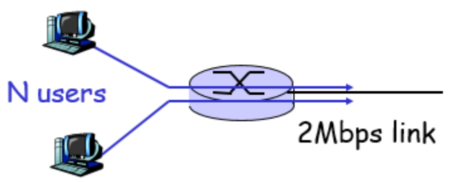
《计算机网络 I-双语》 第 2 次课 （Chapter 1- Network Core、Delay loss and throughput） 作业答案

1. Suppose users share a 2 Mbps link. Also suppose each user transmits continuously at 1 Mbps when transmitting, but each user transmits only 20 percent of the time.



   a. When circuit switching is used, how many users can be supported?

      Answer: 2 users

   b. For the remainder of this problem, suppose packet switching is used. Why will there be essentially no queuing delay before the link if two or fewer users transmit at the same time? Why will there be a queuing delay if three users transmit at the same time?

      Answer: Since each user requires 1Mbps, if two or fewer users transmit simultaneously, maximum of 2Mbps is required. The bandwidth of link is 2Mbps, so there will be no queuing delay.

      But there will be a queuing delay if three users transmit at the same time because they required 3Mbps bandwidth

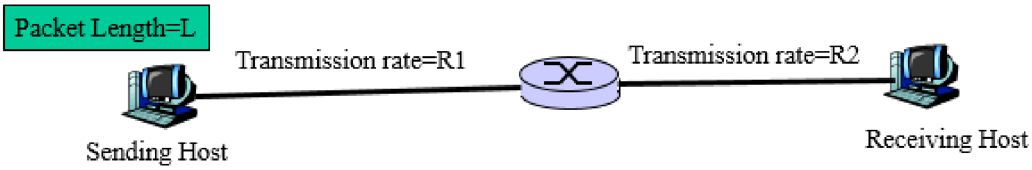
   c. Find the probability that a given user is transmitting.

      Answer: 0.2

   d. Suppose now there are three users. Find the probability that at any given time, all three users are transmitting simultaneously. Find the fraction of time during which the queue grows

      Answer: probability of three users transmit simultaneously is 0.2*0.2*0.2=0.008， so the fraction of time during which the queue grows is 0.008

2. Suppose there is exactly one packet switch between a sending host and a receiving host. The transmission rates between the sending host and the switch and between the switch and the receiving host are R1 and R2 , respectively. Assuming that the switch uses store-and-forward packet switching, what is the total end-to-end delay to send a packet of length L? (Ignore queuing, propagation delay, and processing delay.)



Answer：L/R1+L/R2

3. Consider sending a packet from a source host to a destination host over a fixed route. List the delay components in the end-to-end delay. Which of these delays are computable and which are not?

Answer: The delay components are processing delays, transmission delays, propagation delay and queuing delay. Transmission delays and propagation delay are computable。 Processing delays and queuing delay are not computable.

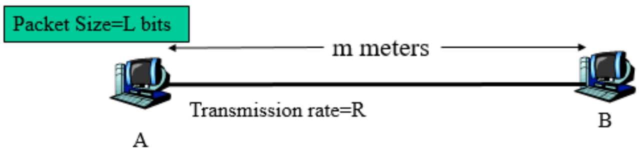
4. The transmission distance between the two hosts is 10km.The propagation rate of the signal on the media is $2*10^8$m/s. Try to calculate the propagation delay and transmission delay if the data block length is 1500bit and the bandwidth is 100Mb / s

Answer：

Propagation delay =10km/$2*10^8$m/s=$5*10^{-5}$s

Transmission delay =1500bit/100Mb/s=$1.5*10^{-5}$s

5. Consider two hosts, A and B, connected by a single link of rate R bps. Suppose that the two hosts are separated by m meters, and suppose the propagation speed along the link is s meters/sec. Host A is to send a packet of size L bits to Host B.



a. Express the propagation delay, d_prop , in terms of m and s.

   Answer: d_prop=m/s seconds

b. Determine the transmission time of the packet, d_ trans , in terms of L and R.

   Answer: d_ trans=L/R seconds

c. Ignoring processing and queuing delays, obtain an expression for the end-to-end delay.

   Answer: (m/s+ L/R) seconds

d. Suppose Host A begins to transmit the packet at time t = 0. At time t = d_ trans ,where is the last bit of the packet?

Answer: The bit is just leaving the host A

e. Suppose d prop is greater than d_trans . At time t = d_trans , where is the first bit of the packet?

Answer: the first bit is in the link and has not reached Host B

f. Suppose d prop is less than d_trans . At time t = d_trans , where is the first bit of the packet?

Answer: the first bit has reached Host B

g. Suppose s = $2.5 \cdot 10^8$m/s , L = 120 bits, and R = 56 kbps. Find the distance m so that d_prop equals d_trans

Answer: m=L/R*s=$(120/56*10^3)(2.5*10^8)$=536km

6. Suppose Host A wants to send a large file to Host B. The path from Host A to Host B has three links, of rates R 1 = 500 kbps, R 2 = 2 Mbps, and R 3 = 1 Mbps.

a. Assuming no other traffic in the network, what is the throughput for the file transfer?

Throughput is Min{500kbps,2Mbps,1Mbps}, 500Kbps

b. Suppose the file is 4 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

Each block is 500kb

4 million bytes= 32 million bits

32 million bits / 500kb=64

The file will be divided into 64 blocks, each block is 500kb

It will take: 64*500kb/500kbps=64 seconds

c. Repeat (a) and (b), but now with R 2 reduced to 100 kbps.

throughput is Min{500kbps，100kbps,1Mbps}, 100kbps

The file will be divided into 320 blocks, each block is 100kb

It will take: 320*100kb/100kbps=320 seconds