Austin Melendez
302368430
CSC138 - Section 03

Homework 1

1)

a) Transmission delay is the time it takes to get all the bits into the wire itself, limited by the bandwidth speed of the link. This can be calculated by using the equation (L/R) where the packet length (L) is in bits and the link bandwidth (R) is in bits per second. The propagation delay is how long it takes for a bit to physically travel from sender end of the connection to the receiver's end. This can be calculated using the equation (d/s) where (d) is the distance of the physical line and (s) is the propagation speed of the line.

b) As the arrival rate of the pack rate increases the queueing delay would become longer, since the queueing delay depends on the congestion level of the router. As more packets arrive, the queue becomes longer, and in extreme cases it can lead to the loss of packets.

c) In order to reduce the propagation delay the only two things you could change are increasing the speed of the physical connection with a higher speed, using something like fiber optic, or you can somehow reduce the physical distance of the connection.

2)

a) In order to have a continuous stream of data you would want to use a circuit-switched network approach. This is because with a circuit-switched network approach you have a guaranteed bandwidth since end-end resources are allocated to and reserved for your communications between the source and destination.

b) The maximum number of users the network can support is 150. If the network has a 1500 Mbps capacity and each user requires 100 Mbps, but only 10 percent of users are active at any time, then the network can support 15 active users. However, if only 10 percent are active at any time, then the network can support 150 maximum users, given that it never exceeds 10 percent usage.

3)

3) a) $X \sim Bin(n,p) \longrightarrow X \sim Bin(29, 0.01)$

$$P(X=1) = \binom{29}{1} .01^1 (1-.01)^{29-1} = \binom{29}{1} .01^1 (.99)^{28}$$

$$P(X=1) = 0.2188685933 = \boxed{0.218869}$$

b)

$$P(X \leq 15) = \sum_{i=0}^{15} \binom{29}{i} 0.01^i \cdot (.99)^{29-i}$$

$$= \binom{29}{0} .01^0 (.99)^{29} + \binom{29}{1} .01^1 (.99)^{28} + \ldots + \binom{29}{15} .01^{15} (.99)^{14}$$

$$P(X \leq 15) = (0.747172) + (0.218869) + (.030951142) + (.0028157) + (.00018474) + (.0000093) + \ldots + (6.7378 \times 10^{-23})$$

$$\boxed{P(X \leq 15) \approx 1.000000}$$

c)

$$P(X > 15) = 1 - P(X \leq 15) = 1 - (1.000) = 0$$

$$\boxed{P(X > 15) = 0.000000}$$

As long as users are truly active only one percent of the time, then this means that more users can be easily supported with a much lower bandwidth using packet-switching. This

means a reduction in cost of infrastructure, while still maintaining support for a very large amount of users.

4)

a) Throughput = $\min\{R_1, R_2, R_3\}$

= $\min\{1, 1, 100, 10\}$

= 1 Mbps

b) $d_{trans} = L/R = 10\text{ kb}/1\text{ Mbps} = 80000\text{ bits}/1000000\text{ bps}$

$d_{trans} = .08$ sec

$d_{prop} = d/s = 4\text{ km}/3\times10^8\text{ m/sec} = 4000\text{ m}/3\times10^8\text{ m/s}$

$d_{prop} = .0000133\overline{3}$ sec

c) $d_{trans} = 80000\text{ bits}/100\,000\,000\text{ bps} = .0008$ sec

$d_{prop} = 10000\text{ m}/3\times10^8\text{ m/s} = .0000033\overline{3}$ sec

d) $d_{trans} = 80000\text{ bits}/10000000\text{ bps} = .008$ sec

$d_{prop} = 200000\text{ m}/3\times10^8\text{ m/s} = .00000666$ sec

e) $d_{end\text{-}end} = \sum (d_{proc} + d_{trans} + d_{prop} + d_{queue})$

$= (0 + .08 + .000013 + 0) + (.0008 + .0000033\overline{3}) +$
$(.008 + .000006\overline{6})$

$d_{end\text{-}end} = 0.089133333$ sec

f) $d_{trans} = .0008$ sec

$d_{prop} => .0008 = X\ m / 3 \times 10^8\ m/s =$

$.0008\ (3 \times 10^8\ m/s) = X\ m$

$X = 240000\ m$

5)

a) The maximum number of simultaneous connections supported at any one time in the given network is 16.

b) The maximum number of simultaneous connections supported between Router A and Router C in the given network is 8.

c) No, it is not possible to make both of these connections simultaneously, because when Router A connects with Router C it will either be networked through Router B or Router D. This means that either Router B or Router D will have both connections to it occupied by the four users on the other routers.

6)

$20TB / 1Gbps = 1.6 \times 10^{14}\ bits / 1000000000\ bps$

(1TB = 8×10^{12} bits)

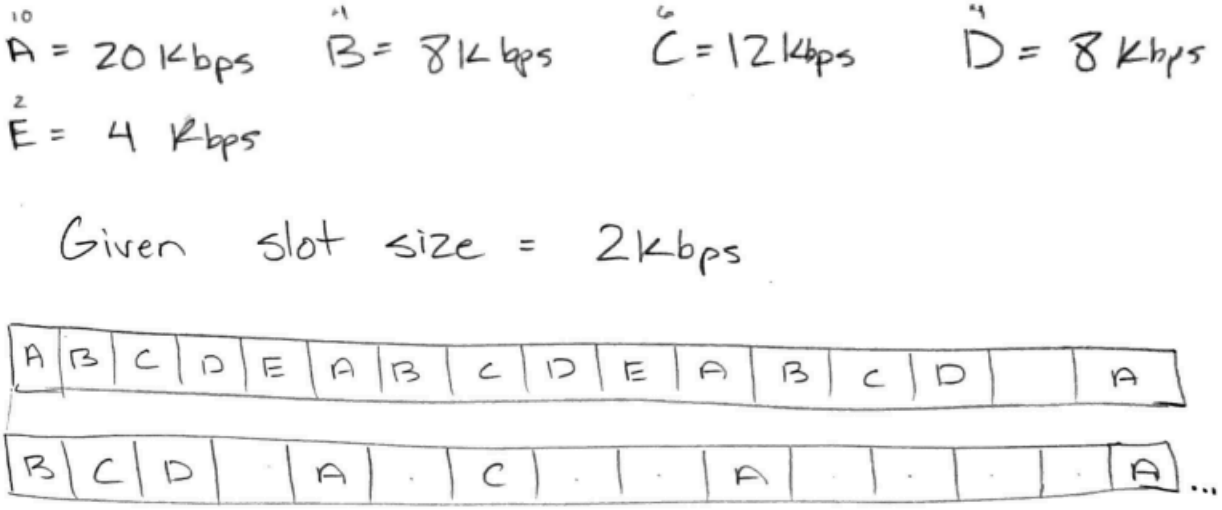
$= 160000\ sec \times \frac{1m}{60sec} \times \frac{1hr}{60m}$

$= 44.444\ hrs > 24\ hrs$

It would be faster to ship the drive overnight using FedEx because the transmission time of 20TB over a 1Gbps dedicated link is greater than 24 hours.

7) The protocol layers are the Application layer, Transport layer, Network layer, Link layer, and Physical layer. The advantages of organizing networked systems into protocol layers is for increased modularity which eases maintenance and improves reliability. It also facilitates interoperability between systems, and allows easy troubleshooting and abstraction between layers

8) With 5 different inputs, and given that the common slot size is 2 Kbps, you will need 50 total time slots, since with a synchronous TDM time slots are reserved, there will be many blank slots until A has transmitted all its data.



9) In order to investigate a suspected DDOS attack, you can utilize a packet "sniffing" tool, such as wireshark, to investigate the packets coming into the network. This tool copies every packet that is sent to and from the server. This will give you information like passwords, personal information, protocol types, server and user information, etc.