

ECEN4533 Exam #2 20 April 2009

1) A data network switch is connected to a 5.3 Mbps trunk line running at a 79% load. The traffic is known to be self similar with an H parameter value of 0.59 and an average packet size (including overhead) of 430 bytes.

1a) [10] **Compute** the average number of packets $E[K(t)]$ in the switch. [Answer = 7.087 packets]

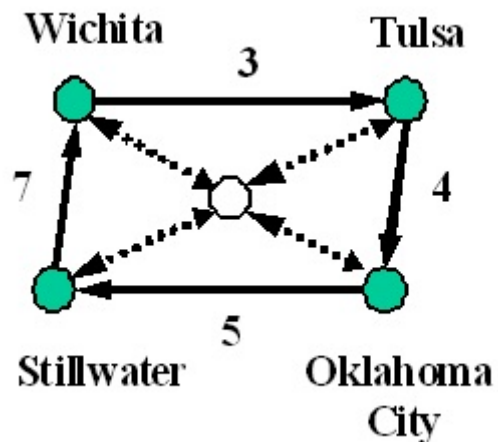
1b) [10] **Compute** the average time $E[T]$ a packet spends in the switch. [5.823 msec]

1c) [5] **Compute** the average number of packets/second exiting the switch. [1,217 packets/second]

2) The traffic to a switch connected to a 1.5 Mbps trunk has exponentially distributed inter-arrival times and two equally likely packet sizes; 50 bytes and 1450 bytes (includes overhead). The trunk load is known to be 68%.

[25] **Compute** the average time $E[T]$ a packet spends in this switch. [11.95 msec]

3) An active *unidirectional* ring network between Tulsa, Oklahoma City, Stillwater, and Wichita, consists of four *links*, shown as solid lines. The number of *circuits* carried on each link is a number listed by each link. The dotted lines represent inactive *bidirectional* leased line connections of a protection network that will only be activated if a link on the unidirectional ring fails. The protection network is then required to carry traffic between the two nodes formerly connected by the failed unidirectional link. The circle in the middle represents a switching node that will be activated as part of the protection network. This node will be able to switch inbound traffic on any protection line to any output protection line.



[25] Optimally size the two way leased line protection links such that the system will still function properly if a *single* link failure occurs on any of the four links on the active unidirectional ring network. [Note: Optimally means don't make the leased lines sized to carry more circuits than they need to carry. For example if you state all 4 leased line circuits should be sized to carry 100 circuits, you'll have a system that can certainly survive any single link failure on the ring, but the protection system will be more costly than it needs to be.] [The Wichita & Stillwater protection links to the central switch need to be sized to carry 7 circuits. The Tulsa and OKC links need to be able to carry 4 and 5 circuits respectively.]

4) A window flow control system is being used on a link with a Normalized Propagation Delay (NPD) of 5. The window is hard-wired to be 5 segments (packets). The average time to transmit a packet is known to be 10 μ sec, and the average time to transmit an ACK is 1 μ sec. ACK's are

generated and transmitted by the receiver immediately upon successful reception of the last byte of every segment. Processing times at the information source and sink can be treated as = 0.

4a) [10] **Calculate** the expected efficiency of this system. [0.4505]

4b) [15] Suppose the window is adjusted to be fixed at 11 segments. A 10 segment file is to be transmitted, but the 2nd segment disappears en route and hence its ACK never shows at the transmitter. If the transmitter has a TIME OUT value of 12 NPD (clock starts when the leading edge of packet #2 is transmitted) and Go Back N is being used...

Calculate the time it will take for the 10 segment file to be successfully transmitted assuming no other traffic disappears. The clock starts when the leading edge of segment #1 is transmitted by the information source and stops when the ACK for #10 is received by the information source.

[321 μ sec]