Introduction to Mobile IP

Introduction

- Wireless devices offering IP connectivity
  - PDA, handhelds, digital cellular phones, etc.
- Mobile networking
  - Computing activities are not disrupted when the user changes the computer's point of attachment to the Internet
  - All the needed reconnection occurs automatically and non-interactively
- Technical obstacles
  - Internet Protocol (IP) routing scheme
  - Security concerns

What is Mobile IP

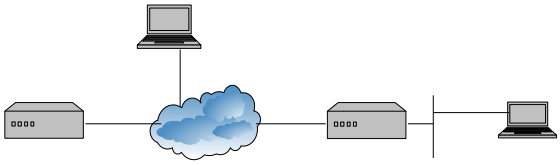
Definition:

Mobile IP is a standard communication protocol, defined to allow mobile device users to move from one IP network to another while maintaining their permanent IP address [2]

Mobile IP - Motivation

- An IP address not only identifies a host but also a point-of-attachment
- A host cannot change its IP address without terminating on-going sessions
- ***Mobility*** is the ability of a node to change its point-of-attachment while maintaining all existing communications and using the same IP address

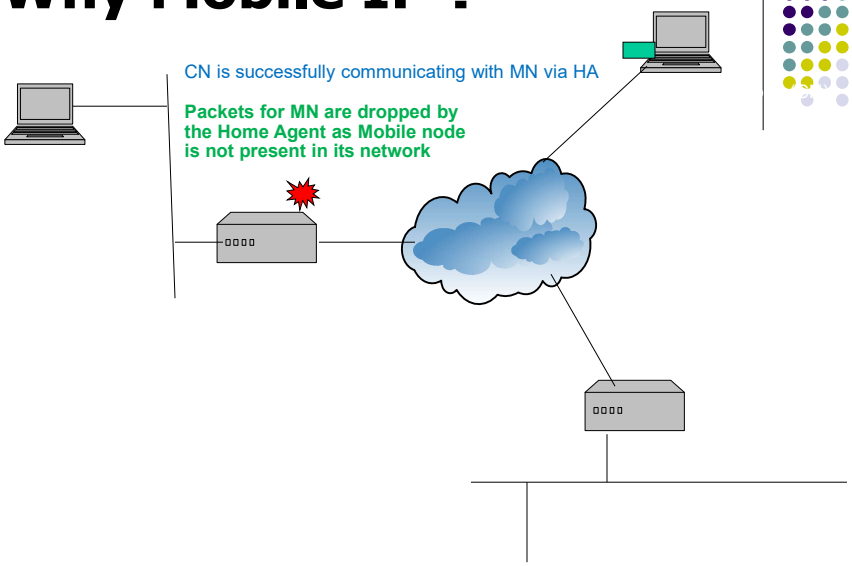
Mobile IP Architecture



- **Mobile Node (MN) -** A Node moving to different network, with permanent Home Address.
- **Home Agent** (HA) - A **router** on a mobile node's home network which tunnels datagrams for delivery to the mobile node when it is away from home, and maintains current location information for the mobile node.

- **Home Address -** The static fixed IP Address allocated to a mobile node by Home Agent.
- **Home Network -** A network, having a network prefix/network id.matching that of a mobile node's home address
- **Foriegn Network -** A network other than a Mobile node's home network.
- **Foreign Agent -** Router in foreign network that provides **CoA** and tunneling with **HA** and forward the packets to **MN**.
- **Care-of Address -** Termination point of a tunnel toward a MN in the foreign netwrok.
- **Mobility Binding -** The association of a home address with a care-of address (CoA).
- **Correspondent Node (CN) -** A peer node with which a Mobile node is communicating.

Why Mobile IP ?



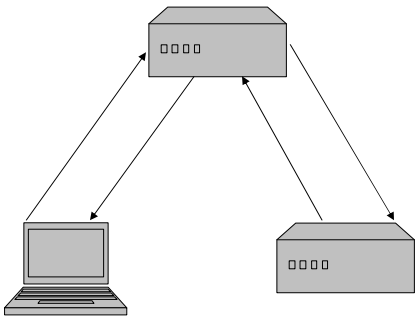
Why Mobile IP (Cont.)

- **Trends:** People's perspective of looking at internet has changed from ages, with the introduction of Mobility.
- **Need:** Increase in the variety of mobile devices, such as PDA's, laptops and cellular phones, more and more internet services are accessible to moving users with the widely deployed wireless networks.
- **Gene X:** 3G Networks, Mobile IPV6

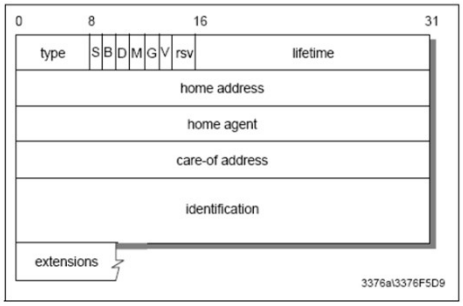
How Mobile IP works

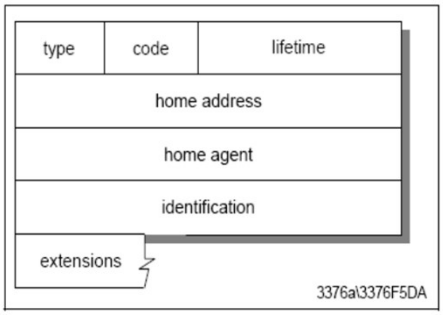
Registration

1. **Registration Request by MN to FA**
2. **FA Relays Registration request to HA**
3. **HA sends Registration reply to FA**
4. **FA Relays Registration reply to MN**

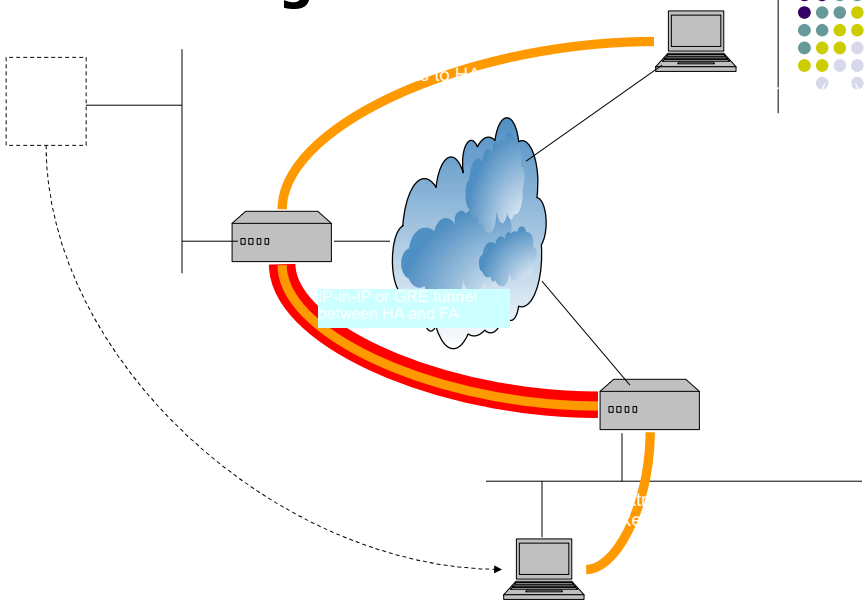


Registration message format





Tunneling in Mobile IP

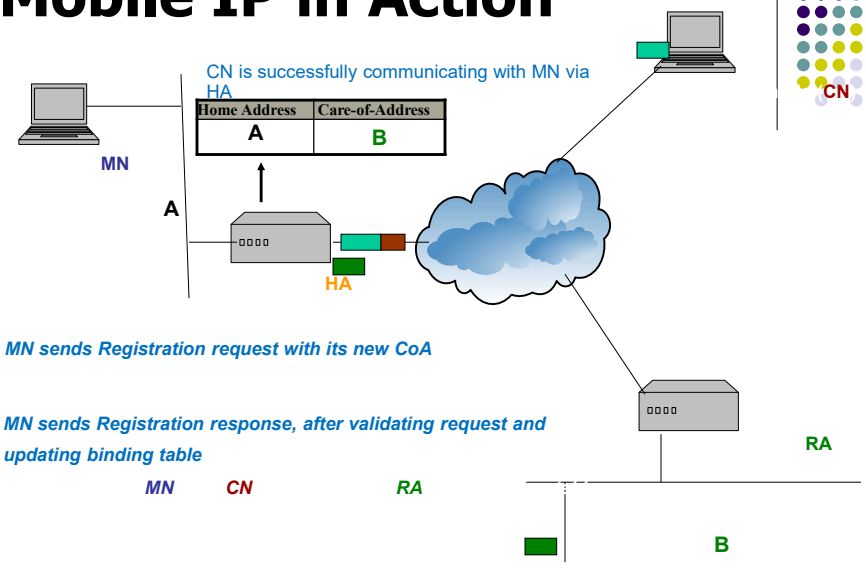


Tunneling in Mobile IP(Cont.)

- When CN sends the data to MN, it uses the original address of the MN, so the packet goes to HA.
- From the mobility binding HA encapsulates the packet (IP-in-IP or GRE) and sends to CoA.
- The FA de-capsulate the packet and extracts the original packet that was sent by the CN.
- The FA then sends this packet to the MN using the Home address destination.
- The reverse route from MN to CN may or may not follow this path.

  Triangle routing – Reply packets are sent directly to CN from MN
  Reverse Tunneling – Reply packet are tunneled to HA by FA.

Mobile IP in Action



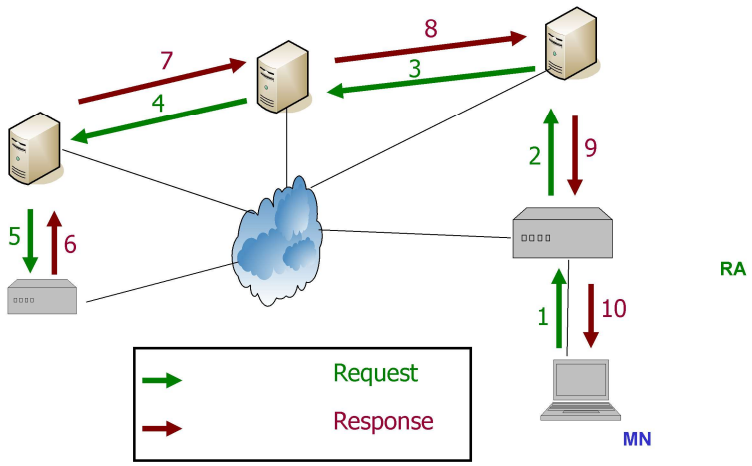
Security in Mobile IP

- Required as Mobile Nodes are often in unprotected remote network
- **Authenticity** and **Integrity** of Registration messages using Authentication (e.g. HMAC-MD5).
- *Replay attack* protection for Registration messages using sequence number.

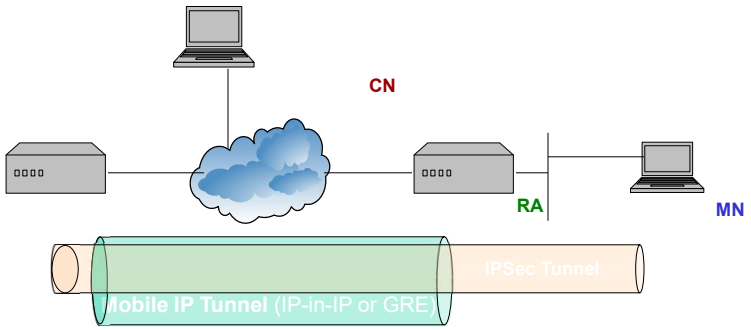
Security Issues in Mobile IP

Issue	Protocol	Solution
Optional authentication between MN and FA	IPv4	AAA and Broker AAA services
Location Privacy	IPv4,IPv6	None
Confidentiality for Data Packets	IPv4,IPv6	IPSec or SSL

Security in Mobile IP (Cont.)



Security in Mobile IP (Cont.)



Mobile IP in IPv6

- Conceptually same as MIPv4
- Inbuilt support using specific extensions for mobile IP
- Route optimization using new type of routing header
- "Triangle routing" problem solved using new destination header option
- Mobility Header to exchange binding messages (e.g. Registration)

Problems facing Mobile IP

- Routing inefficiencies
  - Asymmetry in routing: Triangle routing
  - Route optimization requires changes in the correspondent nodes that will take a long time to deploy
- Security issues
  - Firewalls
    - Blocks all classes of incoming packets that do not meet specified criteria
    - It presents difficulties for mobile nodes wishing to communicate with other nodes within their home enterprise networks

17

Problems facing Mobile IP (cont)

- Security issues
  - Ingress filtering
    - Many border router discard packets coming from within the enterprise if the packets do not contain a source IP address configured for one of the enterprise's internal network
    - Mobile node would otherwise use their home address as the source IP address of the packets they transmit
    - Possible solution: tunneling outgoing packets from the care-of address (Q: where is the target for the tunneled packets from the mobile node? Home agent?)

18