Computer Networks: Assignment 3

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Main Questions

Q1) Decide whether you wish to assume that the network layer always has a packet to send, OR as discussed in the description of GoBack-N protocol in book/class.
A - We have assumed that the network layer always has a packet to send.

Q2) Decide what that probability should be so that a few frames are indeed dropped, and are re-transmitted as necessary.
A - Right now we have set Packet Drop Probability as 10%.

Q3) Decide whether you should introduce a certain delay EITHER at the transmitter end or at the receiver end (or both) so as to simulate queuing and propagation delay. (This is over and above the delay experienced by messages sent from client to server, or vice-versa.)
A - We have introduced a delay of 1 second at the receivers end as processing delay.

Q4) Decide whether you wish to use one-timer or one for every sequence number.
A - No, we have used a different timer for every sequence number.

Q5) One question that you have to address is how is a time implemented with the set of time operations. A related question: how does one wait for “event” to occur – possibly keep check the actual clock.
A - We have used actual clock time to simulate timeouts. For this, we use timeval library of C.

Q6) Do you think you will need to synchronize the clocks at the client and server ends?
A - No, Clock Synchronisation is the work of the physical layer and we are simulating the Data Link Layer Protocol at the application layer.
Moreover, for timeouts, we are using actual time which will be independent for sender and receiver. The timer starts as soon as the sender sends the frame, so no clock synchronisation is required.

Explanation:

We are running the protocol on 2 different machines, and both machines can simultaneously send and receive frames. For this, we have made 2 different socket connections between the machines to simulate the full-duplex channel.

A machine can send 8 outgoing frames before receiving an acknowledgement. But it can receive only one frame at one time, so the sender's window is of size 8 and the receiver's window is of size 1. If an acknowledgement is not received within a fixed time then the corresponding frames are resent (Go-Back-Nl). Acknowledgements to a later frame act as an acknowledgement to previous frames as well.
Note - We piggyback we acknowledge in the sending frame.

For example, if we have 2 sockets A and B then one machine can send frames only on socket A and receive frames only from socket B. Similarly, another machine will send frames only on socket B and receive frames only from socket A.

We have tried to simulate the event-driven mechanism by randomly selecting whether to send or receive a frame or check for a timeout.
Three possible events could occur -

1. The timer runs out for a sent frame.
2. A-frame arrives at the physical layer (receiving socket).
3. We send a frame to the physical layer (sending socket).

To simulate packet drops we are dropping the frames at the receivers end randomly with some probability. To do this we basically do not send the acknowledgement to that frame.
To simulate the processing delay at the receiver's end we have introduced sleep system call for some time upon the receiving of a frame.

Analysis:
You are required to:

1) Observe and record the times that correspond to the time when a frame was first sent, and the time when the frame was first received at the other end.
2) Record the average number of times a frame was sent.
3) Repeat the above for two significantly different values of drop probability and two different delays.

Machine A

Analysis of Frames sent me :
Frame no: 0, First Time Sent : 0.000213, No of attempts: 2
Frame no: 1, First Time Sent : 0.000370, No of attempts: 2
Frame no: 2, First Time Sent : 0.000404, No of attempts: 2
Frame no: 3, First Time Sent : 1.004865, No of attempts: 4
Frame no: 4, First Time Sent : 8.031066, No of attempts: 4
Frame no: 5, First Time Sent : 8.031154, No of attempts: 5
Frame no: 6, First Time Sent : 8.031213, No of attempts: 5
Frame no: 7, First Time Sent : 10.041746, No of attempts: 6
Frame no: 8, First Time Sent : 11.046042, No of attempts: 6

Frame no: 9, First Time Sent : 11.046143, No of attempts: 6
Average no of attempts to send packets : 42
Analysis of Frames Received by me :
Frame no: 0, First Time Received : 1.004821
Frame no: 1, First Time Received : 2.009601
Frame no: 2, First Time Received : 3.012189
Frame no: 3, First Time Received : 4.015319
Frame no: 4, First Time Received : 5.018672
Frame no: 5, First Time Received : 6.022369
Frame no: 6, First Time Received : 7.025602
Frame no: 7, First Time Received : 18.066370
Frame no: 8, First Time Received : 19.071875
Frame no: 9, First Time Received : 25.084851

Machine B

Analysis of Frames sent me :
Frame no: 0, First Time Sent : 0.000095, No of attempts: 2
Frame no: 1, First Time Sent : 0.000167, No of attempts: 2
Frame no: 2, First Time Sent : 0.000187, No of attempts: 2
Frame no: 3, First Time Sent : 0.000237, No of attempts: 2
Frame no: 4, First Time Sent : 0.000265, No of attempts: 4
Frame no: 5, First Time Sent : 0.000287, No of attempts: 4
Frame no: 6, First Time Sent : 0.000317, No of attempts: 4
Frame no: 7, First Time Sent : 8.008363, No of attempts: 6
Frame no: 8, First Time Sent : 12.014714, No of attempts: 5
Frame no: 9, First Time Sent : 16.020499, No of attempts: 4
Average no of attempts to send packets : 35
Analysis of Frames Received by me :
Frame no: 0, First Time Received : 2.002350
Frame no: 1, First Time Received : 4.002501
Frame no: 2, First Time Received : 6.002795
Frame no: 3, First Time Received : 8.008322
Frame no: 4, First Time Received : 20.026393
Frame no: 5, First Time Received : 22.027888
Frame no: 6, First Time Received : 24.030671
Frame no: 7, First Time Received : 26.035803
Frame no: 8, First Time Received : 28.040869
Frame no: 9, First Time Received : 30.044909

Reference:

We have referred the template of Go-Back-N Protocol from the Course Textbook.