Networks Assignment 4

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I. Aim

The aim of this assignment is to implement Go Back N and Selective Repeat protocols and see how different factors affect them.

II. Introduction

Both Go Back N and Selective Repeat are sliding window protocols which are used for reliable data transfer. Both pipeline the packets for more efficiency. When an acknowledgement is not received for a packet, Go Back N pessimistically re sends the whole window whereas Selective Repeat re sends only the unacknowledged packet. When packets usually get lost in intervals, Go Back N performs better but when packets are lost at random anytime then Selective Repeat performs better.

III. Implementational details

- The multiplicative factor for timeout was changed from the suggested value of 2 because I was getting round trip time in microseconds but when sometimes a packet is received out of order, the time required to acknowledge it at the appropriate time is in milliseconds. Due to this difference a packet would re transmit abnormally large number of times, therefore to prevent this a higher multiplicative factor is used. In Go Back N, a threshold is used for timeout value instead of increasing the multiplicative factor. Also to prevent the sudden change in round trip time from affecting the average round trip time, a threshold is used to decide whether a particular round trip time is to be used for average round trip time calculation or not.

  Sender:
- One thread is used to generate packets at the rate specified in command line and store in a buffer
- One thread is used to send packets to the receiver from the buffer
- For each packet sent, a separate timer thread is spawned. The timer thread waits for timeout interval and then re transmits the packet.
- One thread receives acknowledgement packets and updates state variables accordingly.

  Receiver:
- Receiver buffers higher sequence numbered packets
- If the expected sequence numbered packet is received then it check for continuous higher sequenced packets already buffered and acknowledges them all at once.

IV. Results

Common parameters for Selective Repeat:

- number of bits for sequence number = 8
- max buffer size = 100
- window size = 4

Common parameters for Go Back N:

- max packets = 400
- max buffer size = 10
- senders window size = 3

TABLE I
Selective Repeat

r	l	p	Re-transmission Ratio	Average RTT (μ secs)
20	256	1e-3	1.0025	316.686
20	256	1e-5	1	67.2175
20	256	1e-7	1	70.8885
20	1500	1e-3	1.0025	331.469
20	1500	1e-5	1	65.467
20	1500	1e-7	1	70.5724
300	256	1e-3	1.005	272.797
300	256	1e-5	1	44.9432
300	256	1e-7	1	64.968
300	1500	1e-3	1.005	294.797
300	1500	1e-5	1	60.4682
300	1500	1e-7	1	61.9425

This work was done as part of Introduction to Computer Networks course

TABLE II
GO BACK N

r	l	p	Re-transmission Ratio	Average RTT (μ secs)
20	256	1e-3	1.03	455.107
20	256	1e-5	1	99.3775
20	256	1e-7	1	99.3025
20	1500	1e-3	1.045	480.622
20	1500	1e-5	1	106.94
20	1500	1e-7	1	88.022
300	256	1e-3	1.3	823.653
300	256	1e-5	1	90.705
300	256	1e-7	1	81.705
300	1500	1e-3	1.075	824.643
300	1500	1e-5	1	95.6325
300	1500	1e-7	1	96.6675

V. OBSERVATIONS

- Firstly notice that for small probability values, re transmission ratio is 1. This is because these probability values are so small that no packet is dropped.
- Whenever re transmission ratio is greater than 1, we can see that the average RTT increases significantly. This is because without packet drop, it takes a few micro seconds for acknowledgement but due to timeout and then re transmission it will take a few milliseconds.
- We can see in general that Selective Repeat has a better re transmission ratio. This is because in our model and with the low probability values we are using, the chances of many packets being dropped in a continuous interval are very low. In these conditions, as we have seen in the introduction, Selective Repeat performs better.
- We can see that as the drop probability increases, the re transmission ratio also increases, this is because of the higher probability of a packet being dropped hence requiring re transmission.
- We can also see that when we increase the packet generation rate, the re transmission ratio increases.

VI. PLOTS

Fig. 1. Effect of drop probability on Re transmission ratio

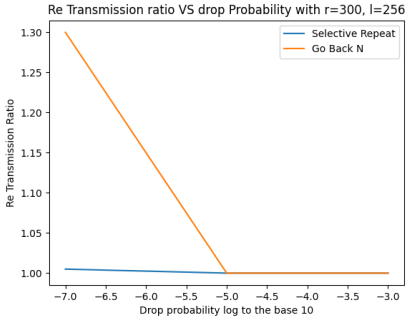
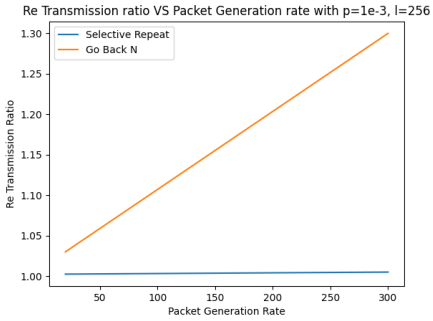


Fig. 2. Effect of packet generation rate on Re transmission ratio



VII. LEARNING OUTCOMES

- Clear understanding of how Selective Repeat and Go Back N works
- Observed the effects of various parameters on these protocols
- Consolidated my learning of thread programming
- Learnt to write script files
- Learnt to document my work thoroughly

REFERENCES

[1] Assignment 4 problem statement pdf and slides.