Kent Mark

Cpre 489 – Homework 1

9/11/2021

Homework 1

Problem 6

* 1. L/R seconds
  2. The bit is just leaving Host A
  3. The first bit is in the link and hasn’t reached Host B yet
  4. The first bit has made it to Host B

Problem 8

* 1. Given total “n” users to be transmitted simultaneously the probability is

Problem 13

* 1. (L/R + 2L/R + … + (N-1)L/R)/N

= L/(RN) \* (1 + 2 + … + (N-1))

= L/(RN) \* N(N-1)/2

= LN(N-1)L/(2R)

1. It takes LN/R seconds to transmit N packets. As such, the buffer is empty when each batch of N packets arrive. This means that the average delay of a packet across all batches is the average delay within one batch which is (N-1)L/2R

Problem 25

1. = 400000 bits
2. Size of file = 800000 bits, transmission rate between A and B is 5 Mbps. The maximum number of bits that the link can have is independent of the file size, but is dependent on the bandwidth delay product which we calculated in a previous problem. So the maximum amount of bits in a link at any given time is 400000 bits.
3. The bandwidth-delay product can be described as the maximum number of bits that can be in a link.
4. The width of a bit = length of link / bandwidth-delay product, so 1 bit is 125 meters long, which is longer than a regulation football field.
5. s/R

Problem 31

1. Time from source host to packet switch = = 0.2 seconds. With store and forwarding switching the total time to move message from the source host to the destination host is 0.2 seconds \* 3 hops = 0.6 seconds.
2. Time to send 1st packet from source host to first packet switch = . Time at which 2nd packet is received at the first time switch = time at which 1st packet is received at the first switch = time when 1st packet is received at the second switch = 2 \* m sec = 0.004 m sec.
3. Time at which 1st packet is received at the destination host = 0.002 \* 3 hops = 0.006 m sec. After this, every 0.002 m seconds a packet is received, therefore the time at which the last packet is received will be = 0.006 m sec + 99 \* 0.002 m sec = 0.198 sec. This shows that delay is significantly less compared to question A.
4. In a situation where message segmentation isn’t used, if bit errors are not tolerated, should there be a single bit error, the entire message has to be retransmitted, instead of a single packet. Also, without message segmentation, large packets are sent through router networks which forces smaller packets to queue behind them and adds to their delay.
5. Two drawbacks of segmentation are that: packets have be put in a sequence when they reach their destination, and message segmentation produces smaller packets which increases the amount of header bytes since header size stays consistent regardless of packet size.

Problem 33

There are F/S packets and each packet is S = 80 bits. The equation to get the time at which the last packet is received at the first router is The first F/S – 2 packets are at the destination, and the F/S-1 packet is at the second router. This means the last packet must be transmitted by the first and second routers and each transmission will take sec. So delay in sending the whole file is delay = . To find S which gives the minimum delay