care of address' in the destination field) encapsulating the original IP datagram from user B and forwards it to the foreign agent through the tunnel.

- In the foreign network, the foreign agent decapsulates the datagrams and sends them to A.

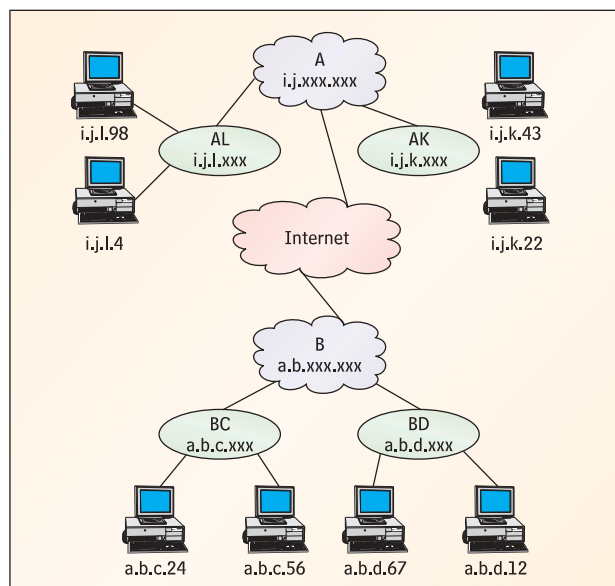


Figure 1

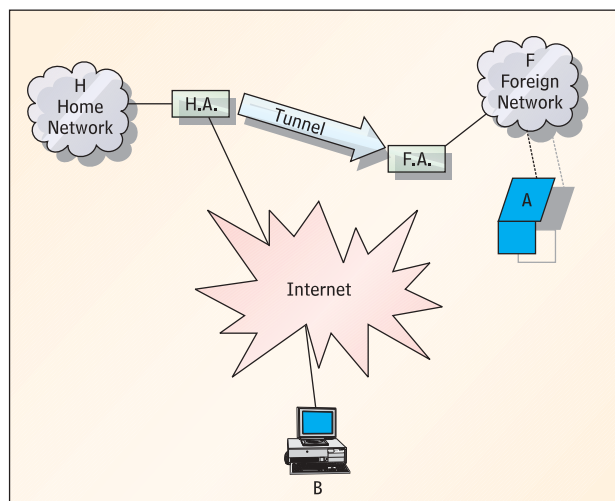


Figure 2

- If A sends IP datagrams to B, IP datagrams are sent using the standard IP routing mechanism. No tunnelling takes place in this case.

The number of mobile computers accessing the Internet is expected to increase at a rate faster than that of mobile phones because of the already existing advanced technology for the development of wireless mobile computing devices. One obvious advantage of this technology, once realised, is to access the

Internet anywhere, anytime. This extent of flexibility can change existing fundamental work ethics, similar to what has happened in the case of mobile phones. However, although many well-known companies have developed some of the implementations of Mobile IP, a concrete standard design of Mobile IP, which provides solutions on issues like security and quality of service for the complex Internet marketplace is yet to arrive.

