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
802.5 Ring Maintenance

- 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
  - Breacon 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 $\Rightarrow 76\%$