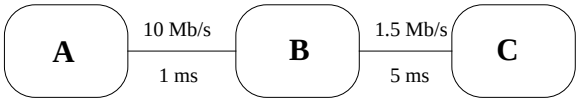
2.993 Principles of Internet Computing
Spring 1999
Homework #1

Due: 2/11/99

1. *Rate/Delay Concepts* (from McCanne and Walrand)

Suppose three computers, A, B and C, are interconnected by two links as follows:



The bit rate of the link between A and B is 10 Mb/s, while the bit rate between B and C is 1.5 Mb/s. The propagation delays are 1 ms and 5 ms, respectively.

(a) How long does it take for A to send an 8KB packet to B and for B to fully receive that packet (1KB=8192 bits)?

(b) How long does it take for A to send an 8KB packet to C (via B) and for C to fully receive that packet? Assume that B must receive the entire packet before forwarding it to C (i.e., B must receive the last bit of the packet from A before it starts sending the first bit to C — this is called "store and forward").

(c) Assume now that A sends packets to C continuously (i.e., back to back) at a rate dictated by the link between A and B. Assume that B can queue up at most 10 packets at any given time. How long after A starts blasting packets will B be forced to drop a packet? Beyond that point, how often will B drop packets? If B's queue size is increased to 20 packets, how often will it drop packets (assuming A still sends continuously)?

(d) Now, instead, assume A sends packets back-to-back until it receives an "acknowledgment" from C, at which time it immediately stops sending. Assume that C generates this acknowledgment as soon as it receives the last bit of the first packet from A. How many packets will A send? Does the queue at B overflow?

2. Peterson and Davie, Ch. 1, Problem 12

3. Peterson and Davie, Ch. 1, Problem 13

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4. Peterson and Davie, Ch. 1, Problem 14