University of Pittsburgh

School of Library and Information Science
Telecommunications

Course : TelCom 2310 - Computer Networks
Term : Fall Term 01-1

Homework Assignment 3

Due Date: November 22, 2000

Problem 1.

Consider the following design problem concerning the implementation of a network service. Using a virtual circuit, each data packet must have a 3-byte header, and each router must tie up 8 bytes of storage for circuit identification. Using datagrams, 15-bytes headers are needed, but no router table space is required. Transmission capacity costs 1 cent per 10^6 bytes, per hop. Router memory can be purchased for 1 cent per byte and is depreciated over two years (business hours). The statistically average session runs over 1000 sec, in which time 200 packets are transmitted. The mean packet requires four hops. Which implementation is more cost effective, and by how much?

Problem 2.

2.1 Give a simple heuristic for finding two paths through a network from a given source to a given destination that can survive the loss of any communication link (assuming two such paths exist and routers do not crash).

2.2 Show that your heuristic is correct and discuss its efficiency.

Problem 3.

As a possible congestion control mechanism in a subnet using virtual circuits internally, a router could refrain from acknowledging a received packet until (1) it knows its last transmission along the virtual circuit was received successfully, and (2) it has a free buffer. For simplicity, assume that each virtual circuit has one buffer dedicated to it for each direction of traffic.

3.1 If it takes T sec to transmit a packet (data and acknowledgement) and there are n routers on the path, what is the rate at which packets are delivered to the destination host? Assume that transmission errors are rare, and that the host-router connection does not fail and is infinitely fast.

3.2 Argue about the efficiency of such a scheme.

Problem 4.

A datagram subnet allows routers to drop packets whenever they need to. The probability of a router discarding a packet is p. Consider the case of a source host connected to the source router, which is connected to the destination router, and then to the destination host. If either of the routers discards a packet, the source host eventually times out and tries again. Assume that host-router and router-router lines are counted as hops.

4.1 What is the mean number of hops a packet makes per transmission?

4.2 What is the mean number of transmissions a packet makes?

4.3 What is the mean number of hops required per received packet?