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CSEN503 Introduction to Communication Networks
Winter Term 2022
Practice Assignment 2

Problem 2-1

Consider an application that generates a burst of 5 packets once every minute. Each packet has length 1Mbit. If the packets are to be sent through a packet-switched network that has rate 1Mbps, what is the delay encountered for each packet? Assuming that this application is the only one running on the network, what is the utilization (the percentage of time that network resources are occupied)?

Problem 2-2

Consider two hosts, A and B, connected by a single link of rate (bandwidth) R (measured in Kbits/s). Suppose that the two hosts are separated by m meters, and the propagation speed along the link is S_p meters per second. Host A is to send a packet of size L bits to host B.

(a) Express the propagation delay D_p in terms of m and S_p.
(b) Express the transmission delay D_t in terms of L and R.
(c) What will be the total end-to-end delay?
(d) Suppose $S_p = 2x10^8$ m/s, L = 100 bits, and R = 28 kbps. Find the distance m such that $D_p = D_t$.

Problem 2-3

Consider a point-to-point link m = 100 km in length. The propagation speed S_p of bits in this link is $2x10^8$m/s. At what bandwidth B will propagation delay D_p equal transmission delay D_t for a 100 byte packets?

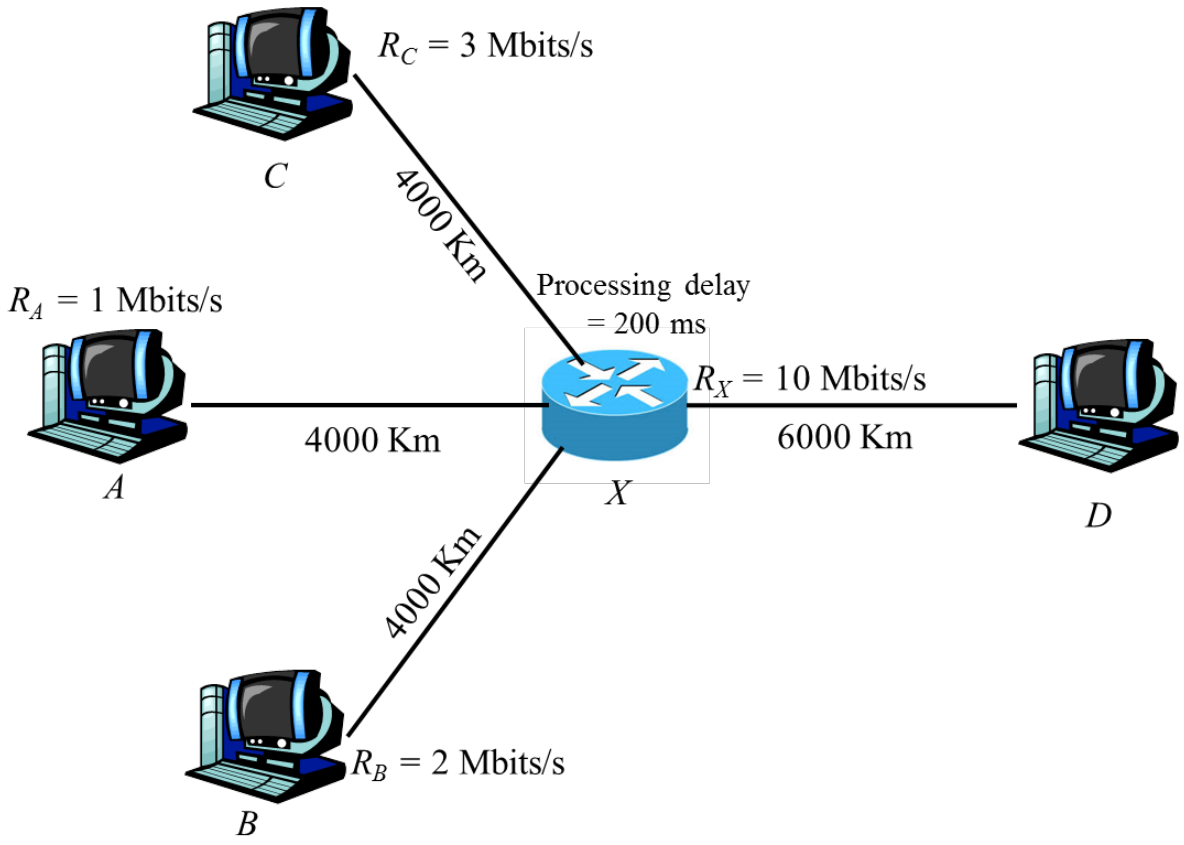
Problem 2-4

Host A wants to send a 1Mbyte packet to Host B. The propagation speed of bits is $2x10^8$ m/s. Assume that A and B are connected via a router R. Link AR connects A to R, and link RB connects R to B. Link AR is 1 km long and link RB is 2 km long. Suppose the capacity of each

of the two links is 10 Mbytes/s and the processing delay at the Router (R) is 10 ms. After how much time will host B receive the packet. Note that Router (R) must receive the whole packet before being able to forward it.

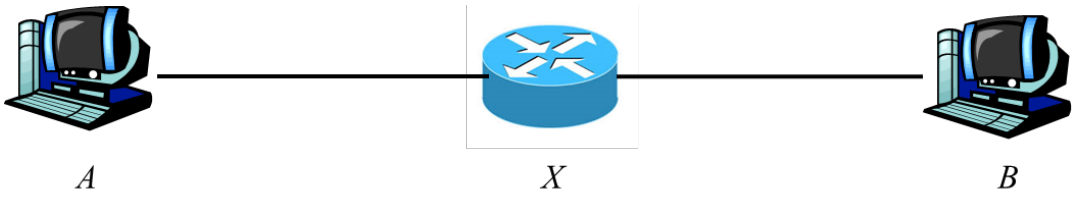
Problem 2-5 (Winter 2017 Quiz 1 V1)

The figure below shows a network of four clients: A, B, C, and D, connected through a router, X. The transmission rate of each device and length of each link are shown on the figure. In addition, the processing delay of the router is 200ms. At t = 0, clients A, B, and C each send a packet of size 1 Mbits to Client D (through the router). Calculate the total delay for each packet until they are received at D. Assume the propagation speed over all links is 2.0×10^8 m/s. Also assume that initially the router's queue (buffer) is empty and that there is no traffic other than the three packets mentioned above.



Problem 2-6 (Winter 2017 1st Chance Midterm - Question 2)

The figure below shows a network where Host A is communicating with Host B through Router X. Assume that propagation delays and the router's processing delay can be ignored. Host A and Router X can transmit at the same rate of 1Mbits/s.



a) If Host A generates a burst of 5 packets, where the size of each packet is 1 Mbits, and sends them back-to-back to Host B through Router X, calculate the total delay until all packets are received at Host B if store-and-forward packet switching is used at Router X.

b) Repeat part a) if circuit switching is used at Router X.

c) Instead of generating a burst of 5 packets, Host A now generates only one packet with size 5 Mbits. Calculate the delay if store and forward packet switching is used.

d) Repeat part c) if circuit switching is used.