CS 348: Computer Networks

- Latency; 31st July 2012

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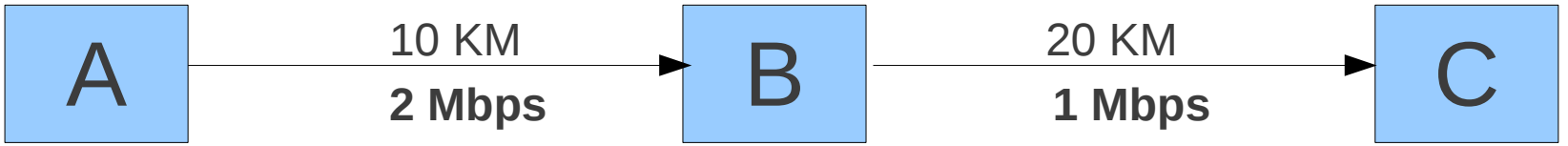
Clicker Question

The time taken for a signal to travel from sender to receiver is: _____.

1. Round-Trip-Time	2. Transmission delay
3. Propagation delay	4. Transmission + Propagation

It is not sufficient to just pick an answer. You need to also think about how you will justify your answer!

Activity: Pair-Solo



How long will it take to successfully transmit a 10MB file from A to C?

- Assume that the speed of light 300000 KM/sec, Queuing delays are zero and that there is no buffer at node B.

- Pair - Discuss the solution approach with your neighbour.
- Solo - Work out the answer by yourself.

Recall from last class (PHY): Bandwidth and Delay

Bandwidth:

- Amount of data that can be transmitted per unit time.

Delay (Latency):

- Time taken to send a message from point A to point B
  - Latency = Propagation + Transmit + Queue
  - Propagation = Distance / SpeedOfLight
  - Transmit = Size / Bandwidth
  - Queue = Waiting for Transmit

Delay X Bandwidth Product

- Relative importance of bandwidth and delay
  - Small message: 1ms vs 100ms dominates 1Mbps vs 100Mbps
  - Large message: 1Mbps vs 100Mbps dominates 1ms vs 100ms
- Example:
  - 100ms delay and 45Mbps bandwidth

    => 560 KB of data in the pipe

Activity: Think-Pair-Share

Consider an web-based email application. Focus on the part between the mail client and the receiving mail server.

- List all the various delays in this communication.
  - Sender side: Sending mail client (Application) sends the email to the Transport layer, which in turn does some processing and sends it to the Network layer, which then sends it to Link layer and down to PHY.
  - Receiver side: PHY receives, sends it up the layers, each doing some processing, till the mail reaches the receiving mail server (Application).
- Assume that there is a direct link between the machines (no need to consider intermediate routers or multi-hop network).

Do this activity in a **Think-Pair-Share** mode.

Class discussion (draw figure)

Major sender side delays:

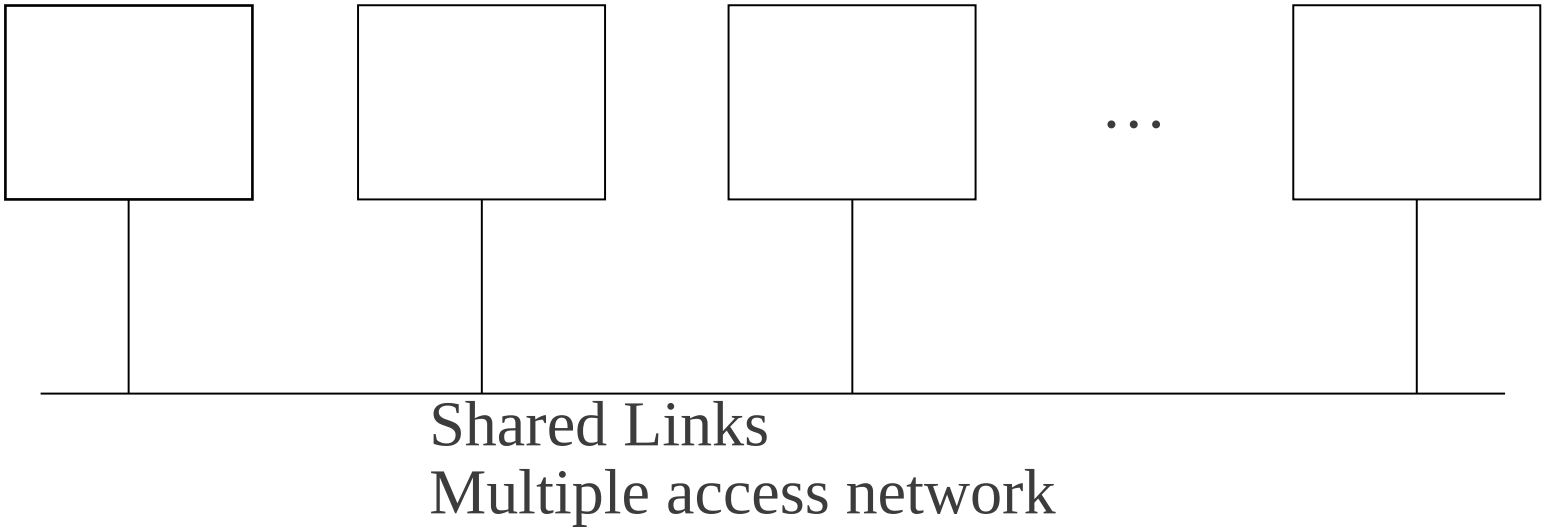
1. Application-to-Transport: Data construction + Header attachment + Queue (delay till transport layer starts processing).
2. Transport-to-Network: Segmentation (create packets), Processing for retransmission (setup buffers, timers), Attach header, Queue (delay till network layer starts).
3. Network-to-Link: Packetization, Processing for routing (Addressing, Route lookup), Queue (for link layer).
4. Link-to-PHY: Queue (medium access) + Transmit.
5. At PHY: Propagation delay.

Class discussion (contd.)

Major receiver side delays:

1. PHY-to-Link: Frame construction (bits to packet); Transmit up to link layer.
2. Link-to-Network: Demultiplexing; Error check.
3. Network-to-Transport: Demultiplexing; Error check.
4. Transport-to-Application: Processing for sending ACK; Reassembly.
5. Application: Manipulation of data (Ex: web server processing requests or browser rendering responses).

We will move from a single link to ...



And then onto … switched networks