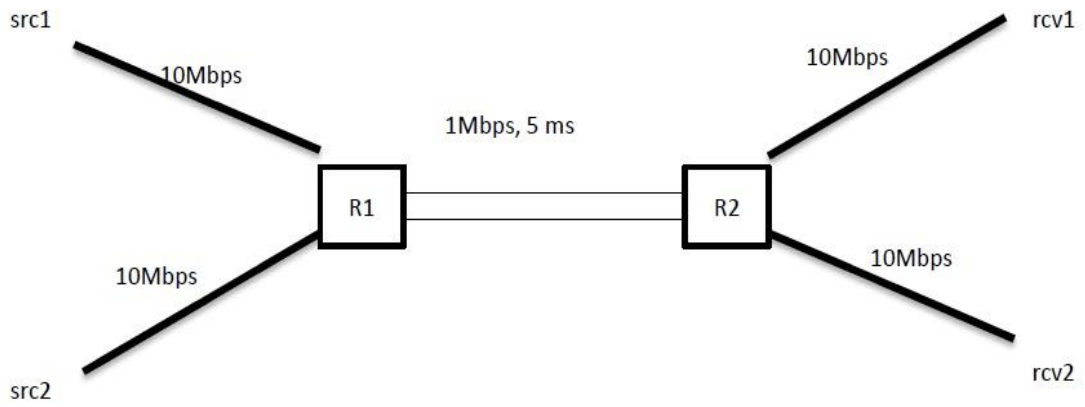
Network Simulation Assignment 1 Report

Test Setup



The test setup graphical networking model to be simulated and validated is as given in the figure above.

Routers R1 and Router R2 are connected with a 1 Mbps link and 5ms of latency.

Senders src1 and src2 are connected to R1 with 10 Mbps links.

Receivers rcv1 and rcv2 are connected to R2 with 10Mbps links.

For this purpose, R1,R2, src1, src2, rcv1, rcv2 and the links are created with the stated parameters above.
And this network module was analysed through packet-level simulations performed by NS-2.

As the different cases of packet origin and destination involves different end-to-end RTT, this network configuration needs to be tested for throughput and latency.
Thus, we have to test and verify this model over a range of latency characteristics and check for throughput over repeated runs of simulation..

Throughput metrics need to be monitored over the simulations.

Procedure

Simulations are run for 400s for each of the TCP versions – TCP SACK and TCP VEGAS, With respect to the following three cases –

Case 1:

- src1-R1 and R2-rcv1 end-2-end delay = 5 ms
- src2-R1 and R2-rcv2 end-2-end delay = 12.5 ms

Case 2:

- src1-R1 and R2-rcv1 end-2-end delay = 5 ms
- src2-R1 and R2-rcv2 end-2-end delay = 20 ms

Case 3:

- src1-R1 and R2-rcv1 end-2-end delay = 5 ms
- src2-R1 and R2-rcv2 end-2-end delay = 27.5 ms

The throughput metrics are calculated using the number of packets transmitted and received. However, the first 100s of the simulation is ignored for metrics measurements to avoid any variations in values in the initial time as the transmission and reception over the network configuration may be stabilizing to optimal values. Thus, the metrics are measured only over the 300s.

Table for TCP SACK showing Throughput Ratio -

SACK	Throughput 1	Throughput 2	Throughput Ratio
Case 1	0.524	0.476	1.1
Case 2	0.546	0.455	1.2
Case 3	0.565	0.435	1.3

Table for TCP VEGAS showing Throughput Ratio -

VEGAS	Throughput 1	Throughput 2	Throughput Ratio
Case 1	0.583	0.417	1.4
Case 2	0.688	0.313	2.2
Case 3	0.750	0.250	3.0

Results & Comments –

For TCP SACK, the throughput ratio of Src1 to Src2 increases consistently but marginally over the three different cases where the end-to-end RTT of the two sources are in the ratio of 1:2, 1:3 and 1:4 respectively. We see that the Throughput ratios in these cases come to be 1.1, 1.2 and 1.3 respectively. We see this marginal increase in the ratio due to marginal increase in Throughput 1 and marginal decrease in Throughput 2.

For TCP VEGAS, the throughput ratio of Src1 to Src2 increases significantly over the three different cases where the end-to-end RTT of the two sources are in the ratio of 1:2, 1:3 and 1:4 respectively. We see that the Throughput ratios in these cases come to be 1.4, 2.2 and 3.0 respectively. We see this significant increase in the ratio due to significant increase in Throughput 1 and significant decrease in Throughput 2.

By the analysis of the three cases for each of the TCP flavors, we can see that TCP SACK – Selective Acknowledgement version, implements the selective acknowledgement of packets. This implies that segments are not acknowledged cumulatively, but is acknowledged selectively. This is better than acknowledging every segment that arrives. And this gives the marginal improvement with increase in end –to-end RTT in the three cases.

However, TCP VEGAS flavour encounters congestion in a more efficient and proactive way. It checks for timeouts effectively and efficiently as a work around to the congestion and timeout problem with high RTT or latency issues. Also, it overcomes the problems of having repeated duplicate acknowledgements to detect transit data loss or packet loss. Thus, TCP VEGAS flavour is quite different from TCP SACK with respect to its implementation.

From the analysis, we see that the performance of TCP VEGAS is better than TCP SACK version with respect to the three cases of increasing end-to-end RTT's.