Department of Computer Science and Engineering
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MINOR ASSIGNMENT-01

UNIX Network Programming (CSE 4042)

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Workouts on network performance parameters

1. Assume that an RTT (round trip time) is of 80 ms. An RTT $= 2 \times T_p$, where T_p is the propagation delay. Initially $2 \times$ RTT of "`handshake`" is required to setup the connection before data is sent. The file that would be transmitted is broken into packets of size 1 KB. So, calculate the total time required to transfer a 1.5 MB file in the following cases:

   (a) The bandwidth is 10 Mbps and data packets can be sent continuously.

   (b) The bandwidth is 10 Mbps, but after we finish sending each data packet, we must wait one RTT before sending the next data packet.

   Do a comparative analysis of total time in both the cases to conclude the better approach in sending the file over a network.

2. Hosts **A** and **B** are each connected to a switch **S** via 10-Mbps links as in the below Figure-1. The propagation delay on each link is 20μs. **S** is a store-and-forward device; it begins retransmitting a received packet 35μs after it has finished receiving it. Calculate the total time required to transmit $10,000$ bits from **A** to **B**.

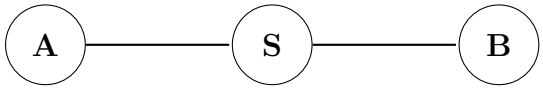

Figure 1: Two node interconnection through a switch

   (a) As a single packet.

   (b) As two 5,000-bit packets sent one right after the other.

3. Consider a closed-loop network (e.g. a token ring network) with bandwidth 100 Mbps and propagation speed of 2×10^8 m/s. What would the circumference of the loop be to exactly contain one 250 byte packet? (**Hint: The bandwidth-delay product defines the number of bits that can fill a link.**)

4. Consider a source computer (S) transmitting a file of size 10^6 bits to a destination computer (D) over a network of two routers (R_1 and R_2) and three links(L_1, L_2,and L_3). L_1 connects S to R_1; L_2 connects R_1 to R_2; and L_3 connects R_2 to D. Let each link of length 100km. assume signals travel over each line at a speed of 10^8 meters per second. Assume that bandwidth of the network is 1 Mbps(i.e. the link bandwidth on each link is 1Mbps). Let the file broken down into 1000 packets each of size 1000 bits. Find the total sum of transmission and propagation delays in transmitting the file from S to D.

5. Let us consider a typical two node network. The two nodes are D meter distance apart. The date rate of the network is R bps and the propagation speed is V m/sec. Determine the efficiency and throughput of the network for a packet size of P bits transmitted from one node to other node in terms of transmission time and propagation time.

6. A system has an n-layer protocol hierarchy. Applications generate messages of length M bytes. At each of the layers, an h-byte header is added. What fraction of the network bandwidth is filled with headers?

7. An image is 1024×768 pixels with 3 bytes/pixel. Assume the image is uncompressed. How long does it take to transmit it over a 56-kbps modem channel? Over a 1-Mbps cable modem? Over a 10-Mbps Ethernet? Over 100-Mbps Ethernet?

8. A 100 km-long cable runs at the T1 data rate. The propagation speed in the cable is 2/3 the speed of light in vacuum. How many bits fit in the cable? (T1 data rate is 1.544 mbps and speed of light in vacuum 3×10^8 m/sec)

9. Suppose, we need to download a book. The book contains 80 pages, each page is an average 20 lines with 80 characters in each line, each character requires 8 bit. If we want to download the books in 30 sec, what will be the required bit rate.

10. If the data rate of a ring network is 20 Mbps, signal propagation speed is 200 m/s, then the number of bits that can be placed on the channel of 200 km is.