Ethernet Switches - 1

- layer 2 (frame) forwarding, filtering using LAN addresses
- **Switching**: A-to-B and A’-to-B’ simultaneously, no collisions
- large number of interfaces
- often: individual hosts, star-connected into switch
  - **Ethernet, but no collisions!**
Ethernet Switches - 2

• **cut-through switching**: frame forwarded from input to output port without awaiting for assembly of entire frame
  - slight reduction in latency

• combinations of shared/dedicated, 10/100/1000 Mbps interfaces
Ethernet Switches - 3
IEEE 802.11 Wireless LAN - 1

• Wireless LANs: untethered (often mobile) networking
• IEEE 802.11 standard:
  • MAC protocol
  • unlicensed frequency spectrum: 900Mhz, 2.4Ghz
IEEE 802.11 Wireless LAN - 2

• Basic Service Set (BSS) (a.k.a. “cell”) contains:
  • wireless hosts
  • access point (AP): base station
• BSS’s combined to form distribution system (DS)
Ad Hoc Networks

• Ad hoc network: IEEE 802.11 stations can dynamically form network \textit{without} AP
• Applications:
  • “laptop” meeting in conference room, car
  • interconnection of “personal” devices
  • battlefield
• IETF MANET (Mobile Ad hoc Networks) working group
IEEE 802.11 MAC Protocol: CSMA/CA

802.11 CSMA sender:
- if sense channel idle for DISF sec.
  then transmit entire frame (no collision detection)
- if sense channel busy
  then binary backoff

802.11 CSMA receiver:
if received OK
return ACK after SIFS
IEEE 802.11 MAC Protocol

802.11 CSMA Protocol:
- NAV: Network Allocation Vector
- 802.11 frame has transmission time field
- others (hearing sister) defer access for NAV time units
Hidden Terminal effect

- hidden terminals: A, C cannot hear each other
  - obstacles, signal attenuation
  - collisions at B
- goal: avoid collisions at B
- CSMA/CA: CSMA with Collision Avoidance
Collision Avoidance: RTS-CTS exchange - 1

- CSMA/CA: explicit channel reservation
  - sender: send short RTS: request to send
  - receiver: reply with short CTS: clear to send
- CTS reserves channel for sender, notifying (possibly hidden) stations
- Avoid hidden station collisions
Collision Avoidance: RTS-CTS exchange - 2

- RTS and CTS short:
  - collisions less likely, of shorter duration
  - end result similar to collision detection
- IEEE 802.11 allows:
  - CSMA
  - CSMA/CA: reservations
  - polling from AP