CS-307 Computer Networks 26 September 2018
QUIZ #1 Duration: 20 Minutes
Section – A Weightate 5%

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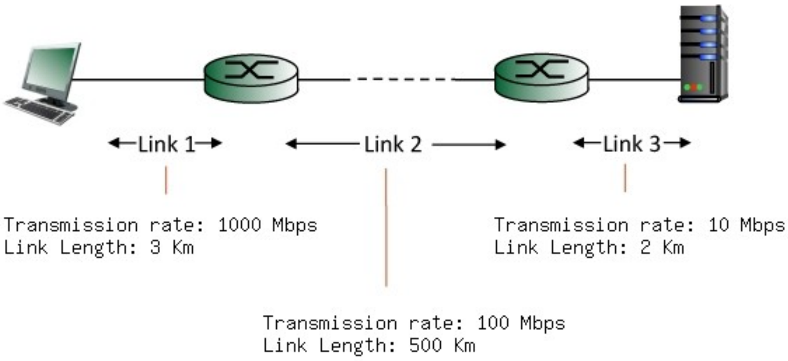
1. Consider the figure below, with three links, each with the specified transmission rate and link length.

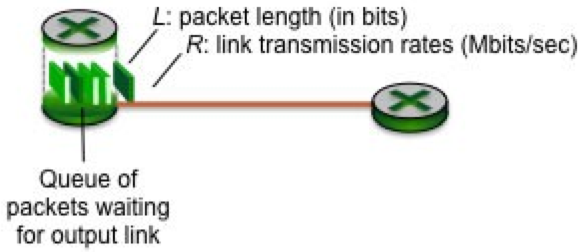


Find the end-to-end delay (including the transmission delays and propagation delays on each of the three links, but ignoring queueing delays and processing delays) from when the left host begins transmitting the first bit of a packet to the time when the last bit of that packet is received at the server at the right. The speed of light propagation delay on each link is 3x10**8 m/sec. Note that the transmission rates are in Mbps and the link distances are in Km. Assume a packet length of **16000** bits. Give your answer in milliseconds. [10+10+10=30 Marks]

Link 1 transmission delay = L/R = 16000 bits / 1000 Mbps = 0.016000 msec.
Link 1 propagation delay = d/s = 3 Km / 3*10**8 m/sec = 0.010000 msec.
Link 2 transmission delay = L/R = 16000 bits / 100 Mbps = 0.160000 msec.
Link 2 propagation delay = d/s = 500 Km / 3*10**8 m/sec = 1.666667 msec.
Link 3 transmission delay = L/R = 16000 bits / 10 Mbps = 1.600000 msec.
Link 3 propagation delay = d/s = 2 Km / 3*10**8 m/sec = 0.006667 msec.

Thus, the total end-to-end delay is the sum of these six delays: 3.459333 msecs.

2. Consider the figure below, in which a single router is transmitting packets, each of length *L* bits, over a single link with transmission rate *R* Mbps to another router at the other end of the link.



Suppose that the packet length is *L*= 12000 bits, and that the link transmission rate along the link to router on the right is *R* = 100 Mbps.

(a) What is the transmission delay (the time needed to transmit all of a packet's bits into the link)?
(b) what is the maximum number of packets per second that can be transmitted by the link?

[10+10=20 Marks]

(a)The link transmission delay = L/R = 12000 bits / 100 Mbps = 0.120000 msec.
(b) The link can transmit 8333.333333 packets per second

1.1 What is the maximum achievable end-end throughput (in Mbps) for each of four client-to-server pairs, assuming that the middle link is fair-shared (i.e., divides its transmission rate equally among the four pairs)? Provide a brief explanation of your answer.

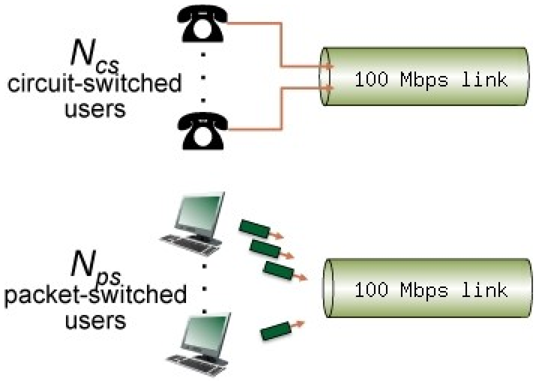
1.2 Which link is the bottleneck link for each session? and Why?

1.3 Assuming that the senders are sending at the maximum rate possible, what are the link utilizations for the sender links (R_S), client links (R_C), and the middle link (R)?

2. Consider the two scenarios below:

- A circuit-switching scenario in which N_{cs} users, each requiring a bandwidth of 25 Mbps, must share a link of capacity 100 Mbps.
- A packet-switching scenario with N_{ps} users sharing a 100 Mbps link, where each user again requires 25 Mbps when transmitting, but only needs to transmit 30 percent of the time.

[10+10 = 20 Marks]



2.1 When circuit switching is used, what is the maximum number of circuit-switched users that can be supported? Explain your answer.

2.2 Now suppose that packet switching is used. Suppose there are 7 packet-switching users (i.e., N_{ps} = 7). Can this many users be supported under circuit-switching? Explain.