Mobile Networking Through Mobile IP

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Mobile computing circa 1998

- Mobile networking – the ability to maintain network connectivity despite changes in the point of attachment to the Internet
- Unfortunately, IP addresses are not mobile, meaning transparent mobility is hard
- Mobile IP RFC – allow a mobile node to have two IP addresses – a home and a care-of address
How Mobile IP works

• Routers forward packets based on a common assumption of where IP addresses are located
• To keep network connectivity, mobile nodes need to keep the same IP address as it moves
• Home address – a static IP that Internet packets are routed to
• Care-of address – changes when the node moves
• Home-agent - responsible for forwarding packets from the home-address to the care-of address
How Mobile IP works

• When the home-agent receives a packet, it does some modifications, like... before sending it out to the care-of

• Then when the care-of address sends data out, it changes some more information in packets, like ...
But what about the protocol stack?

• A goal of mobile IP was to handle mobility at layer...

• Mobile IP also relies on layer 4 applications to help establish a beachhead in a new network. Applications, like...

• The author suggests that applications should be context aware so as to present an appropriate amount of data depending on the connection
What Mobile IP really does

• Discover the care-of address
• Register the care-of address
• Tunnel to the care-of address
Discovering Care-of Addresses

• Mobile IP discovery processes uses an existing protocol (...) to piggyback needed care-of addresses.
• These are then called “agent advertisements” and are sent periodically unless specifically requested by the node.
• When a node can no longer hear these requests, it’s time to move on.
Agent advertisements

• Agent advertisements perform the following:
  – Allows nodes to detect home and foreign agents
  – Lists available care-of addresses
  – Informs the mobile node about connectivity, other service info and the status of the agent and network (whether it’s home or foreign)
Registering Care-Of

• With a care-of IP address, now the node needs to tell it’s home agent.
• This process happens by...
Registering Care-Of Addresses

MH requests service → FA

FA advertises service

FA relays request to HA → HA

FA relays status to MH → FA

HA accepts or denies
Registering Care-Of

• When the mobile node registers, the home agent stores state.
• The state is a three-tuple comprised of … , … , … to form a “binding”
• Because a binding update changes a routing table, we need authentication, otherwise …
Security

• The home agent and the mobile node need to share a “security association” (a what?)

• Then MD5 hash the registration request.

• Make sure to add some unique data to each request otherwise...

• Mobile IP can use two types of unique data ...

• But timestamps have problems because ...
Malicious foreign agents?

- Foreign agents are supposed to de-encapsulate encapsulated IP-in-IP packets
- What if a foreign agent was malicious...
Tunneling to the Care-Of Address

- IP-in-IP – the home agent adds a IP header around the IP packet. The care-of address is the destination address in the new IP packet.

- The new packet can have a protocol type of 4 or 55...
Mobile IP and IPv6

• Basically the same, but mobile nodes can configure themselves using autoconf and neighbor discovery protocols in IPv6. The consequence is that foreign agents...

• IPv6 is supposed to have authentication built in, so Mobile IPv6 doesn’t need any

• IPv6 packets aren’t tunneled because they use IPv6 source routing headers

• Source routing wasn’t done in IPv4 for 2 reasons...
Open Questions

• Triangle Routing effect...
• Firewalls are no friend of mobile IP...
• Ingress filtering...
• Mobile IP makes the claim that we all need transparent TCP hand-off. Do we really...
• Can DNS be used to encode mobile node IP addresses...
Conclusion

• “Of course, everything depends heavily on the willingness of platform and router vendors to implement Mobile IP, but indications are strong that most major vendors already have implementations either finished or underway.”