Medium Access Sublayer
Medium Access Sublayer

- Switching
- 802.x
- Bridges
- FastEther, GigEther, etc.
- Routing
Switching

- Traffic isolation
  - Collision domains
- Buffering
802.4 Token Bus

- Logical ring on broadcast media
- Pushed by real-time proponents
- More complex than 802.3
  - Dozens of state variables
- No collisions
- New station discovery
- Neighbor discovery
- Four priority levels
  - Highest has guaranteed bandwidth
802.4 Ring Maintenance

- Solicit_Successor
- Resolve_contention if collision
  - Binary Count down
  - Stations use 2 random delay bits
- Leaving the Ring
  - Set_Successor
- Idle Ring
  - Claim_Token
- Lost Token
  - Retransmit Token, Who_Follows
  - Claim_Token, Multiple Tokens
802.5 Token Ring

- Ring of point-to-point connections
- 3 Byte Token circulates in ring
  - Each bit is copied by each node
  - 1 bit delay per node
  - 3 Byte Token is modified into data preamble
- Token must fit on Network.
  - Bit delay plus propagation delay
  - Sender removes bits it transmitted
  - Regenerates token
802.5 Token Ring MAC

- Transform Token and transmit
  - For duration of token-holding time
  - Start and end have non-data signal
- Frame Status
  - 0,0 no destination
  - 1,0 destination did not accept frame
  - 1,1 frame accepted
- Token has priority bits
Monitor station oversees ring
  - Startup: Claim_Token
  - Drain orphan frames
  - Monitors for token every max time interval
    - Drains ring, generates new token
  - If Ring gets to be less than 24 bits long
    - Inserts extra delay bits

Ring Breaks
  - Beacon Frame
  - Address of dead node
802.3 Ethernet

- Manchester Encoding
  - detect bit transition in middle of signal
- Preamble 10101010
- Start of frame 10101011
- 6 Byte address
  - Individual addresses
  - Group addresses-Multicast
  - Broadcast -- all 1s
- Global Addresses
802.3 Ethernet

- source address
- 2 byte length of data
- 0-1500 bytes of data
- 0-46 padding
- 4 byte checksum
Bridges

- Connect different Data Link Protocols
  - Different Frame and checksums
  - Different data rates
    - Different timers
    - Different packet sizes
- Transparent Bridge
  - Initial Flooding
  - Watch traffic, build table
    - Backward Learning
  - Time stamp
    - Purge entries more than a few minutes old
Bridge Routing Procedure

- Same Lan, Different, Unknown
- Spanning Tree
  - Build Tree, ignoring some links
- Source Routing Bridges
  - Senders know about Network topology
  - Bridges only forward flagged packets
    - Flag includes bridge number
    - Host chooses among equivalent bridges
  - Implement: software, hybrid, hardware
Switches

- Switch fabrics
  - Fully Connected
  - Batcher-Banyan switch
- Deploying switches
  - Cisco switches
  - VLans
  - Switching vs. Routing
FDDI, FastEthernet

- FDDI
- Fast Ethernet
  - 100Base-T4, 100 M, Cat3, 4 pairs
  - 100Base-TX, 100 M, Cat5 full duplex
  - 100Base-FX, 2000m, fiber, full duplex
Gigabit Ethernet

- 802.3z
  - 1000Base-{SX, LX, TX}
    - Fiber Review
    - Flux budget
Gigabit Ethernet

• Slot time Problem
  • 2 km reduced to 200 m with 100 Mb Enet
  • 1000 Mb Enet would be 20 meters!
• Slot Time to 512 bytes
  • 4096 bits
  • 64 bit packet size kept for compat
  • Extended carrier symbols
  • Not much gain for small packets
Gigabit Ethernet

- Frame Bursting
  - 512 bit packet $\Rightarrow$ 12% 
- With Frame Bursting
  - 512 bit packet $\Rightarrow$ 76%