Assignment 4

"Course 1-02-327 and 1-01-051: Introduction to Networks"

Due **June 26, 2010** at 11:59:59pm

1 Queuing (No Skew) (16 points)

Packet	Size	Flow
1	120	1
2	80	1
3	100	1
4	110	1
5	150	2
6	220	2
7	180	3
8	60	3

Suppose a router has three input flows and one output. It receives the packets listed in the table above all at about the same time, in the order listed, during a period in which the output port is busy but all queues are otherwise empty. Give the order in which the packets are transmitted, assuming

(a) (8 points) fair queuing

(b) (8 points) weighted fair queuing, with flow 1 having weight 1.5, flow 2 having weight 2, and flow 3 having weight 1

Assume all ties are resolved in the order 1, 2, 3.

2 Queuing (With Skew) (12 points)

Consider a router that is managing three flows, on which packets of constant size arrive at the following wall clock times:

- flow A: 1, 2, 4, 6
- flow B: 2, 6, 8, 11
- flow C: 1, 2, 3, 5

All three flows share the same outbound link, on which the router can transmit one packet per time unit. Assume that there is an infinite amount of buffer space.

Suppose the router implements fair queuing. For each packet, give the wall clock time when it is transmitted by the router. Arrival time ties are to be resolved in order A, B, C. Note that wall clock time $T = 2$ is Fair Queuing clock time $A_i = 1.5$.

3 Queuing Effects (12 points)

Two users, one using Telnet and one sending files with FTP, both send their traffic out via router R. Both Telnet and FTP are protocols which run on top of TCP. This means that their data packets are placed inside TCP packets when sent out.

The outbound link from R is slow enough that both users keep packets in Rs queue at all times. Discuss the relative performance seen by the Telnet user if Rs queuing policy for these two flows is

(a) (4 points) round-robin service

(b) (4 points) fair queuing

(c) (4 points) modified fair queuing, where we count the cost only of data bytes, and not IP or TCP headers

Consider outbound traffic only. Assume Telnet packets have 1 byte of data, FTP packets have 512 bytes of data, and all packets have 40 bytes of headers.

4 802.11 Beacon Frames (6 points)

Explain the role of beacon frames in 802.11

5 802.11 Transmission (10 points)

Suppose an 802.11b station is configured to always reserve the channel with the RTS/CTS sequence. Suppose this station suddenly wants to transmit 1,000 bytes of data, and all other stations are idle at this time. As a function of SIFS and DIFS, and ignoring propagation delay, and assuming no bit errors, calculate the time required to transmit the frame and receive the acknowledgement.

What to turn in

You may work in groups of up to three (3) students. Turn in your submission for the above assignment including:

- Names of all students in the group
- Total number of hours spent on the assignment
  - This will help me gauge the difficulty and effectiveness of the assignment and will not affect your grade in any way.
- Date of submission
- All work, including calculations and graphs as appropriate

Turn in the above via email to `ise327@gmail` or via Telem. Yaakov Leshem has requested that all submissions be electronic, so please do not turn in paper work.

Note: Do not send work submissions to my personal email – use the `ise327` email. Do not send me ODT files. I cannot deal with them.