CSE 473 – Introduction to Computer Networks

Quiz 1 Solution

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1. (5 points). Consider a 10 Mb/s link that is 400 km long, with a queue large enough to hold 2,000 packets. Assume that packets arrive at the queue with an average rate of 4,000 packets per second and that the average packet length is 2,000 bits.

   Approximately, what is the propagation delay for the link (be sure to include the units in your answer)?

   (400 km)/(210,000 km/s) is approximately 2 ms

   What is the transmission time for an average length packet?

   (2000 bits)/(10 bits/μs) = 200 μs

   What is the traffic intensity?

   (4000 packets/sec)(2000 bits/packet)/(10 Mb/s) = 0.8*

   What is the average number of packets in the queue?

   0.8/(1− 0.8) = 4

   What is the average queueing delay?

   *4*200 = 800 μs*

2. (5 points) A user in Chicago, connected to the internet via a 2 Mb/s connection retrieves a 25 KB (B=bytes) web page from a web server in Miami, where the page references 3 images of 200 KB each. Assume that the one way propagation delay is 20 ms.

   Approximately how long does it take for the page (including images) to appear on the user's screen, assuming non-persistent HTTP using a single connection at a time?

   4(80 ms) + (8*(25+3*200) Kbits)/(2 Mb/s) = 320 ms + 2.5 sec = 2.82 sec*

   In this case, do you think it would make much difference to the user if we used persistent HTTP in place of non-persistent HTTP?

   Not much difference, since the use of persistent HTTP would just reduce the first part of the above expression (the 320 ms), which is already much smaller than the time required to actually transmit the packet across the DSL link.