

Interesting Properties of Networks

- Sharing physical links: Multiplexing
 - Isochronous
 - Fixed size data frames
 - Hard-edged admission control
 - Circuits
 - Asynchronous
 - Variable size packets
 - Soft admission control
 - connectionless

Interesting Properties of Networks

- Must work over a huge range of parameters
 - Delays vary
 - Speed of light is constant
 - Microseconds across a room
 - Nearly 1 second over satellite
 - Link speeds
 - Kb/s (modems,radios)
 - Gb/s (optical fibers)
 - Offered load
 - Individual characters (typing)
 - Megabits/second (files/video)
 - Number of communicating computers

Interesting Properties of Networks

- Receive and Forward Delays
 - Propagation
 - Speed of light is fixed
 - Transmission
 - Packet length / data rate
 - Processing
 - Lookups, copying, error checks
 - Queuing
 - Packets arrive in bursts
 - Dependent on other traffic

Interesting Properties of Networks

- Losses
 - Network links aren't a controlled environment
 - Subject to noise (random bit errors)
 - Include error checks
 - Backhoes (power failures, broken computers, etc)
 - redundancy
 - Best effort service
 - Discard packets when buffers overflow
 - Retransmit for reliable communication

Interesting Properties of Networks

- Duplicates
 - Make individual messages idempotent
 - Include nonces
- Reordering
 - Causes
 - Redundant paths
 - Losses
 - Some applications care, some don't
 - Those that care trade delay for fixing order

Example Problem 1: Ethernet

- Ethernet, as described by the reading (“Ethernet, distributed packet switching for local computer networks”),
 - A. Delegates arbitration of conflicting transmissions to each station;
 - B. Always guarantees the delivery of packets;
 - C. Can support an unbounded number of computers;
 - D. Has limited physical range;

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Example Problem 2: Ethernet

- When an Ethernet station detects interference while transmitting, it:
 - A. Completes the transmission of the packet normally.
 - B. Immediately stops transmitting, and retransmits the packet later.
 - C. Records the address of the interfering station, and sends it a subsequent *interference notification* packet
 - D. Jams the Ethernet briefly
 - E. Reports a possible security violation
 - F. Sets the *possibly corrupt* bit at the very end of the packet

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Example Problem 3: Ethernet

- An Ethernet is a network that uses:
 - A. Luminiferous ether to carry packets.
 - B. Manchester encoding to frame bits.
 - C. Exponential back-off to resolve repeated conflicts between multiple senders.
 - D. Retransmissions to avoid congestion.

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Example Problem 4: Congestion

- Congestion is said to occur in a receive-and-forward network when:
 - A. Communication stalls because of cycles in the flow-control dependencies.
 - B. The throughput demanded of a network link exceeds its capacity.
 - C. The volume of e-mail received by each user exceeds the rate at which users can read e-mail.
 - D. The load presented to a network link persistently exceeds its capacity.
 - E. The amount of space required to store routing tables at each node becomes burdensome.

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