

ECSE-4730: Computer Communication Networks (CCN)

Chapter 5: The Data Link Layer - 3

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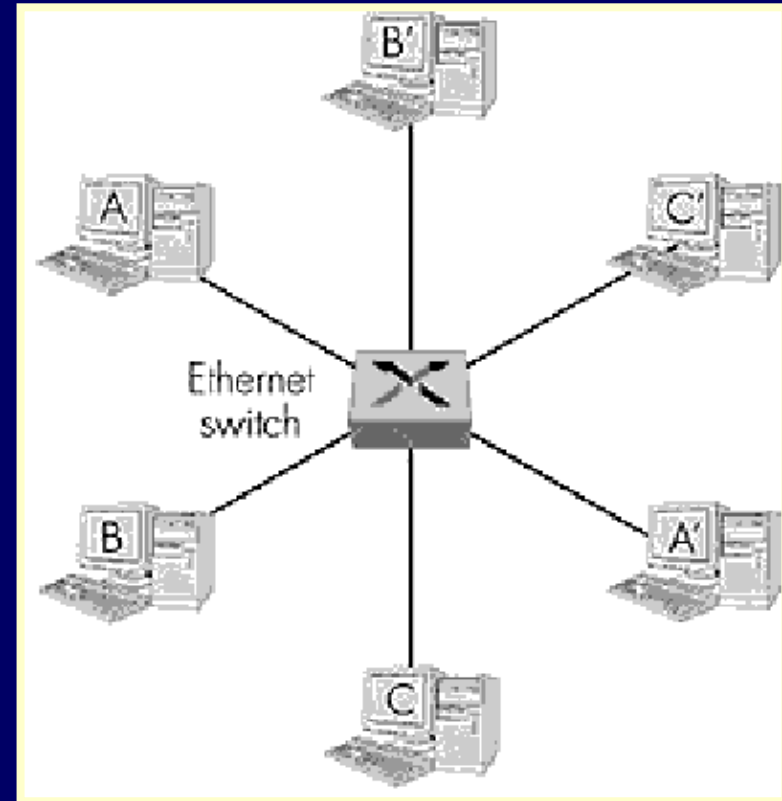
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Ethernet Switches - 1

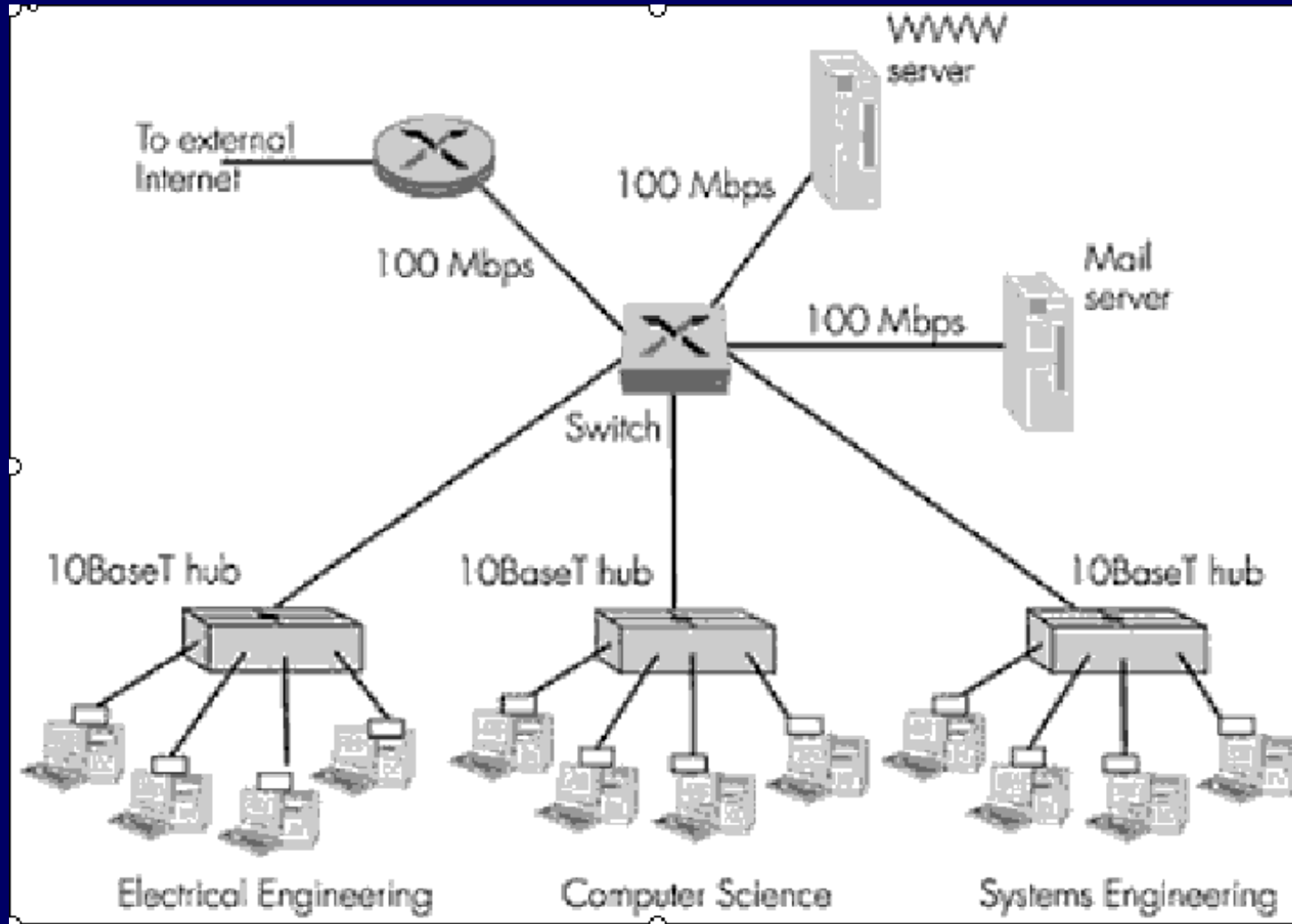
- layer 2 (frame) forwarding, filtering using LAN addresses
- **Switching: A-to-B and A'-to-B' simultaneously, no collisions**
- large number of interfaces
- often: individual hosts, star-connected into switch
 - **Ethernet, but no collisions!**



Ethernet Switches - 2

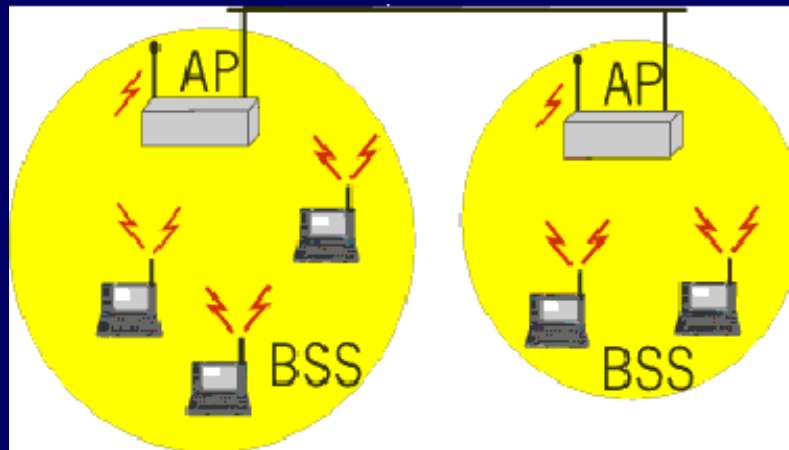
- **cut-through switching: frame forwarded from input to output port without awaiting for assembly of entire frame**
 - **slight reduction in latency**
- **combinations of shared/dedicated, 10/100/1000 Mbps interfaces**

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 *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
DIFS sec.

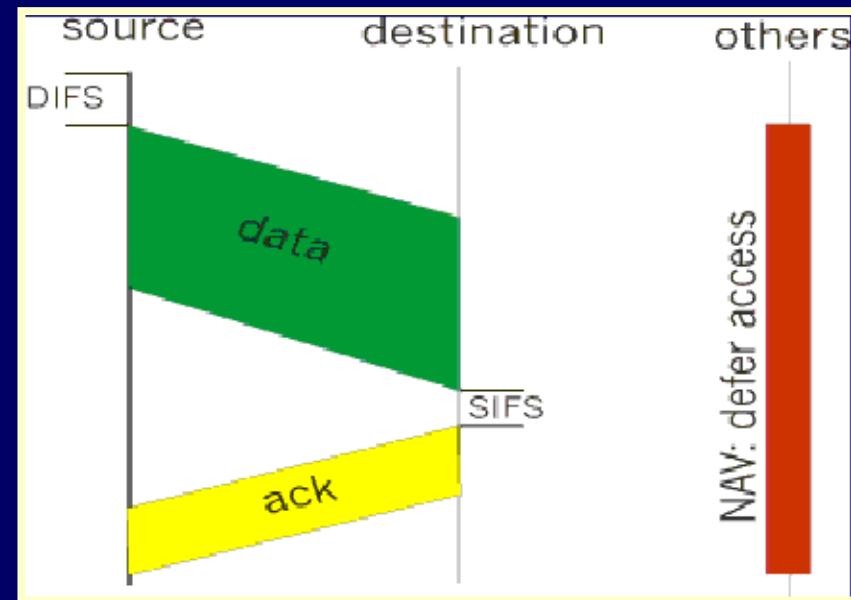
then transmit entire frame
(no collision detection)

-if sense channel busy
then binary backoff

802.11 CSMA receiver:

if received OK

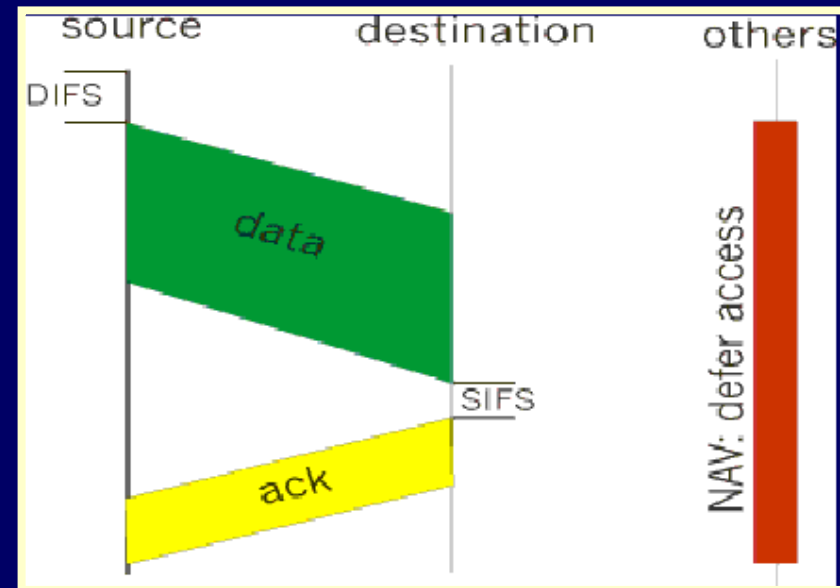
return ACK after SIFS



IEEE 802.11 MAC Protocol

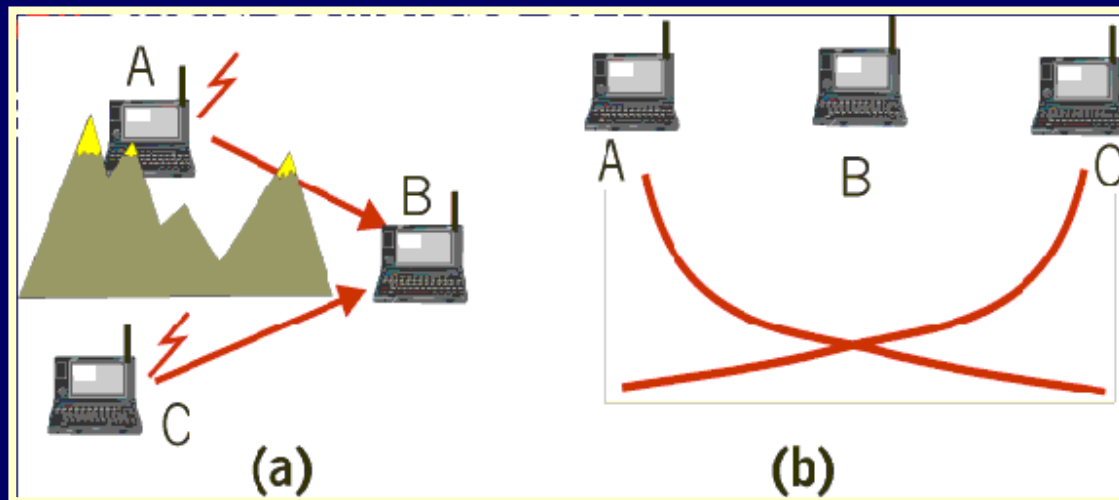
802.11 CSMA Protocol: others

- NAV: Network Allocation Vector
- 802.11 frame has transmission time field
- others (hearing sata) defer access for NAV time units



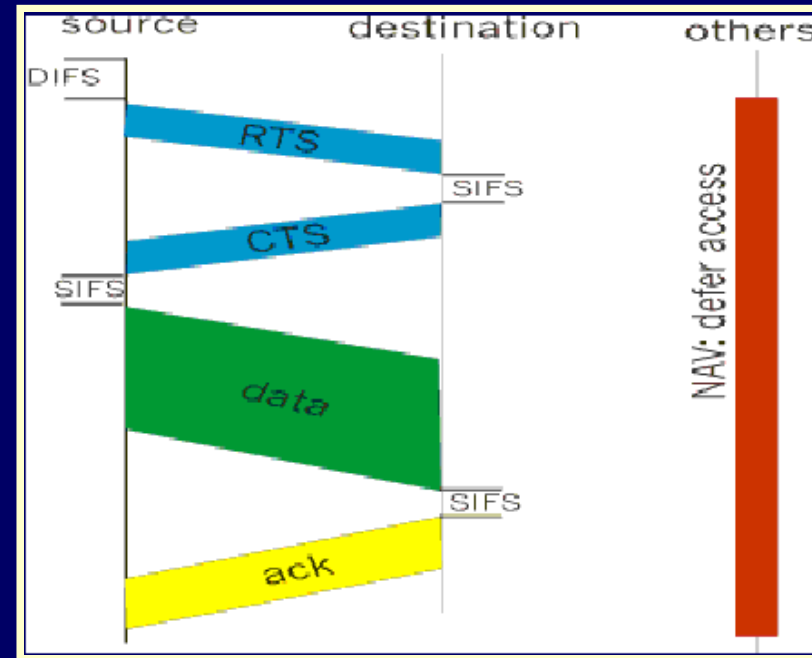
Hidden Terminal effect

- **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

