Homework 5

Due: April 7, Tuesday

Chapter 4. The following are from the textbook.

P1 (10 points)
P7 (10 points)
P9 (10 points)
P13 (5 points)
P17 (10 points)
P19 (10 points)
P26 (10 points)
P28 (10 points)

Problem A (10 points).

Table 1 is a routing table using CIDR. Address bytes are in hexadecimal. The notation "/12" in C4.50.0.0/12 denotes a netmask with 12 leading 1 bits, that is, FF.F0.0.0. Note that the last three entries cover every address and thus serve in lieu of a default route. State to what next hop the following will be delivered.

(a) C4.5E.13.87
(b) C4.5E.22.09
(c) C3.41.80.02
(d) 5E.43.91.12
(e) C4.6D.31.2E
(f) C4.6B.31.2E

Network	Next Hop
C4.50.0.0/12	A
C4.5E.10.0/20	B
C4.60.0.0/12	C
C4.68.0.0/14	D
80.0.0.0/1	E
40.0.0.0/2	F
0.0.0.0/2	G

Table 1. Routing Table for Problem A

Problem B (15 points).

In this problem, we compare the throughput of three routers with different designs shown in figure 1.

(a) Shared Memory Router: The memory speed enables one read and one write every 5ns; the bus rate is 200MHZ; the bus width is 32 bits.
(b) Bus Backplane Design: The bus rate and speed are as in (a). Each line card (input port) has a copy of the forwarding table.

(c) Switched Backplane Design (i.e., cross-bar): The line cards use input buffers with the same memory technology as in (a) and a memory width of 32 bits. Assume that the head of line blocking limits the throughput of each line card to 25% of the rate of its connection to the backplane.

For each router design, determine the maximum average total rate of traffic that can flow across different line cards. Describe precisely how you define that rate and clarify the assumptions that you make. In particular, examine carefully how many times a given packet has to cross the bus in the first two designs. Also, be clear about how you count rates (do you add the input and output rate or not).

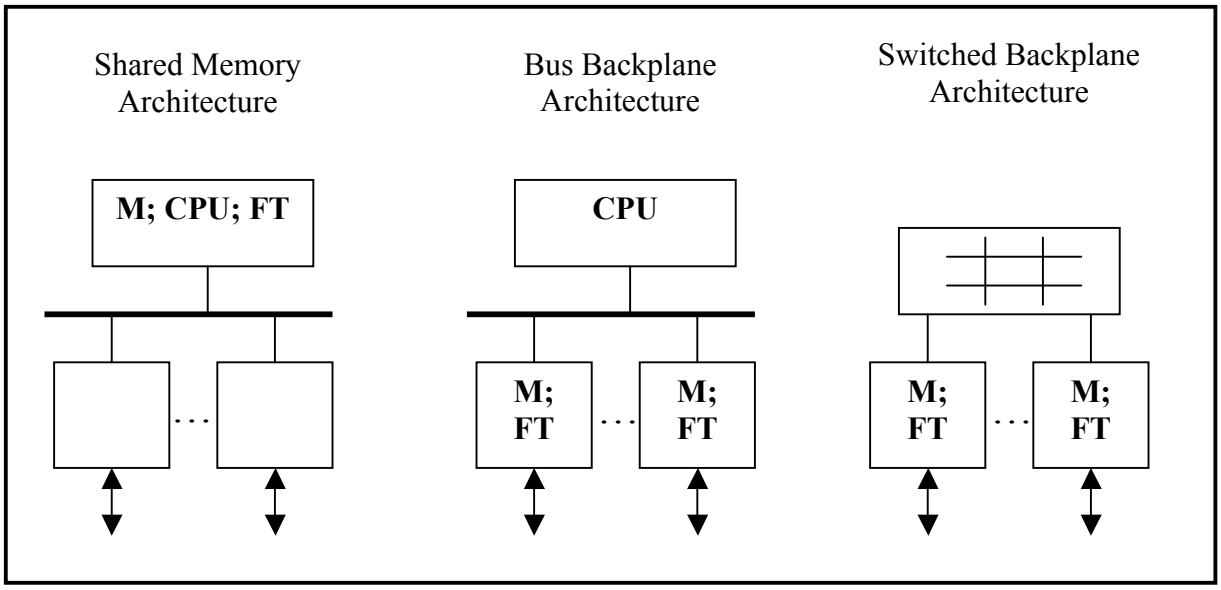

Figure 1. The three network architectures

Problem C (20 points) Internet Round-Trip Delay Measurement.

You will write a short piece of code/script to measure the round-trip delay on an Internet path chosen by you. You may use existing UNIX/Linux networking utilities to do this, automated by shell scripts. You may write your own C++/JAVA code. If you find some online resources for doing this, that is also fine. The chosen path shoud be reasonably long, i.e., over a wide area.

The objective is to collect about 9,000 samples of round-trip delay on an Internet path over a 24-hour period. For instance, you can collect one sample every 10 seconds.

In your submission, please

a) write a short description on how you set up and conduct the experiment;
b) plot the delay samples on a graph;
c) plot the probability density function (i.e., histogram with appropriate bins);
d) compute the average and standard deviation of the delay samples.

e) Are the delay samples “stationary” or “non-stationary”? In other words, do they exihbit similar variations during the 24-hour period or not? Please substantiate your answer.