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SIMULATION BASED PERFORMANCE ANALYSIS OF TCP VARIANTS**HITESH N. PARVADIYA****STUDENT****DEPARTMENT OF ELECTRONICS & COMMUNICATION****ATMIYA INSTITUTE OF TECHNOLOGY & SCIENCE****RAJKOT****KETAN B. SHETH****HEAD****DEPARTMENT OF ELECTRONICS & COMMUNICATION****ATMIYA INSTITUTE OF TECHNOLOGY & SCIENCE****RAJKOT****RAHUL D. MEHTA****ASSOCIATE PROFESSOR****DEPARTMENT OF ELECTRONICS & COMMUNICATION****GOVERNMENT ENGINEERING COLLEGE****RAJKOT****ABSTRACT**

TCP/IP protocol, which was formerly developed for wired links, is now an inseparable part of the Internet. Hence, its competence on wireless links could play a significant role in the performance of the Internet. The use of original TCP/IP protocol on wireless links in spreading the Internet has encountered some serious performance issues, the reason being the wired links are very less prone to channel errors and more affected by congestion. There is no way in TCP to distinguish the correct reason for losses hence losses are not treated distinctively. The research of more than 25 years has gone through different variants of TCP, out of which most up-to-date variant TCP SACK (Selective Acknowledgement) is the most resourceful. Its potential to avoid redundant retransmissions based on SACK information accessible at TCP sender. It should be noticed that even TCP SACK is powerless of judging the concrete cause of loss i.e. corruption or congestion.

KEYWORDS

ns-2, TCP, TAHOE TCP, RENO TCP, NEW RENO TCP, SACK TCP.

1. INTRODUCTION

Today the world is becoming smaller and various ways of communication are being used to avail the facilities for people. Internet is one of the widely used techniques to serve different purposes including above one. It is used to transfer data, for entertainment, for education purpose, for paying bills online, for shopping, to be aware of the new researches and innovations, etc. The Internet is expanding rapidly, major contribution in this expansion is of the global acceptance of the TCP/IP protocol stack and use of wireless links, particularly in case of remote areas. In my paper I want to do the comparison of tcp variants on the basis of their throughput with the error rate.

2. TAHOE TCP

In Tahoe, duplicate acknowledgements (*dupacks*) will be sent by the receiver on arrival of each out of order packet. Sender waits for three *dupacks* to retransmit the dropped packets. Three *dupacks* are required to ensure that the packet was really dropped, not the out of order (delayed) because of connection IP layer. This retransmission is known as "fast retransmission". Thus, source does not have to wait for the timeout, so faster recovery is achieved by this technique. When the third *dupacks* is received at the sender, *ssthresh* (slow start threshold) is set to half of the current *cwnd*. *cwnd* will be set to *ssthresh* plus three.

3. RENO TCP

TCP Reno is the subsequent version of TCP Tahoe, which retains fast retransmits mechanism of TCP Tahoe in the same manner. Moreover, it triggers fast recovery after fast retransmission, after retransmitting the missing segment, sender would perform the congestion avoidance. The *dupack* conveys more information to sender than just a packet loss. Receiver can generate a *dupack* only after receiving a correct segment, means one segment has left the network and there is chance of sending another. This is "fast recovery" algorithm. After fast retransmitting a segment, on arrival of each *dupack*, *cwnd* will be incremented by segment size. A new packet size can be transmitted if *cwnd* allows. When the new acknowledgement reaches the sender that acknowledges new data, fast recovery is over. *cwnd* will be defined as the *ssthresh* which was set to half the *cwnd*, means this is a congestion avoidance phase as it is cut to half when a packet loss is detected. It enters into fast recovery after three *dupacks*. As a part of fast recovery, sender fast retransmits the lost segment following which *dupacks* were received. TCP sender continues transmission according to network conditions. Fast recovery is ended either on arrival of acknowledgement of *recover* (maximum sequence number at time of initialization of fast recovery) or timeout. Timeout occurs to recover from second loss in the window, in case of multiple losses in the same window. In a way, this is early exit from fast recovery, which leads to unsatisfactory performance.

4. SACK TCP

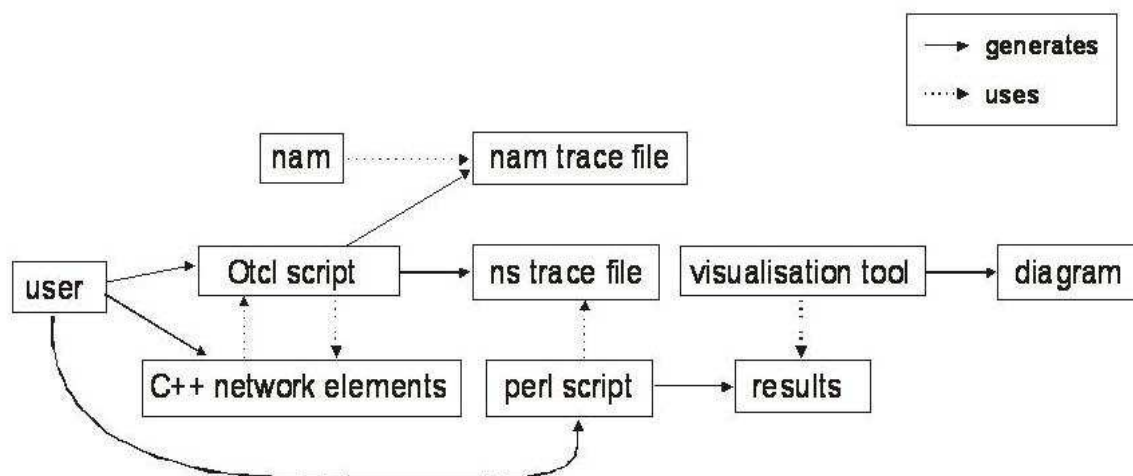
In case of TCP New Reno, limited information is available to sender about safely reached packets at receiver side. It may result into some unnecessary retransmissions. The Selective Acknowledgement (SACK) technique, combined with a selective repeat retransmission policy, can help to overcome this limitation. The receiving TCP sends SACK blocks to the sender which inform the sender of segments which has already been received. The sender can then retransmits only the missing data segments instead of transmitting all the segments following the lost one like preceding versions. When more than one loss in the same window exist, then performance of SACK TCP will be significantly better.

5. PLATFORM TO BE USED

NETWORK SIMULATOR (*ns-2.35*), Is a discrete event simulator for networking research, Work at packet level. Provide substantial support to simulate bunch of protocols like TCP, UDP, FTP, and HTTP. Simulate wired and wireless network. Primarily Linux based. Use TCL as its scripting language. Ns-2 is a standard experiment environment in research community. It is a open source software easily download from <ftp://ftp.isi.edu/nsnam/>.

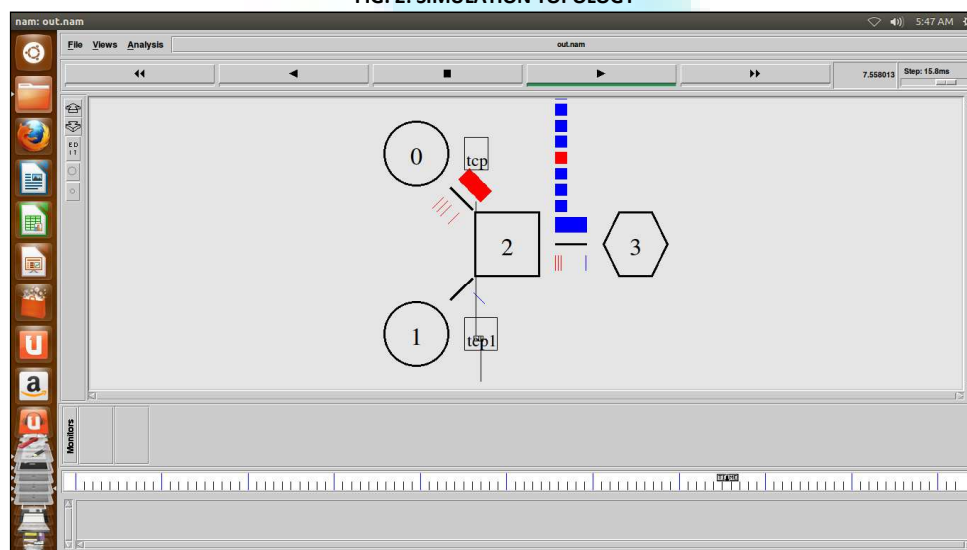
6. BASIC BLOCK DIAGRAM

FIG. 1: SIMULATION BLOCK DIAGRAM



7. ERRORNEOUS ENVIRONMENT

FIG. 2: SIMULATION TOPOLOGY



8. BASIC ERROR MODEL

ns2 supports various error models. Errors were handled by an inbuilt basic error model of *ns2* for above both types of simulations. Error model simulate errors by marking packet's error flag or by dumping a packet into drop target. Unit of errors can be specified in terms of bits, packets or time-based. Default unit is packet. File name is *errormodel.cc* which is located under *ns-allinone-2.35/ns-2.35/queue/* directory. Unit of the error was not specified so it would corrupt packets randomly. If error rate is 0.01, then 1% of packets will be corrupted. A *recv()* function is used to receive the packet and to decide whether to corrupt it by uniform randomness. To determine the status of any packets i.e. to corrupt it or to let it go normally, another function *CorruptPkt()* is available which is called in execution of *recv()* only. *CorruptPkt()* uses another function *Random::uniform()* which will return a variable in case of corrupting a packet. Any packet is corrupted by checking out the returned value. This corrupted segment will be dropped into drop target not reach the receiver so receiver will interpret it as a loss.

9. SIMULATION DISCUSSION

As I want to do the comparison of tcp variants, I have written the simulation scripts for above selected topology and then my goal is to analysis the throughput with the change in the error rate .To do the same, I generate the different X-graph with the error rate=0.01 with the change in different variants (TCP, RENO TCP, NEWRENO TCP, SACK TCP) and done the analysis.

10. SIMULATION RESULTS

FIG. 3: BASIC TCP with error rate=0.01

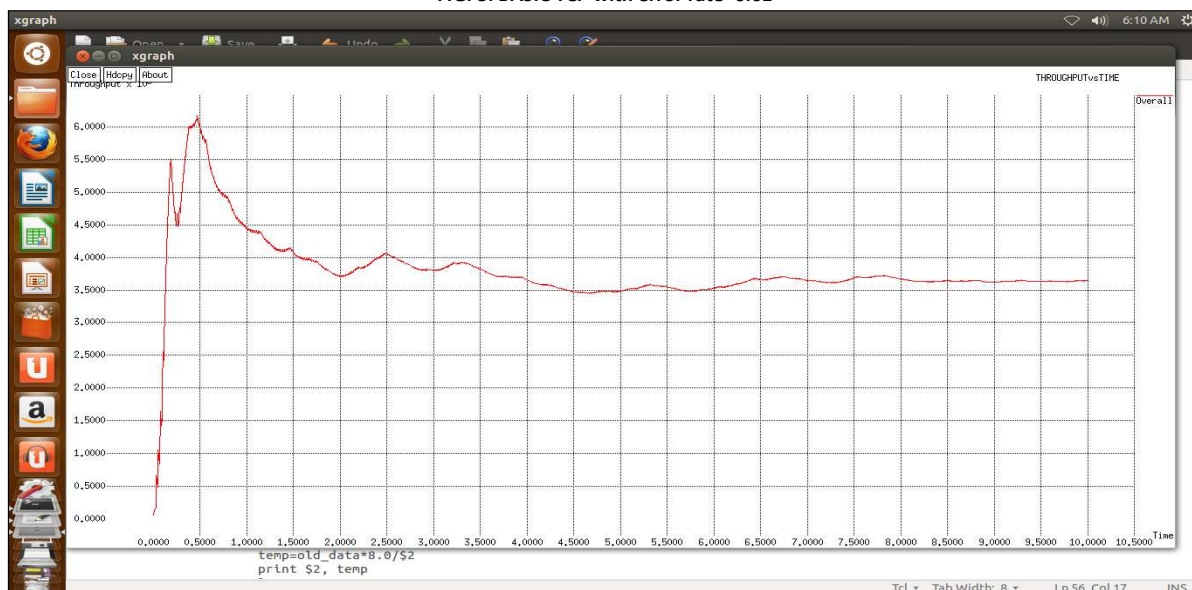


FIG. 4: RENO TCP with error rate=0.01

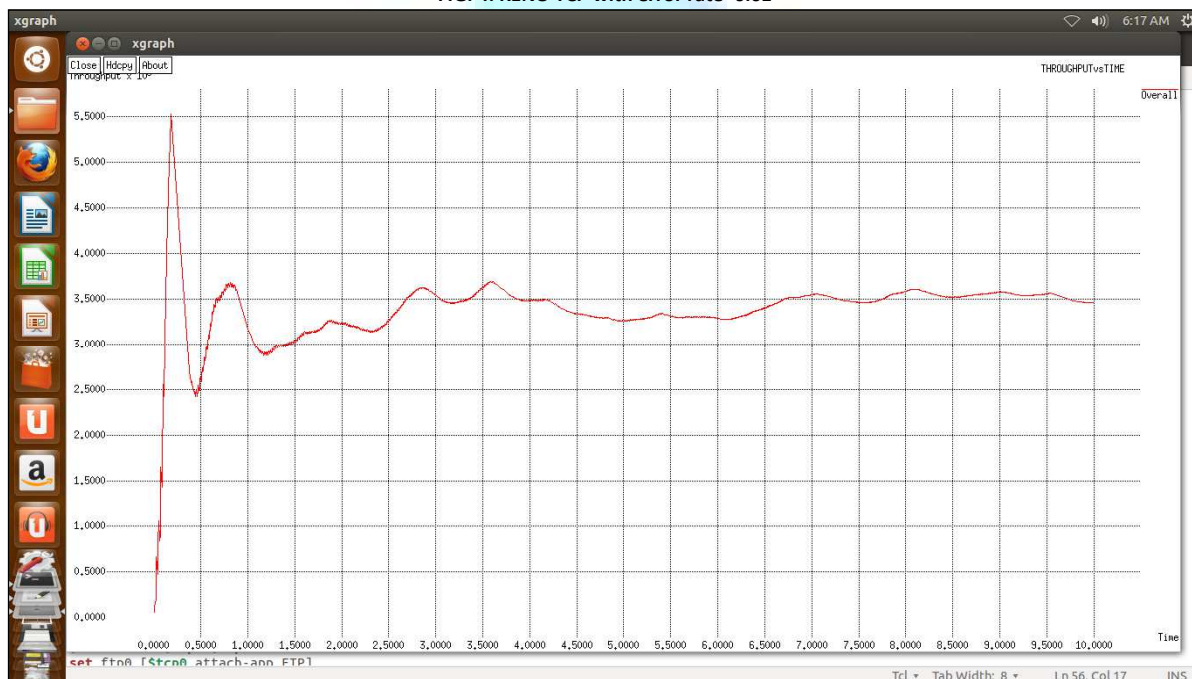


FIG. 5: NEW RENO TCP with error rate=0.01

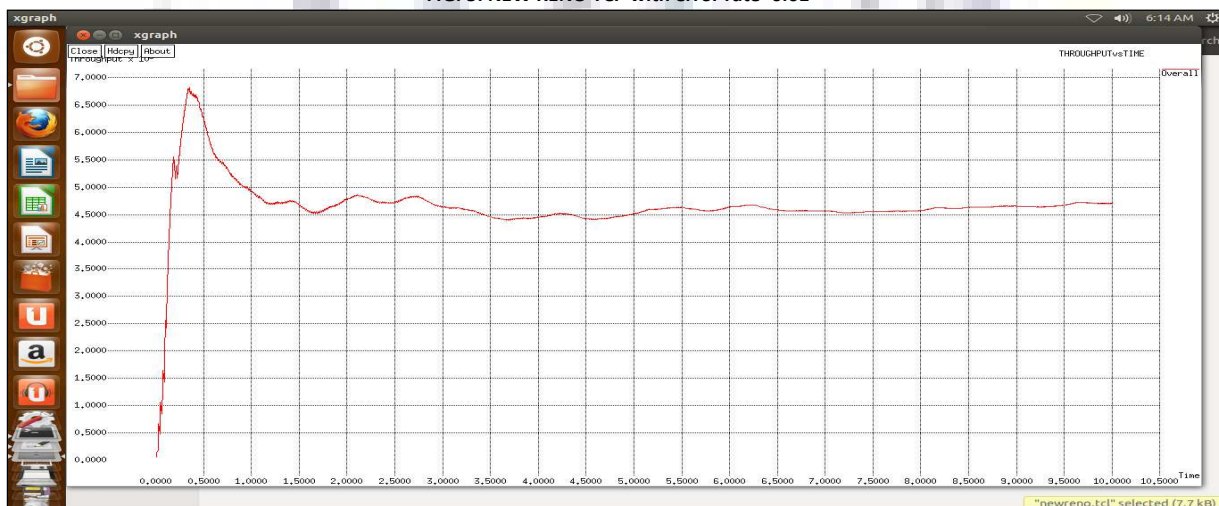
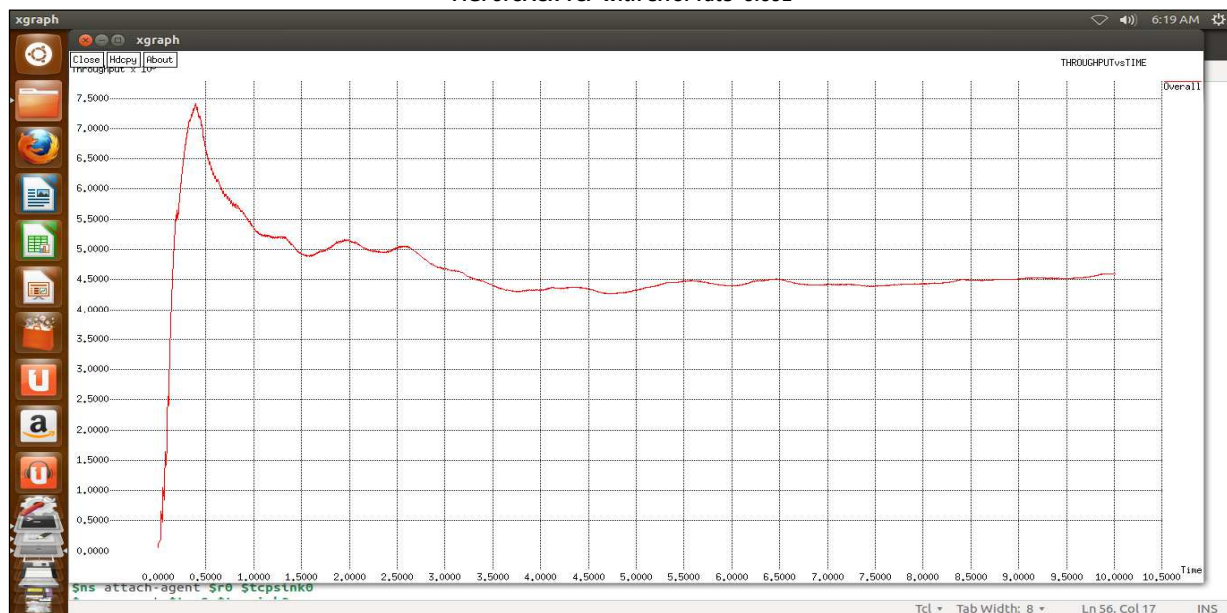


FIG. 6: SACK TCP with error rate=0.001



11. CONCLUSION

As I learn about the all the variants of TCP and done the comparatively study, and find that as the matter of the performance TCP SACK is the best in all the four variants. I change the variants and analyze the throughput, and conclude the for the error rate =0.01, Sack give the better performance.

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