

Course Code: CS3001	Course Name: Computer Networks
Instructors: Ms. Yusra Kaleem	
Student Name:	Section & Roll No.:

Time Allowed: 35 minutes.

Maximum Points: 15 points

**Question #1:** What are the different approaches of moving data through the network?

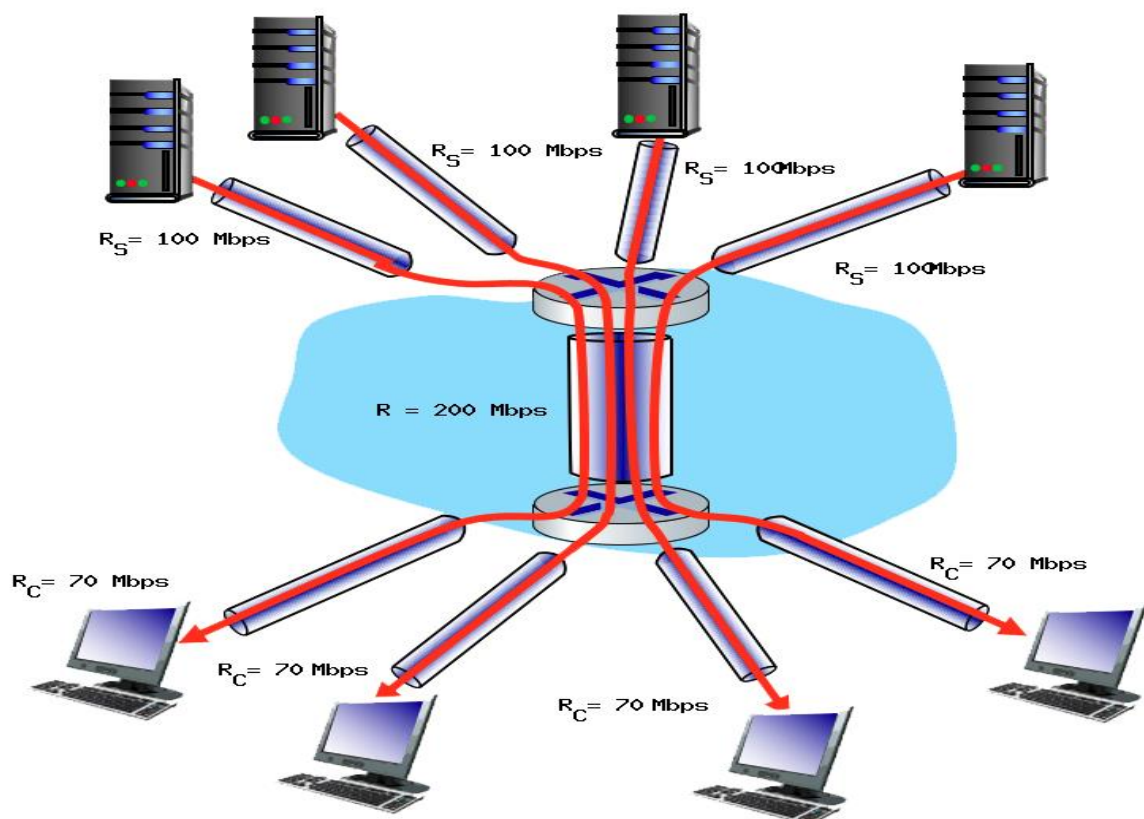
[2points]

**Answer #1: Packet Switching:** Packet switching is a method for sending data whereby the data is divided in packets. Each packet is given a header containing information of the destination. Each packet is forwarded through the network to the destination using this information.

**Circuit Switching:** Circuit-switched is a type of network in which a physical path is obtained for and dedicated to a single connection between two end-points in the network for the duration of the connection. Ordinary voice phone service is circuit-switched.

**Question #2:** 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  $R_S = 100$  Mbps. Each of the four links from the shared middle link to a client has a transmission capacity of  $R_C = 70$  Mbps.

[4points]



A) What is the maximum achievable end-end throughput (in Mbps) for each of four client-to-server pairs, assuming that the middle link is fairly shared?

Solution#  $R = 200\text{Mbps}/4 = 50\text{Mbps}$ . End to End Throughput =  $\min \{R_S, R, R_C\} = \{100\text{Mbps}, 50\text{Mbps},$

70Mbps} = End to End throughput = 50Mbps

B) Which link is the bottleneck link?

Solution# The middle link is bottleneck link.

C) Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the server links ( $R_s$ )?

Solution#  $R_s$  link Utilization =  $50/100 = 0.5$  or in % it is 50%

D) Assuming that the servers are sending at the maximum rate possible, what are the link utilizations for the client links ( $R_c$ )?

Solution#  $R_c$  link utilization =  $50/70 = 0.71$  or in % it is 71%

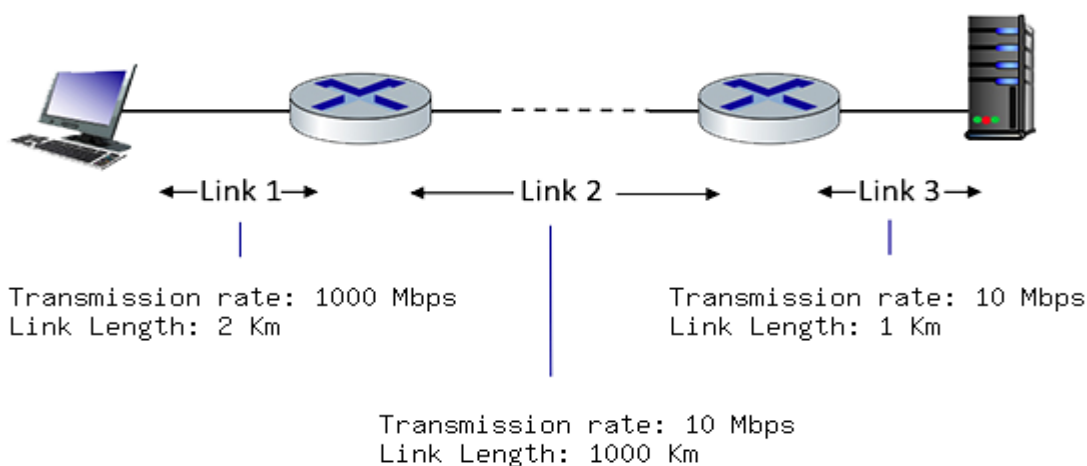
E) Assuming that the servers are sending at the maximum rate possible, what is the link utilizations for the shared link ( $R$ )?

Solution#  $R$  link utilization =  $50/50 = 1$  or in % it is 100%

Question #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 constant and which are variable? [1points]

Solution: The delay components are processing delays, transmission delays, propagation delays, and queuing delays. All of these delays are fixed, except for the queuing delays, which are variable.

Question #4: Consider the figure below, with three links, each with the specified transmission rate and link length. Store & forward technique is used by switches. [5points]



Assume the length of a packet is 8000 bits. The speed of light propagation delay on each link is  $3 \times 10^8$  m/sec.

A) What is total Transmission delay?

Solution#  $T_1 + T_2 + T_3 = L/R_1 + L/R_2 + L/R_3$

Total transmission delay =  $(8000/1000 \times 10^6) + (8000/10 \times 10^6) + (8000/10 \times 10^6)$

Total Transmission delay = 1.608msec

B) What is total Propagation delay?

Solution#  $P1 + P2 + P3 = d1/s + d2/s + d3/s = (2 \times 10^3 / 3 \times 10^8) + (1000 \times 10^3 / 3 \times 10^8) + (1 \times 10^3 / 3 \times 10^8)$

Total Propagation delay = 3.43msec

C) Calculate the total end to end delay?

Solution# Total end to end delay = Total transmission delay + total propagation delay

Total end to end delay = 1.608msec + 3.43msec = 5.038msec

D) What is end-end throughput & which link is bottleneck link?

Solution# Throughput is 10Mbps & link 2 & 3 are bottleneck link.

E) How many packets each link can send in a second?

Solution# R/L

Link 1 =  $1000 \times 10^6 / 8000 = 125000$  packets in one sec

Link 2 & 3 =  $10 \times 10^6 / 8000 = 1250$  Packets in one sec

Question #5: What do you understand from Packet Sniffing, Routing & Forwarding, Throughput and Encapsulation?  
[2points]

- Solution# Packet sniffing, a network attack strategy, captures network traffic at the Ethernet frame level. After capture, this data can be analyzed, and sensitive information can be retrieved. Such a network attack starts with a tool such as Wireshark. A person with a packet sniffer can view this data as it crosses your network.
- Routing is the process of moving data between two devices. Forwarding is the process of collecting data from one device and sending it to another device.
- Forwarding is about moving a packet from a router's input port to the appropriate output port. Routing is about determining the end-to-routes, the path between sources and destinations.
- Throughput refers to the rate of message delivery over a communication channel, such as Ethernet or packet radio, in a communication network. The data that these messages contain may be delivered over physical or logical links, or through network node.
- Encapsulation is adding information from each layer of OSI or TCP/IP model to the packet header treating the higher layer information as data.

*BEST OF LUCK!*