

Wireless Networks

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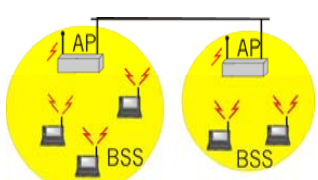
Wireless Networks

- Advantages of wireless links:
 - Mobility
 - Easy setup
- Wireless networks:
 - Infrastructured wireless networks, connected to the Internet through a single last-hop wireless link
 - Ad hoc wireless networks (wireless links only)

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Infrastructured Network Model

- Wireless host communicates with a **base station** or **access point (AP)**.
- **Basic Service Set (BSS)** contains:
 - a base station;
 - wireless hosts reachable from the base station.
- Base stations are connected to each other and wide-area network through wired links.



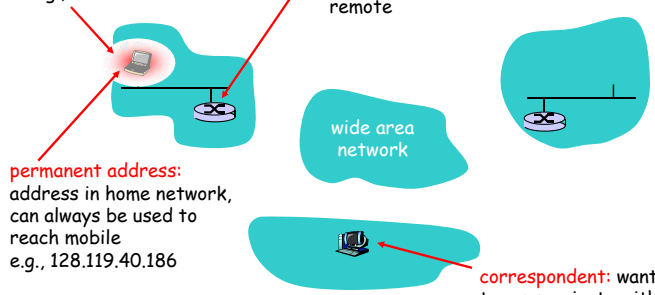
Addressing and routing are extension of (and be compatible with) the Internet.

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Addressing: when mobile is at home

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



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

correspondent: wants to communicate with mobile

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Addressing: when mobile is moving around

permanent address: remains constant (e.g., 128.119.40.186)

care-of-address: address in visited network. (e.g., 79.129.13.2)

visited network: network in which mobile currently resides (e.g., 79.129.13/24)

foreign agent: entity in visited network that performs mobility functions on behalf of mobile.

correspondent

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Mobile Registration

home network

visited network

foreign agent contacts home agent: "this mobile is resident in my network"

mobile contacts foreign agent on entering visited network

End result:

- Foreign agent knows about mobile
- Home agent knows location of mobile

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Principles of Mobile Routing

- 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

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Mobility via Indirect Routing

home network

visited network

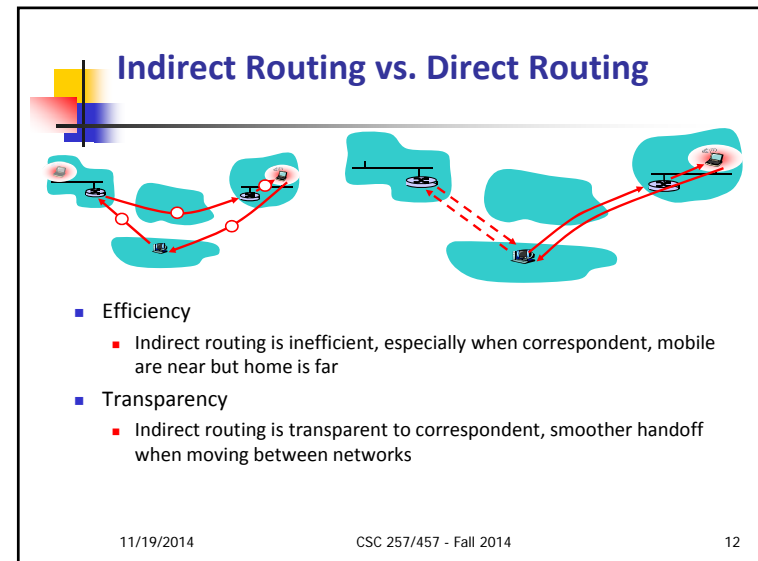
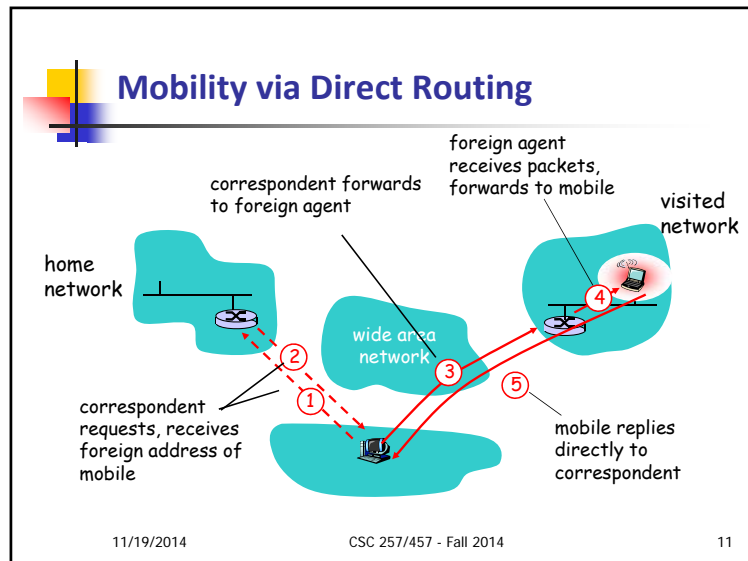
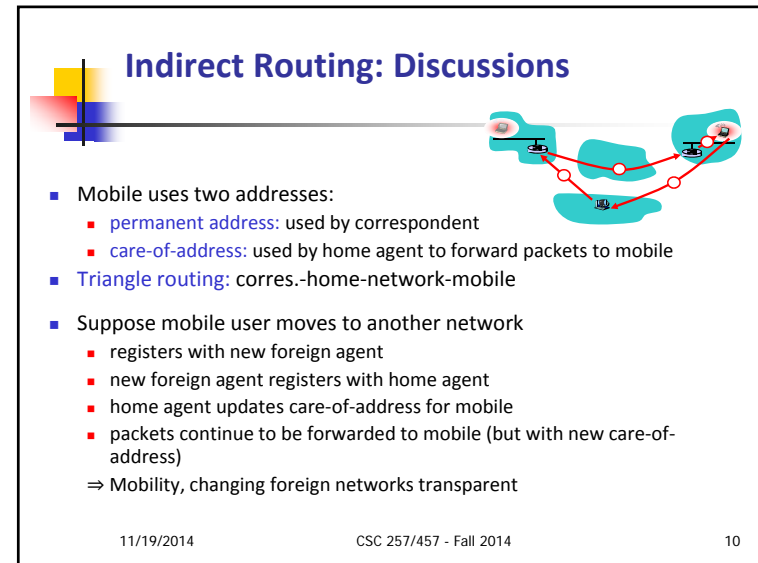
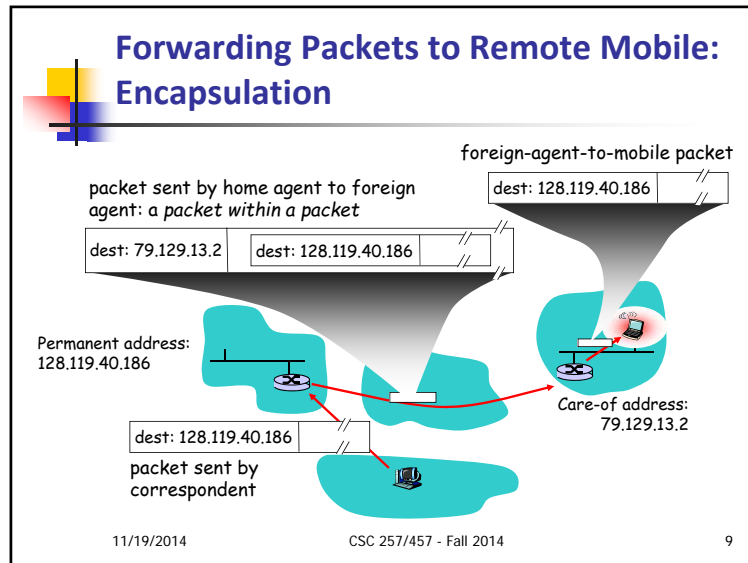
home agent intercepts packets, forwards to foreign agent

foreign agent receives packets, forwards to mobile

correspondent addresses packets using home address of mobile

mobile replies directly to correspondent

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Mobile IP

- Network-layer mobility protocol interoperable with IP [C. Perkins, 2002]
- Has many features we've seen:
 - home agents, foreign agents, foreign-agent registration, care-of-addresses, encapsulation (packet-within-a-packet)
 - use indirect routing

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Ad Hoc Network Model

- No base stations or access points
- Wireless hosts communicate with each other directly
 - to get packet from wireless host A to B may need to route through wireless hosts X, Y, Z
- Compared with based station model
 - more flexible
 - require complex support
- Application scenarios:
 - "laptop" meeting in conference room
 - cars on the road
 - interconnection of "personal" devices
 - emergency/battlefield



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Addressing in Ad Hoc Networks

- Requirements for Internet addressing
 - unique
 - hierarchical
- Requirements for addressing in ad hoc networks?

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Routing in Ad Hoc Networks

- How does ad hoc network routing differ from routing on infrastructured networks?
- DSR [Johnson 1994]
 - No routing table; source maintains whole path, each packet carries whole path
 - Broadcast-style path discovery
- AODV [Perkins and Royer 1999]
 - Every node maintains a routing table; routing hop by hop
 - Broadcast-style path discovery when route to destination is missing; cut short when reaching a node with known routing to destination
 - Routes in routing table may become invalid due to mobility

DSR vs. AODV?

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Sensor Networks

- Wireless ad hoc (but not mobile) networks
 - Without mobility, standard network routing (for Internet) works quite well

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Geographic Location-based Routing

- [Li et al. 2000]
 - Each device is identified by its geographic location (e.g., longitude and latitude)
 - At each routing step, the packet is directed to the current node's neighbor with shortest Cartesian distance to dest.
- Advantage:
 - Simple scheme, low routing overhead
- Problem?
 - Routing loops or "dead ends"
 - Work best for dense networks

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