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Network Layer 3: Mobile IP

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What is mobility?
• spectrum of mobility, from the network perspective:

- no mobility
- high mobility
- mobile user using same access point
- mobile user connecting/disconnecting from network using DHCP
- mobile user passing through multiple access points while maintaining ongoing connections (like cell phone)

Mobility: Vocabulary

- home network: permanent "home" of mobile (e.g., 128.119.40/24)
- home agent: entity that will perform mobility functions on behalf of mobile when mobile is remote
- correspondent

Permanent address: address in home network, can always be used to reach mobile (e.g., 128.119.40.186)

Mobility: more vocabulary

- visited network: network in which mobile currently resides (e.g., 79.129.13/24)
- care-of-address: address in visited network (e.g., 79.129.13.2)
- correspondent: wants to communicate with mobile
- foreign agent: entity in visited network that performs mobility functions on behalf of mobile
- permanent address: remains constant (e.g., 128.119.40.186)
How do you contact a mobile friend:
Consider friend frequently changing addresses, how do you find her?
• search all phone books?
• call her parents?
• expect her to let you know where he/she is?

I wonder where Alice moved to?

Mobility: approaches

- Let routing handle it: routers advertise permanent address of mobile-nodes-in-residence via usual routing table exchange.
  - routing tables indicate where each mobile located
  - no changes to end-systems
- Let end-systems handle it:
  - indirect routing: communication from correspondent to mobile goes through home agent, then forwarded to remote
  - direct routing: correspondent gets foreign address of mobile, sends directly to mobile

Mobility: registration

End result:
• Foreign agent knows about mobile
• Home agent knows location of mobile
Mobility via Indirect Routing

- home network
- correspondent addresses packets using home address of mobile
- visited network
- home agent intercepts packets, forwards to foreign agent
- foreign agent receives packets, forwards to mobile
- mobile replies directly to correspondent

Indirect Routing: comments

- Mobile uses two addresses:
  - permanent address: used by correspondent (hence mobile location is transparent to correspondent)
  - care-of-address: used by home agent to forward datagrams to mobile
- foreign agent functions may be done by mobile itself
- triangle routing: correspondent-home-network-mobile
- inefficient when correspondent, mobile are in same network

Forwarding datagrams to remote mobile

- permanent address: 128.129.40.186
- care-of-address: 79.129.13.2
- packet sent by correspondent
- packet sent by home agent to foreign agent: a packet within a packet
- foreign-agent-to-mobile packet

Indirect Routing: moving between networks

- suppose mobile user moves to another network
  - registers with new foreign agent
  - new foreign agent registers with home agent
  - home agent update care-of-address for mobile
  - packets continue to be forwarded to mobile (but with new care-of-address)
- Mobility, changing foreign networks transparent: on going connections can be maintained!
Mobile IP

- RFC 3220
- has many features we’ve seen:
  - home agents, foreign agents, foreign-agent registration, care-of-addresses, encapsulation (packet-within-a-packet)
- three components to standard:
  - agent discovery
  - registration with home agent
  - indirect routing of datagrams

Mobile IP: agent discovery

- agent advertisement: foreign/home agents advertise service by broadcasting ICMP messages (typefield = 9)

Mobility via Direct Routing

- correspondent forwards to foreign agent
- foreign agent receives packets, forwards to mobile
- visited network
- correspondent requests, receives foreign address of mobile
- mobile replies directly to correspondent

Mobility via Direct Routing: comments

- overcome triangle routing problem
- non-transparent to correspondent: correspondent must get care-of-address from home agent
  - What happens if mobile changes networks?
Mobile IP: registration example

- Home agent
- Foreign agent
- HA: 128.119.40.7
- COA: 79.129.13.2
- ICMP agent adv.
- MA: 128.119.40.186
- Registration req.
- HA: 128.119.40.7
- MA: 128.119.40.186
- Lifetime: 9999
- Identification: 714

Network Layer: summary

What we’ve covered:
- routing principles: link state and distance vector
- hierarchical routing
- IP
- Internet routing protocols RIP, OSPF, BGP
- what’s inside a router?
- IPv6
- mobility

Next stop: the transport layer!