CSCE – 5580 Computer Networks – Assignment 1

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Q1) Suppose users share a 3 Mbps link, where each user transmits continuously at 1 Mbps when transmitting. Each user transmits only 20% of the time.

a) **When circuit switching is used, how many users can be supported?**
   Given
   Total Bandwidth = 3Mbps and Bandwidth for 1 user = 1Mbp
   We know that Bandwidth for 1 user = Total Bandwidth / Total Number of users
   Number of users = 3M / 1M
   A maximum of 3 users can be supported with this configuration.

b) **If three or fewer users transmit at the same time, will there be queuing delay before the link?**
   Each user requires 1Mbps of speed when transmitting. The total available bandwidth is 3Mbps. If 3 or fewer users transmit simultaneously, a max of 3mbps will be required. The available bandwidth will satisfy the mentioned requirement, so there will no delay in queuing before the link.

c) **Given any time, find the probability that a given user is transmitting.**
   Each user only transmits 20% of the time, which signifies that 80% of the time they will be inactive and will be actively transmitting only 20% of the time.

   The probability of a given user transmitting at any specific time is equal to their active time divided by the total time, which is active time + inactive time.

   Probability of user transmitting = Active time/Inactive time
   = 0.2/ (0.2 + 0.8)
   = 0.2/1
   = 0.2
   Hence, the probability f user transmitting at any time is 0.2.

d) **Suppose now there are five users. Find the probability that at any given time, more than three users are transmitting simultaneously.**
   Given total user = 5
   Prob (mor than 5 user transmitting simultaneously) = prob (4 users transmitting simultaneously) + prob (5 users transmitting simultaneously)
   = 5C4 * 0.24*(1 - 0.2) + 5C5 * 0.25
   = 5* 0.23* 0.8 + 0.25
   = 0.00672

Q2) **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. We assume that the switch uses store-and-forward packet switching.**

Question: what is the total end-to-end transmission delay to send a packet of length L?

At the given time t0, the sending host begins to transmit. At time t1 = L/R1, the sending host completes transmission and the entire packet received at the router(as there is no propagation delay).

Because the router has the entire packet at time t1, it can begin to transmit the packet to the receiving host at time t1.

At time t2 = t1 + L/R2, the router completes the transmission, and the entire packet is received at the receiving host (and again, there is not propagation delay).

So, from the above discussion we can conclude that the end to end delay is L/R1 + L/R2.

Q3) **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 R1=1 Mbps, R2=200 kbps, and R3=2 Mbps.**

a) Assuming no other traffic in the network, what is the throughput for the file transfer?
Given:
R1 = 1Mbps
R2 = 200Kbps
R3 = 2 Mbps

The throughput for the file transfer = min [R1, R2, R3]
= min [1Mbps, 200Kbps, 2 Mbps]
= 200 kbps

Therefore, the throughput for the file transfer will be 200Kbps.

b) Suppose the file is 1 million bytes. Dividing the file size by the throughput, roughly how long will it take to transfer the file to Host B?

Given the file size as 1 million bytes.

If we convert the size to bits, it will be equal to 8000000 bits

From the above question we have deduced that the throughput is 200 kbps

To get the time required to transfer the file of mentioned size, we will divide the file size by throughput of the file transfer.

Time required = file size / throughput of transfer

= 8000000 bits / 200000 bps

= 40 Seconds

So, approximately it will take 40 seconds to transfer the file to host B

Q4) **How long does it take a packet of length 2,000 bytes to** *propagate* **over a link of distance of 3,000 km, propagation speed $2.0*10^8$ meters/sec, and transmission rate 2 Mbps?**

We know that, propagation delay (Tp) = Distance / Speed

= 3000 km / $2 * 10^8$

= $1.5 * 10^{-2}$

= 15 ms

So, the time taken for a packet of length 2000 bytes to propagate over 3000 km at $2 * 10^8$ m/sec would be 15 ms.