COMP 30650 Exercise Sheet 1
The Physical Layer

Units, Latency and Bandwidth Delay Product

Exercises

1. A bike is travelling along at a constant speed of 8 km per hour. How far will it travel in 45 minutes?

2. An image is 1600 × 1200 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to **transmit (*put it on the wire*)** it:

    a) Over a 56-kbps modem channel?
    b) Over a 1-Mbps cable modem?
    c) Over a 10-Mbps Ethernet?
    d) Over 100-Mbps Ethernet?
    e) Over gigabit Ethernet?

3. Two computers are communicating over a 60000 km satellite link by using 4000-bit frames at a transmission rate of 100 kbps. Assuming errorless transmission, and taking the signal speed as 2×10^8 m/sec, calculate:
    a) The time required to transmit a frame (***put it on the wire***).
    b) The propagation delay.
    c) The latency.

4. Two computers are communicating over a 10 km fiber optic link by using 500-byte frames at a transmission rate of 100 Mbps. The propagation speed as 2×10^8 m/sec. Assuming errorless transmission, calculate:
    a) The time required to transmit a frame (***put it on the wire***).
    b) The propagation delay.
    c) The latency.

5. Two computers are communicating over a 39000 km satellite link by using 1920-bit frames at a transmission rate of 64 kbps. The propagation speed as 2×10^8 m/sec. Assuming that no error occurs in transmission, calculate:
    a) The time required to transmit a frame (***put it on the wire***).
    b) The propagation delay.
    c) The latency.

6. Two computers are communicating over a 3000 km fiber optic link by using 1500-byte frames at a transmission rate of 1 Mbps. The propagation speed as 2×10^8 m/sec. Assuming errorless transmission, calculate:
    a) The time required to transmit a frame (***put it on the wire***).
    b) The propagation delay.
    c) The latency.

7. Calculate the Bandwidth Delay Product for the following situations
    a) ADSL2 20 Mbit with 50 ms round trip time.
    b) Gigabit LAN Interface with 1 ms round trip time:

8. Imagine that you have trained your Dog to carry a box of three 8-mm tapes instead of a flask of brandy. These tapes each contain 7 gigabytes of data. The dog can travel to your side, wherever you may be, at 18 km/hour. For what range of distances does the dog have a higher data rate than a transmission line whose data rate (excluding overhead) is 150 Mbps?
   How does your answer change if
    a) The dog's speed is doubled;
    b) Each tape capacity is doubled;
    c) The data rate of the transmission line is doubled.

9. You need to share 80 Gibagbytes of data with your friend. You can share the file via the network at a rate of 150 Mbps or you can drive the disk to your friend's house (100km away) at a speed of 72km/hr. Which is the faster method?
