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Simulation based check effect of the different queuing technique on TCP versions

KEYWORDS: RED (Random Early Detection), TCP (Transmission control Protocol), NS2 (Network simulator version 2).

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ABSTRACT TCP/IP protocol stack has been an inseparable part of the Internet. Therefore, behavior and efficiency of the protocol stack significantly contribute to the performance of the Internet. TCP has been modified by various add on techniques to achieve a desired performance level in heterogeneous environments. TCP is responsible for flow, error and congestion control which has a direct impact on network performance and service. In recent years, the demand for network bandwidth is growing due to increase in global population of internet and the variety of applications.

Congestion is the major problem in today's internet. So for managing traffic and to keep the network stable, Congestion Control algorithms are used. Queuing is one of the important methods in traffic management system. This paper gives a comparative analysis of queuing mechanisms Droptail and Random Early Detection on the basis of various performance parameters like throughput and packet drop. The simulation results show the performance of TCP versions in the presence of different queuing Techniques.

I. INTRODUCTION

TCP transports layer protocol. Transmission control Protocol (TCP), is a connection-oriented, reliable protocol that is responsible for process-to process the delivery of packets, part of a message, from one process to another. In recent years, the demand for network bandwidth is growing due to increase in global population of internet and the variety of applications. Optical data communication has been acknowledged as the best solution to meet the bandwidth requirement of users. Optical fiber Network gives higher throughput and bandwidth, but when large network (like, internet's connection undersea over the world) at a tine same congestion problem as copper wire. To solve such problem requires improving TCP protocol.

TCP provides fairness in sharing bandwidth TCP gradually traffic after connection establishment and it decreases when any loss found in particular connection. The flow control is used to control congestion over a transport layer to reduce loss of packet. If any loss found on the receiver then it is responsible to inform the sender about this loss so the sender can take appropriate action for that packet regarding its retransmission and if the rate of loss is high then it take some action to reduce those losses [1]. When TCP is used for making a communication between sender and receiver at time, the faster the sending process sends a SYN (Synchronization Sequence numbers during connection) packet to which the receiving process replicates with its SYN-ACK and the sender replies with an ACK. Once this three way handshake is negotiated, the connection is established and data transmission can begin. When all data is sent, the client and the server exchange FIN (Terminate connection) and ACK in both direction and terminate connection between sender and receiver [1].

Different version of TCP (Tahoe, Reno, New-Reno and SACK TCP) improves the throughput of the network and we can say that SACK TCP is a more stable version of the TCP. In that we get higher throughput than another version like Tahoe, Reno and Newreno. So, for our simulation, we use SACK TCP protocol [6]. If the network congested, then some packet is dropped at an intermediate node because of its queue limitation. Consequently the network is further affected by the retransmission triggered due to the dropped packet cumulative, resulting into more drops and more retransmission. TCP's transmission capacity is governed by cwnd. Hence, in case of cwnd is reduced, Frame its current value, then the flow of the packet is also reducing [1]

TCP handles congestion base on three phases:

1. Slow start (SS)
2. Congestion avoidance (AI: Additive increase)
3. Congestion detection

In today's internet different types of data flow from one end to another and number of users are also increased. So there is a need of congestion control algorithms. Queuing is on the important congestion control mechanisms. Every router must maintain a queuing mechanism that governs how packets are buffered while waiting for the transmission. There are various queuing mechanisms such as droptail, random early detection, queue, fair queues, weighted fair queue and many more. In this paper three queuing mechanisms are studied and analyzed, i.e. drop tail, Random early detection (RED). Droptail is a passive queue management technique while RED active queue management techniques. Droptail is most commonly used in networks and is based on FIFO. RED is the improvement over droptail. These queuing mechanisms are compared on the basis of various performance parameters throughput and packet drop.

II. QUEUING TECHNIQUE

A. DropTail Queuing Technique

Drop Tail is a Passive Queue Management (PQM) algorithm which only sets a maximum length for each queue at router [9]. Routers decide when to drop packets. It uses first in, first out algorithm. In Drop Tail, the traffic is not differentiated. Each packet has the same priority. When the queue buffer is filled to its maximum capacity, the packets arrived afterward are dropped till the queue is full. That is, Drop Tail will keep discarding/dropping the packet until the queue has enough room for new packets.

Droptail is the common algorithm for passive queue management. It drops all the new packets when the buffer is full, and does nothing when buffer still has space. The only two dropping probabilities are 0 and 1. When the number of

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packets arrive in the queue larger than the buffer size, the probability of packet dropping is 1. Otherwise the dropping probability is 0.

It is a simple queue mechanism that is used by the routers that when packets should to be dropped. In this mechanism each packet is treated identically and when queue filled to its maximum capacity the newly incoming packets are dropped until queue have sufficient space to accept incoming traffic. Problem: When a queue is filled the router start to discard all extra packets, thus dropping the tail of mechanism. The loss of packets (datagram's) causes the sender to enter slow start which decreases the throughput and thus increases its congestion window.

B. RED Queuing Technique

RED comes under active queue management techniques. This algorithm has been proposed in order to alleviate the problems of simple droptail queue management. [2] RED was designed with the objectives to (1) minimize packet loss and queuing delay, (2) avoid global synchronization of sources, (3) maintains a high link utilization and (4) removes biases against busty sources.[7]

Random Early Detection (RED) is a congestion avoidance queuing mechanism (as opposed to a congestion administration mechanism) that is potentially useful, particularly in high-speed transit networks. Sally Floyd and Van Jacobson projected it in various papers in the early 1990s.It is active queue management mechanism. It operates on the average queue size and drop packets on the basis of statistics information. If the buffer is empty all incoming packets are acknowledged. As the queue size increases the probability for discarding a packet also increase. When the buffer is the full probability becomes equal to 1 and all incoming packets are dropped.

Pros:RED is capable to evade global synchronization of TCP flows, preserve high throughput as well as a low delay and attains fairness over multiple TCP connections, etc. It is the most common mechanism to stop congestive collapses.

Cons: When the queue in the router starts to fill then a small percentage of packets are discarded. This is deliberate to start TCP sources to decrease their window sizes and hence suffocate back the data rate. This can cause low rates of packet loss in Voice over IP streams. There have been reported incidences in which a series of routers apply RED at the same time, resulting in bursts of packet loss.

III. SIMULATION SCENARIO

In this paper the simulation tool used for analysis is NS-2 which is highly preferred by research communities.NS-2 is a discrete event simulator targeted at networking research. NS provides substantial support for simulation of TCP, routing and Multicast protocol over wired and wireless (Local and satellite) networks.NS2 is an object oriented simulator, written in C++ with an OTcl interpreter as a front end. This means that most of the simulation scripts are created in Tcl (Tool command language). If the components have to be developed for NS-2, then both TCL and C++ have to be used.

Simulation Setup

As shown in fig.1, Sender (s0, s1, s2 and s3) connected with receiver (d0, d1, d2 and d3) with link capacity of 100Mbps.Packet size is chosen 1500 bytes.

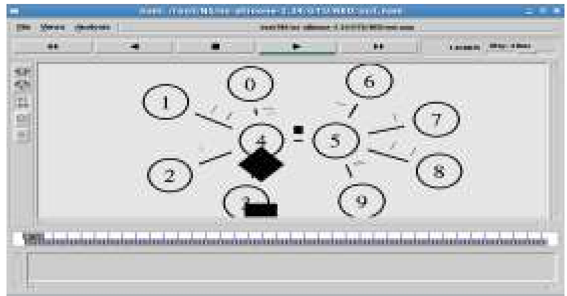

Figure 1: Simulation Topology

For this simulation, a simple topology is created, where many persistent TCP flows share a bottleneck router with AQM schemes or DT, which consists of Four senders and Four receivers connected together via two nodes 4 and 5 as shown in the fig. 1 .This simple topology considers a single bottleneck link (4-5) traversed by multiple TCP flows. In order to analyze the performance experiment is done using the packet level NS-2 simulator. We simulate this network on ns2 for different queuing mechanisms Drop-Tail and RED.

IV. RESULTS

- **Packet loss V/S Time**

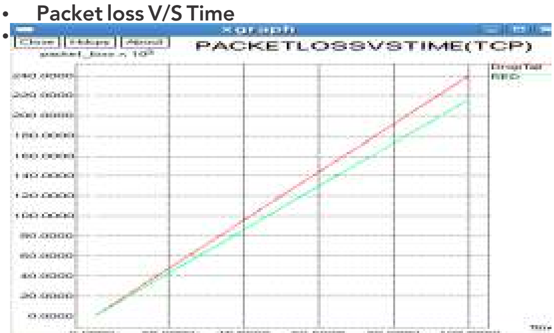

Figure 2 : Packet loss V/s Time (TCP)

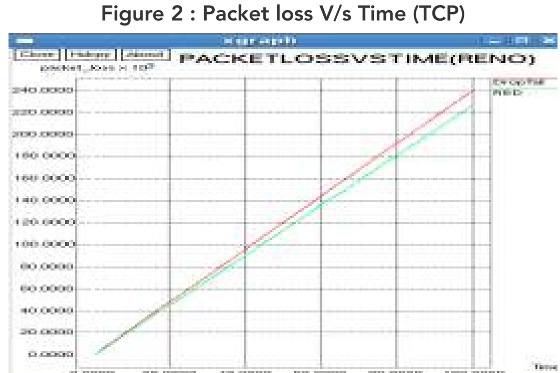

Figure 3 : Packet loss V/s Time (Reno)

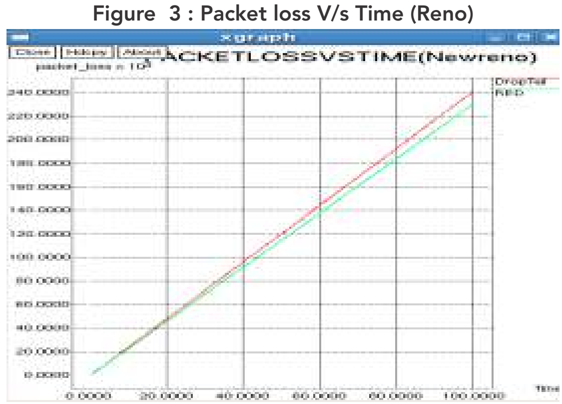

Figure 4 : Packet loss V/s Time (Newreno)

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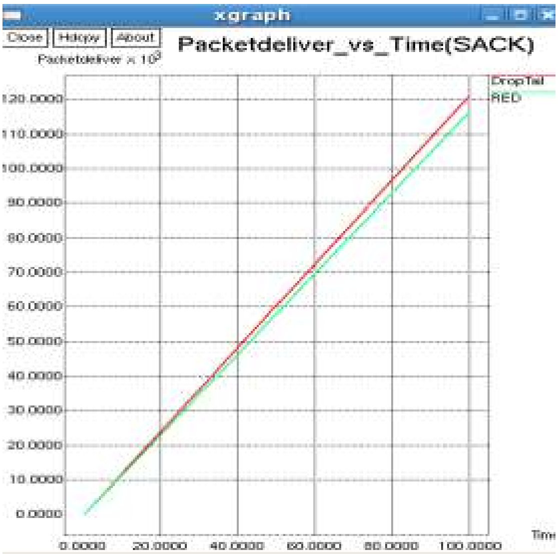

Figure 5: Packet loss V/s Time (SACK)

Table 1 : Packet Loss in DropTail and RED

	DropTail	RED
TCP	239957	216397
RENO	238906	225634
NEWRENO	240601	230136
SACK	240835	230315

Compare Packet loss V/s Time in TCP protocol version in presence of DropTail and RED Queuing Techniques. RED was designed with the objectives to minimize packet loss.So,for this objective, we evaluate with different TCP versions and from above fig.2,3,4 and 5 (and Table 1)we can conclude that using RED packet loss is less compare to DropTail for all the TCP Versions.

- **Sequence No V/S Time**

Table 2 :Seqn No in DropTail and RED

	DropTail	RED
TCP	220301411	512104790
RENO	236715558	568686243
NEWRENO	316417473	629922227
SACK	352172530	651081655

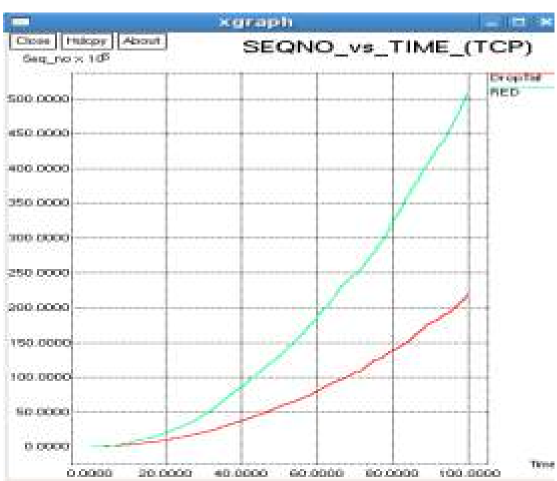

Figure 6 : Sequence No V/S Time (TCP)

Figure 7: Sequence No V/S Time (RENO)

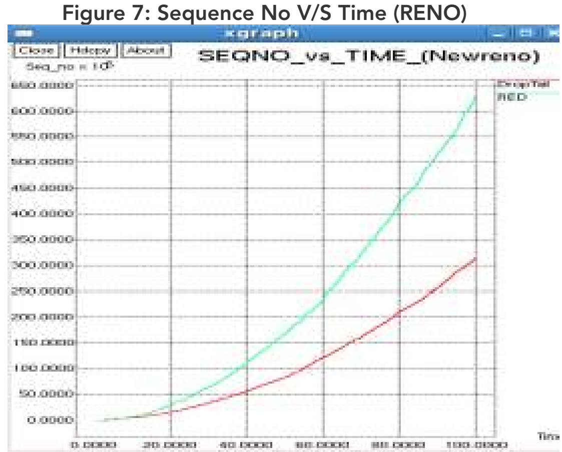

Figure 8: Sequence No V/S Time (Newreno)

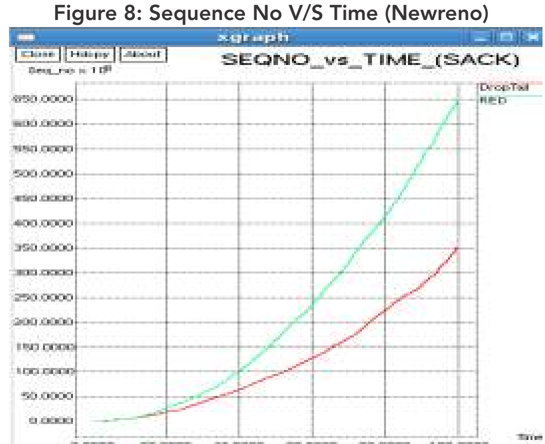

Figure 9: Sequence No V/S Time (SACK)

- **Throughput V/S Time**

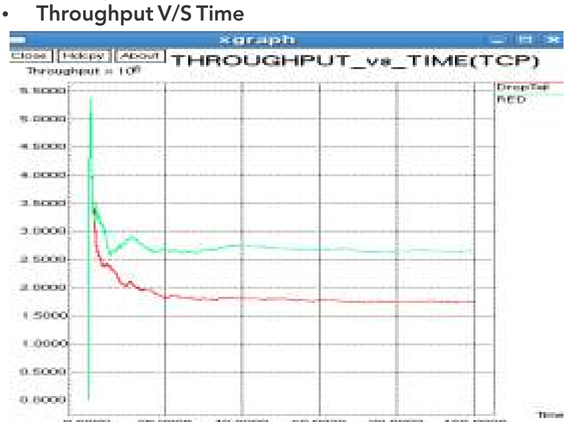

Figure 10: Throughput V/S Time (TCP)

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Figure 11: Throughput V/S Time (RENO)

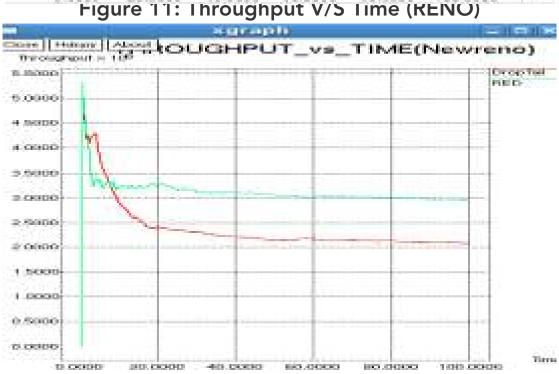

Figure 12: Throughput V/S Time (Newreno)

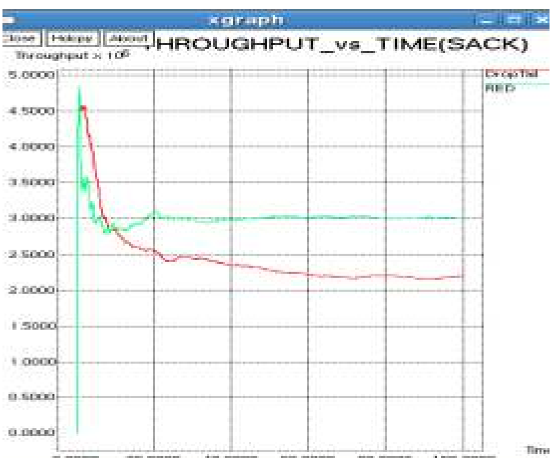

Figure 13: Throughput V/S Time (SACK)

In Fig.6,7,8 and 9.compare Sequence No V/S Time in different TCP version.Second Objective of RED is to maintain high link utilization.So,Using RED we utilized Higher link Capacity Compare to DropTail or we are transmitting a higher number of packet compare to DropTail.In Fig.6,7,8 and 9 and In Table 2 we make Comparison of Different TCP version with DropTail and RED and from the result we can say that using RED we utilized higher link Capacity and we transmitting a higher number of packers compare to DropTail.

- **Queue_ AVERAGE V/S Time**

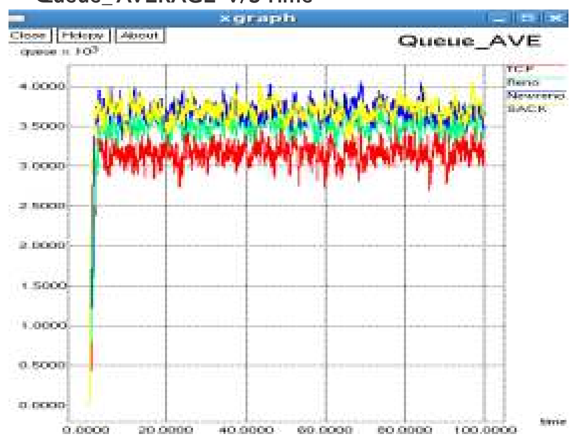

Figure 14: Average Queue Utilization

Fig.14,Show Average Queue Utilization in different TCP Version.As Version improve link utilization also increase.

I. CONCLUSION

Here we analyze the performance of some queuing techniques namely Drop-tail and RED based on simulation results. Result shows that, RED performs better than Droptail because it maintains good link utilization also in presession of different protocol and small queue size. Also it maintains low delay, high throughput, low packet drop and high packet delivery ratio than others. RED achieves fairness significantly better than Drop-tail . RED is comparatively less sensitive to parameter like maxp. RED performed better than Drop-tail in Presence of all TCP version.

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