

1- Discuss the three main differences between LANs and WANs.

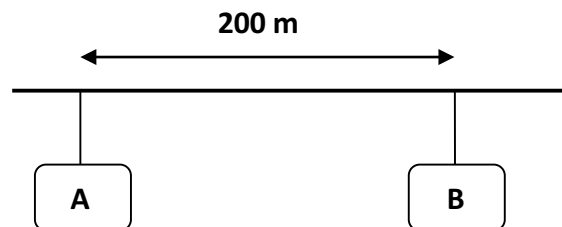
2- Suppose you want to send 50 GB of data to your friend. You can either drive to his home, with a maximum speed of 90 km/hour or you can send it over your DSL connection, which has a data rate of 20 Mbps (both uplink and downlink). What is the maximum distance your friend's home can be away from your home before it is better to use the DSL connection? Ignore the propagation delay.

3- An image is 1920 x 1080 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it:

- a. over a 56-kbps modem channel?
- b. over a 1-Mbps cable modem?
- c. Over a 100-Mbps Ethernet?

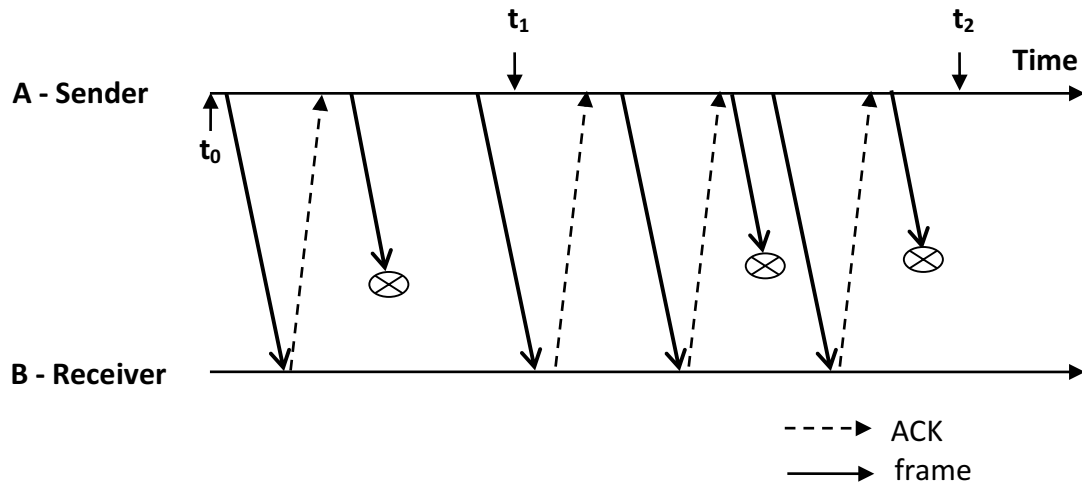
4- Calculate the total time required to transmit a 2-MB file from a server to a client which is 800 km away. The link data rate is 200 kbps. The file is transmitted in 100-KB packets. After each packet is transmitted, the server waits for an acknowledgement to come back from the client, before sending the next packet. The signal speed is 200 km/sec. Ignore the transmission delay of the acknowledgement.

5- Consider A & B two computers connected to a LAN running at 10 Mbps. The cable length between A and B is equal to 200 m. The signal speed on the cable is 200 000 km/sec. Consider a frame of 1500 bytes from A to B.



- a) How much time needs the computer A to transmit the entire frame?
- b) Calculate the propagation delay between A and B.

6- Several frames are sent from A to B, but frame 2, frame 5 and frame 7 are lost. All frames have the same length equal to 1500 bytes. Consider  $t_0 = 0$ ,  $t_1 = 0.6$  ms and  $t_2 = 1.3$  ms.



- Compute the throughput over the link between A and B at  $t = t_1$  and  $t = t_2$ .
- Compute the loss rate over this link at  $t_1$  and  $t_2$ .

7- Suppose the information content of a packet is the data pattern 11111101001100100110011 and an odd parity scheme is being used. What would be the value of the checksum field in a single parity scheme?

8- A bit stream 1110101 is transmitted using the standard CRC method described in the text. The generator polynomial is  $x + 1$ . Show the actual bit string transmitted. Suppose the second bit from the left is inverted during transmission. Show that this error is detected at the receiver's end?

9- The following character encoding is used in a data link protocol: A: 01000111; B: 11100011; FLAG: 01111110; ESC: 11100000 Show the bit sequence transmitted (in binary) for the five-character frame: (B A B ESC FLAG) when each of the following framing methods are used:

- Character count.
  - Flag bytes with byte stuffing.
  - Starting and ending flag bytes, with bit stuffing.
- (FLAG) is used to mark boundaries of frame, and (ESC) is the Character Stuffed code

10- If the distance between two Nodes is 2000 m, the Packet length = 8000 bytes, the Propagation speed =  $2 \times 10^8$  m/s and the channel speed = 20 Mb/s, Determine the propagation delay and transmission delay?