Massachusetts Institute of Technology
Department of Electrical Engineering and Computer Science

6.892 Fall 1999 | **Lecture 12: Mobile Routing** | October 20, 1999

Overview. Mobile IP. Ad hoc routing protocols.

1 Mobile IP

- Q: Why do we need it—doesn't Internet routing take care of it all? A: scalability (because source routes don't scale).
- Need level of indirection. Possibilities include:
  1. Changing DNS entries: impractical and updates are slow. And end communicating hosts need to realize that addresses could change in the middle of a conversation—implies changes to TCP.
  2. Link-layer mobility: E.g., CDPD network. One IP address and the underlying CDPD system's "link-layer" arranges to take care of mobility. But this is CDPD-specific mobility. Another example: learning bridges in wireless LANs. Neat local area solution, don't work in the wide area.
  3. Use the multicast infratructure: exercise for you to think through!
  4. Mobile IP develops a different level of indirection via a home agent.
- Solve continuous mobility problem with backward compatibility.
- Terminology: *mobile host (MH), correspondent host (CH), home agent (HA), foreign agent (FA).* Draw a picture showing this.
- Terminology: *care-of address, home address, foreign network/link.*
- 10000-ft view: CH sends packets to MHs home address; they are intercepted by HA, who turns around and tunnels them to FA where the MH is, and the FA locally delivers the packet to MH after detunneling it. "A level of indirection solves most problems!"
- Details:
  1. Q: How does MH know HA and FA?
     A: HAs and FAs periodically broadcast (or multicast) their presence using special Mobile IP *agent advertisements.*
  2. Q: How do you know you're at home?
     A: hear your own HA.
  3. Q: Why do you need to know this?
     A: then no need for HA proxy ARP.
  4. Q: what if you hear multiple FA advertisements?
     A: Pick one.

5. If MH is at home, then no problem. (HA doesn't proxy ARP).
6. If not, then it acquires a foreign care-of address from the agent advertisement.
7. Q: whose address is the care-of address?
   A: FA's own IP address.
8. Q: what else does the MH need to know?
   A: Collocated care-of address—its address in foreign domain.
9. Q: How does it get this?
   A: Performs authenticated visitor registration with FA and gets it.
10. Q: Why isn't it the collocated address?
    A: Allows for "local" mobility to be handled locally.
11. How is HA registration done?
    A: MH sends an authenticated message to HA with its care-of address, which is forwarded via FA following FA registration.
12. HA (or technically any router on home link) performs *proxy ARP* and snarfs all packets intended for MH. HA *tunnels* packets to care-of address, which therefore gets to FA. Q: what is proxy ARP and gratuitous ARP?
13. Q: what are the tunnel entry and exit points?
    A: entry = HA, exit = FA.
14. Q: What does FA do with packet?
    A: Detunnels then forwards to MH's collocated address.
15. Why does HA need to tunnel? Why not simply change destination address?
    A: Care-of address is FA's address.
16. Q: Will this work if collocated address were known to HA? Why or why not?
    A: No, routers check for spoofing.
17. Q: How does reverse direction work?
    A: In reverse direction, FA is default router. Reverse tunneling may need to be done.
18. Authentication: schemes basically preserve current level of insecurity. MH to HA communication can be quite secure using a shared secret; MH to FA less secure. Simple authentication based on a random authenticator.
19. In addition to agent advertisements, also have *agent solicitations* for better response. (Both use ICMP).
20. *Route optimization.*
21. Can we use source routing?
22. Registrations are reliable.

- A cynical critique:
  - Long handoff latencies. (Lots of research to overcome this.)
  - Can't you simply use DHCP and be done? Most connections are short anyway!
  - Are the rewards commensurate with the efforts (complicated protocol)?
  - Personal view: has definite benefits (e.g., mobile servers,etc.).

2 Mobile ad hoc routing

- Mobile nodes with no cellular or base station infrastructure. How to route packets between nodes?
- DSDV, TORA, DSR, AODV
- Assume continuous mobility, so mostly on-demand.
- DSDV: sequence numbers to d-v messages.
- TORA: based on potential differences.
- DSR: Source-based routes; route discovery and maintanence.
- AODV: on-demand distance-vector