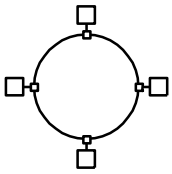
Shared Access Networks

Token Ring
ATM
Fibre channel
Myrinet

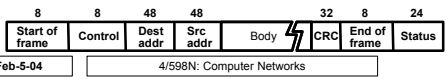
Token Ring Overview

- Examples
  - 16Mbps IEEE 802.5 (based on earlier IBM ring)
  - 100Mbps Fiber Distributed Data Interface (FDDI)
    - 4B/5B encoding



Token Ring (cont)

- Idea
  - Frames flow in one direction: upstream to downstream
  - special bit pattern (token) rotates around ring
  - must capture token before transmitting
  - release token after done transmitting
    - immediate release
    - delayed release
  - remove your frame when it comes back around
  - stations get round-robin service
- Frame Format



Timed Token Algorithm

- Token Holding Time (THT)
  - upper limit on how long a station can hold the token
- Token Rotation Time (TRT)
  - how long it takes the token to traverse the ring.
  - TRT <= ActiveNodes x THT + RingLatency
- Target Token Rotation Time (TTRT)
  - agreed-upon upper bound on TRT

Algorithm (cont)

- Each node measures TRT between successive tokens
  - if measured-TRT > TTRT: token is late so don't send
  - if measured-TRT < TTRT: token is early so OK to send
- Two classes of traffic
  - synchronous: can always send
  - asynchronous: can send only if token is early
- Worse case: 2xTTRT between seeing token
- Back-to-back 2xTTRT rotations not possible

Token Maintenance

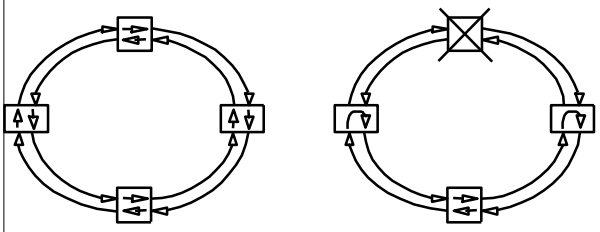
- Lost Token
  - no token when initializing ring
  - bit error corrupts token pattern
  - node holding token crashes
- Generating a Token (and agreeing on TTRT)
  - execute when join ring or suspect a failure
  - send a claim frame that includes the node's TTRT bid
  - when receive claim frame, update the bid and forward
  - if your claim frame makes it all the way around the ring:
    - your bid was the lowest
    - everyone knows TTRT
    - you insert new token

Maintenance (cont)

- Monitoring for a Valid Token
  - should periodically see valid transmission (frame or token)
  - maximum gap = ring latency + max frame < = 2.5ms
  - set timer at 2.5ms and send claim frame if it fires

FDDI (Fiber Distributed Data Interface)

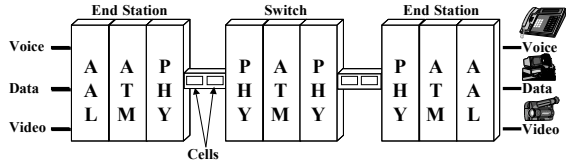
- The late-80's version of token ring (100Mbps, fiber-based)
- Dual-ring (two fibers): 2nd ring used for fault recovery
- Can handle single point failures



ATM Technology (courtesy: ATM Forum)

- Negotiated Service Contract
  - Connection Oriented - virtual circuit
  - End-to-End Quality of Service
- Cell Switching
  - 53 Byte Cell
  - 48 Byte Payload, 5 Byte Header
- Fixed Size
- Header contains virtual circuit information
- Payload can be voice, video or other data types

ATM System Architecture



- Adaptation Layer (AAL): Inserts/extracts information into 48 byte payload
- ATM Layer: Adds/removes 5 byte header to payload
- Physical Layer: Converts to appropriate electrical or optical format

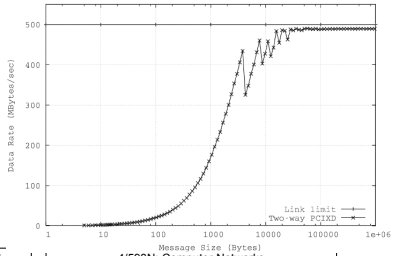
Fibre Channel

- Connect servers, workstations, disk storage etc.
- Optical or electrical media
- 133 Mbps to 1062 Mbps
- 10 km
- point-to-point links or loop or connect to a switch
- IP, SCSI etc.

- http://hsi.web.cern.ch/HSI/fcs/spec/overview.htm

Myrinet

- 2 GB full duplex high speed network interface
- http://www.myri.com/myrinet/performance/index.html
- http://www.conservativecomputer.com/myrinet/perf.html



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- Few μsec latency