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

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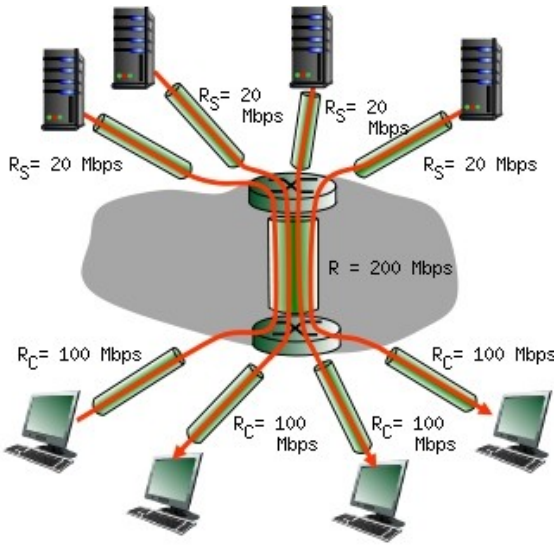
1. Consider the scenario shown below, with four different servers connected to four different clients over four three-hop paths. The four pairs share a common middle hop with a transmission capacity of R = 200 Mbps. The four links from the servers to the shared link have a transmission capacity of R_S = 20 Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of R_C = 100 Mbps per second. [10+10+10=30 Marks]



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.

The maximum achievable end-end-throughput is 20 Mbps.

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

This is the transmission capacity of the first hop, which is the bottleneck link, since the first-hop transmission capacity of 20 Mbps is less than one quarter of the shared-link transmission capacity (200/4 = 50 Mbps) and less than the third-hop transmission capacity of 100 Mbps.

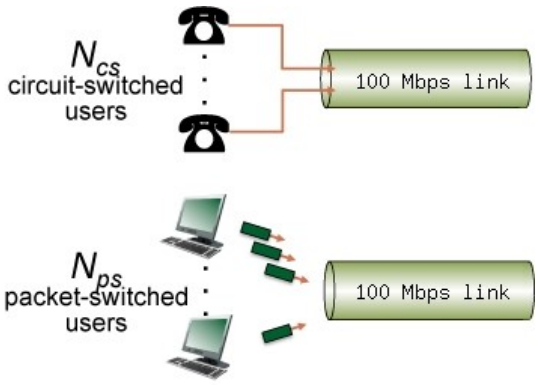
1.3 Assuming that the senders are sending at the maximum rate possible, what are the link utilizations for the sender links (R_S), client links (R_C), and the middle link (R)?

The utilization of sender links is 100% . The utilization of receiver links is 20% . The utilization of the middle link is 40% .

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.

When circuit switching is used, at most 4 circuit-switched users that can be supported. This is because each circuit-switched user must be allocated its 25 Mbps bandwidth, and there is 100 Mbps of link capacity that can be allocated.

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.

No. Under circuit switching, the 7 users would each need to be allocated 25 Mbps, for an aggregate of 175 Mbps - more than the 100 Mbps of link capacity available.