Assignment 1

CSL 374/672

Due date: January 21, 2013, midnight (Monday)

Note: *Solve all problems on your own.* Approach the instructor for clarifications. Your solutions must be written up in .tex format (Latex) and a pdf report should be generated. Upload the report to moodle along with your socket programming code.

1. Find out the following properties of the transmission medium that is used by the computer network in your hostel or favourite laboratory on campus. You may consult the system administrator of the network.

   (a) type (twisted-pair, coaxial, optical fiber, wireless etc.)

   (b) link-layer technology used (Ethernet, switched Ethernet, DSL, WiFi etc.)

   (c) maximum speed in bits/sec allowed by the technology (in theory)

   From a machine in this network, check your download and upload speed using http://www.testmyspeed.com/. What are the download and upload speeds you get? Compare these to the maximum speed allowed by the technology used in your network. What percentage of the maximum speed are the download and upload speeds? If this percentage is not close to 100%, then suggest one possible reason why this might be the case.

2. Learn about the program `ping` from the WWW.

   (a) Write a one-paragraph description of it in your own words. You should mention what protocol it uses and the method used to generate echo packets from the remote host.

   (b) Use the `ping` command to determine the RTT to www.google.com, www.rice.edu, and www.iitd.ac.in. Mention the IP addresses of these web servers along with the RTT to them in seconds. Which of the three servers is closest in terms of RTT. Which is farthest in terms of RTT? Why do you think is the reason for this?

3. You can learn socket programming basics and use C source code from "Beej's Guide to Network Programming" http://beej.us/guide/bgnet/ to implement this assignment. Write two socket programs, client.c and echo.c, that together communicate using "Datagram Sockets". Each datagram generated by client.c must contain (a) a sequence number which identifies the packet, (b) a timestamp with microsecond level precision which indicates the time at which the packet is first transmitted, and (c) an even non-negative integer called the time-to-live field (TTL) with initial value T. Let us assume that the packet is of size P bytes.

   When echo.c receives a datagram from client.c, it immediately decrements the TTL value in the datagram and sends the same datagram (with the new TTL) back to client.c. The client.c program on receiving a datagram from echo.c, decrements the TTL value, and checks if this new value is zero. If the new TTL is greater than zero, then client.c sends the datagram (with the new TTL) back to echo.c.

However, if TTL is zero, then client.c prints to a file (on a new line) the difference between the current time and the timestamp field in the datagram. Call this time the "cumulative RTT". A new datagram is then generated by client.c with TTL set to T.

The value of P and T, and the output file name for storing the "cumulative RTT" should be entered on the command line when executing client.c. P should be within the range 100 to 1300 bytes, and T between 2 and 20 (and must be even).

The client.c program totally sends out 50 datagrams and then quits. Run client.c and echo.c on <u>two different machines</u>.

For $T = 2$ and different values of $P = 100, 200, \ldots, 1000$, run client.c. Plot a scatter-plot (using any suitable software, such as matlab, gnuplot etc.) of "cumulative RTT for all 50 datagrams" vs. P for the different values of P when $T = 2$. What do you observe? What information does the slope of the graph contain? Repeat when $T = 8$ and 16.

Add the plots, and your observations for each plot, to the Latex generated pdf report.

Comment your socket programming code well. Upload to moodle <u>in separate files</u> (i) client.c, (ii) echo.c, and (iii) the pdf report.