1.264 Lecture 33 (Solutions)

Telecom: Wired LAN, WAN

Next class: Green chapter 8, 32. Exercise due before class

Exercise

- What's on a telephone pole?
  - Three types of network; name them
- Which is highest on the pole? Why?
- Which of these are point to point connections?
- Which are shared (point to many)?
- Which of these can carry data?
- Which of these can carry voice?
- Which have competitive (open) access?
- What type(s) of wiring does each use?

Solution

- What's on a telephone pole?
  - Electric
  - Phone
  - Cable TV
- Which is highest on pole? Why?
  - Electric, high voltage/current
- Which of these are point-to-point connections?
  - Phone only
- Which are shared (point-to-many)?
  - Electric, cable
- Which can carry data?
  - Phone, cable, electric
- Which can carry voice?
  - Phone, cable, electric
- Which have competitive access?
  - Phone: unbundled to CLEC
  - Cable: not competitive
  - Electric: distribution monopoly, generation competitive
- What type(s) of wiring does each use?
  - Phone: copper, fiber
  - Cable: coax, fiber
  - Electric: copper

Exercise- Maximum traditional LAN length

- Maximum LAN length: L= ct/2
- Speed of signal: c (2 x 10^8 m/sec, 2/3 speed of light)
- Ethernet speed: s (e.g., 10^8 bits/sec, or 100Mb/sec)
- Slot time t: 512/s (min Ethernet frame size=512 bits)

- Compute L for a 100 Mb/sec LAN (s)

- Compute L for a 1 Gb/sec LAN (s)

- You'll see the 1 Gb/sec LAN isn't feasible with traditional LAN. 1 Gb/sec LAN uses:
  - Full duplex (two wires per station, one to send, one to receive)
  - Switches only, no repeaters or bridges, and no collisions
  - Fiber optics (often), with 500 to 5000 meter segments
  - Distance limited by signal fading, etc. (more on this later)

Solution

- Maximum LAN length: L= ct/2
- Speed of signal: c (2 x 10^8 m/sec, 2/3 speed of light)
- Ethernet speed: s (e.g., 10^8 bits/sec, or 100Mb/sec)
- Slot time t: 512/s (min Ethernet frame size=512 bits)

- Compute L for a 100 Mb/sec LAN (s)
  - L= (2x10^8 * 512/10^8)/2 = 512 meters= 0.5 km
- Compute L for a 1 Gb/sec LAN (s)
  - L= (2x10^8 * 512/10^9)/2 = 51.2 meters= 0.05 km

  - Even though collisions are avoided in full duplex, switched LANs, signal attenuation and other losses are limiting
  - LANs typically are 5 km or less

Exercise: SONET

- You are a large airline with a single server site that handles all your reservations
  - Average transaction is 10,000 bytes (80,000 bits)
  - You must handle 2,000 transactions/second
- Where can you locate your servers on the network in the previous slide:
  - At central office A, in a telco colocation site?
  - At a SONET hub on one of the OC-12 rings?
  - At a multiplexer on one of the OC-3 rings?
- Compute the server bandwidth and compare to the network bandwidth
  - OC-3 is 3 * OC-1; OC-12 is 12 * OC-1; OC-48 is 48 * OC-1

Solution

- You need 80,000 * 2,000= 160 Mbits/sec
- OC-1 is 51 Mbits/sec
- OC-3 is 155 Mbits/sec. Not enough
- OC-12 is 622 Mbits/sec. Clearly enough
- You need to be at central office A or at a SONET hub on one of the OC-12 rings.
  - You don’t need the full OC-12 or OC-48 capacity. Carriers will sell you an appropriate fraction.

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