EE4204/TEE4204 Computer Networks (Part 1)
Socket Programming Assignment (Sem1, 2023-24)

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Instructions:

This lab assignment focuses on implementing a client server socket program with UDP transport protocol for transferring messages using a flow control protocol. Problems 1-3 are for your practice. Problem 4 is the assignment problem. Choose appropriate values for parameters such as data unit size. Repeat the experiment several times and plot the average values in a report with a brief description of results. The details of lab schedule, demo, and rubrics to be used for assessment will be announced separately.

The solution and program must be yours based on your own effort. Our university views any form of cheating and plagiarism (like copying from other students or reports or web sources) very seriously. The penalty for indulging such an act could be as severe as termination of your candidature or award of F grade in the module.

Practice Problems:

1. Develop a socket program in UNIX/Linux that uses (i) TCP as the transport protocol and (ii) UDP as the transport protocol for transferring a short message between a client and server. The client sends a string (input by the user) to the server and the server prints the string on the screen after receiving it.

2. Develop a TCP-based client-server socket program for transferring a large message. Here, the message transmitted from the client to server is read from a large file. The entire message is sent by the client as a single data-unit. After receiving the file, the server sends an ACK message to the receiver. Verify if the file has been sent completely and correctly by comparing the received file with the original file ("*diff*" command could be used). Measure the message transfer time and throughput.

3. Develop a TCP-based client-server socket program for transferring a large message. Here, the message transmitted from the client to server is read from a large file. The message is split into short data-units which are sent one by one without waiting for any acknowledgement between transmissions of two successive data-units. Verify if the file has been sent completely and correctly by comparing the received file with the original file. Measure the message transfer time and throughput for various sizes of data-units.

Assignment Problem

4. Develop a UDP-based client-server socket program for transferring a large message with a possibility of data loss. Here, the message transmitted from the client to server is read from a large file. The message is split into short data-units which are sent by using stop-and-wait flow control. A data-unit sent could be lost during the propagation due to congestion or heavy noise; It may also so happen that it reaches the destination but with some bits damaged. We say that this (congestion/loss/damage) happens with some probability which we term as "error probability". In this case, either the receiver "TIMES OUT" or CRC test fails, and the receiver sends a negative acknowledgement so that the sender can retransmit it.

   You are free to implement the program in your own way, but with stop-and-wait. You can simulate errors/losses/congestion according to the frame error probability in your own way. For example, a data-unit may not be really congested/lost/damaged in your experiment, and because of this, the receiver can declare a data-unit randomly as congested/lost/damaged according to the error probability. This helps avoid implementing the TIMEOUT and CRC. Verify if the file has been received completely and correctly by comparing the received file with the original file. Measure the message transfer time and throughput for various sizes of data-units. Also, measure the performance for various error probabilities and for the error-free scenario. Choose appropriate values for parameters such as data unit size and error probability. Repeat the experiment several times and plot the average values in a report with a brief description of results, assumptions made, etc. Include the following performance figures in your report:

   1) Transfer time vs error probability (error probability = 0 and four other values of your choice)
   2) Throughput vs error probability (error probability = 0 and four other values of your choice)
   3) Transfer time vs data unit size (error probability = 0, error probability = any one value of your choice)
   4) Throughput vs data unit size (error probability = 0, error probability = any one value of your choice)

[ALL THE BEST]