

Wireless Network and Mobility

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Wireless Networks and Mobility

- Wireless networking in the data link layer
 - Short range: IEEE 802.15 Bluetooth
 - Medium range: IEEE 802.11 wireless LAN (WiFi)
 - Long range: Cellular Internet access and long range WiFi
- Mobility in the network layer
 - Infrastructured wireless mobile networks
 - Ad hoc wireless mobile networks

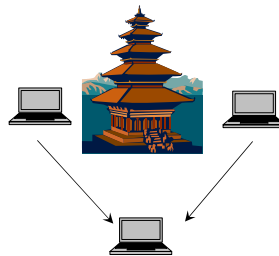
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Media Access Control for Wireless Networks

- Collision if 2 or more nodes transmit at same time
- Efficiency goal of media access control:
 - get all the bandwidth if you're the only one transmitting
 - share the bandwidth fairly if multiple nodes transmit
- CSMA/CD (what is CSMA/CD??)
- Hidden terminal problem
 - the sender doesn't know if a transmission is successful
 - collision detection doesn't work



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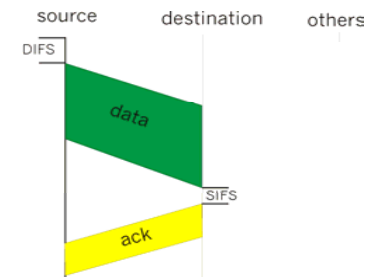
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IEEE 802.11 MAC Protocol: CSMA/CA

- 802.11 CSMA sender
 - if sense channel idle for **DIFS** sec; then transmit entire frame (no collision detection)
 - if sense channel busy; then backoff

- 802.11 CSMA receiver
 - if received OK; return **ACK** after **SIFS** (ACK is needed due to hidden terminal problem)



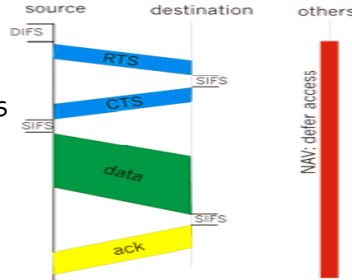
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Better Collision Avoidance through RTS-CTS Exchange

- sender transmits short RTS (request to send) packet: indicates duration of transmission
- receiver replies with short CTS (clear to send) packet
 - notifying (possibly hidden) nodes
- nodes hearing either RTS or CTS will not transmit for specified duration: NAV
- Collision is unlikely because RTS/CTS are short.



IEEE 802.11 MAC Protocol: CSMA/CA

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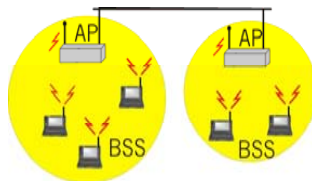
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Mobility: Base Station Model

- 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.



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Mobility: 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
- Applications:
 - "laptop" meeting in conference room, car
 - interconnection of "personal" devices
 - battlefield

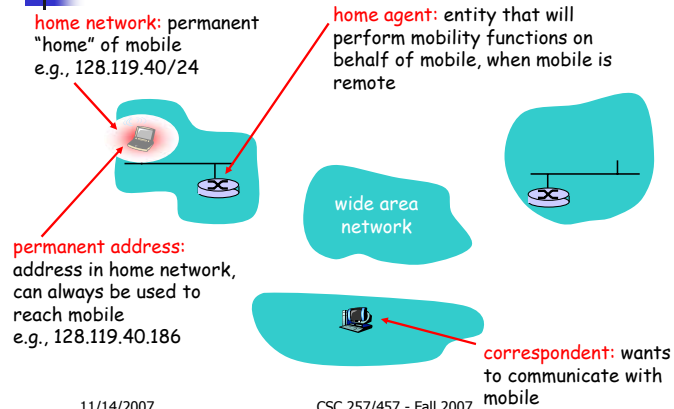


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Addressing: when mobile is at home

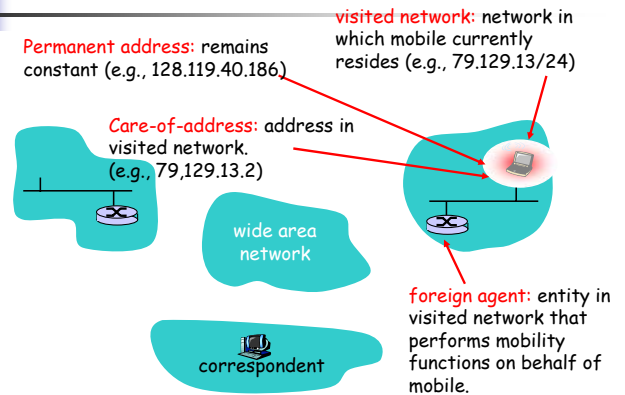


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Addressing: when mobile is moving around

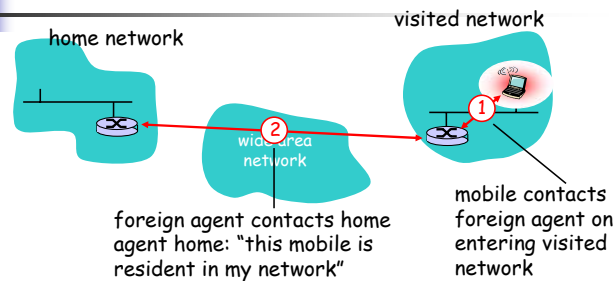


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Mobile Registration



End result:

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

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Principles of Mobile Routing

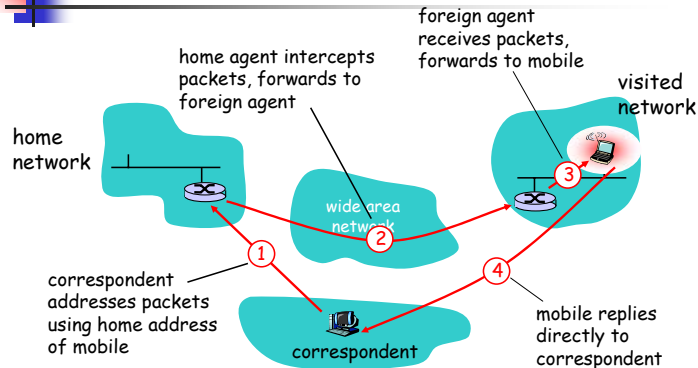
- **Indirect routing**
 - communication from correspondent to mobile goes through home agent, then forwarded to remote
- **Direct routing**
 - correspondent gets foreign address of mobile, sends directly to mobile

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Mobility via Indirect Routing

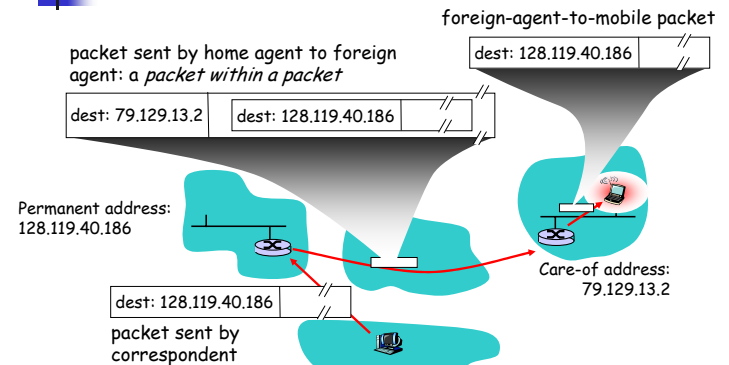


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Forwarding Packets to Remote Mobile: Encapsulation



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Indirect Routing: Discussions

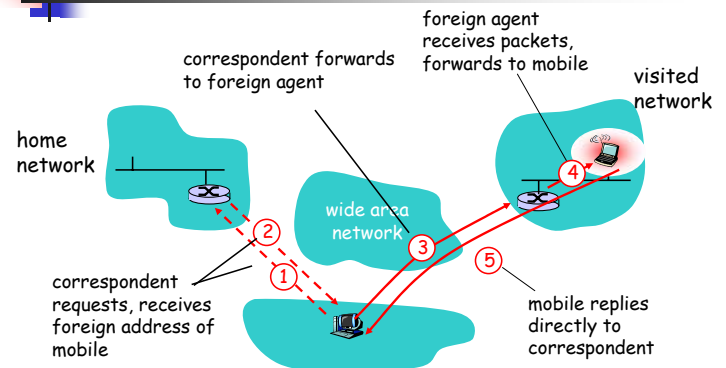
- Mobile uses two addresses:
 - permanent address: used by correspondent
 - care-of-address: used by home agent to forward packets to mobile
- triangle routing: corres.-home-network-mobile
- suppose mobile user moves to another network
 - registers with new foreign agent
 - new foreign agent registers with home agent
 - home agent updates care-of-address for mobile
 - packets continue to be forwarded to mobile (but with new care-of-address)
 ⇒ Mobility, changing foreign networks transparent

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Mobility via Direct Routing

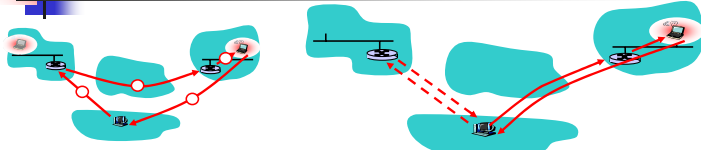


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Indirect Routing vs. Direct Routing



- Efficiency
 - Indirect routing is inefficient, especially when correspondent, mobile are near but home is far
- Transparency
 - Indirect routing is transparent to correspondent, smoother handoff when moving between networks

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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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Mobile Ad Hoc Networks

- Open research area
- Addressing
 - Requirements for addressing in MANET?
- Routing
 - Any idea about finding good routes for MANET?

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