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TCP VARIANTS TO CONTROL CONGESTION

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ABSTRACT

TCP is used to control the congestion.In this paper we are going to use the variants of TCP for instance Reno, New Reno, SACK, FACK and Vegas to control the congestion. We will compare these variants on the basis of different parameters like the number of packets dropped, number of packets sent, total delay etc. These parameters will help to select the best variants in a specific field.

Keywords*: Reno, New Reno, SACK, FACK, Vegas.*

1. INTRODUCTION

If every user sends data at very high rate, it will cause congestion so the packets will be dropped and provide unreliable transmission. But on the other hand if every user sends data at very low rate, resource will not bewell-utilized. So to overcome all these problems we use the congestion control algorithms. Transmission Control Protocol (TCP) is the most popular congestion control protocol that is provide end-to-end and a reliable connection. It is compatible for both wired and wireless network. TCP has various kinds of variants that are used to control to control the congestion for instance TAHOE, RENO, NEW RENO, VEGAS, RBP, Asym, SACK, FACK etc. TCP Tahoe is the base of all other variants. It is introduced by Van Jacobson [1]. Tahoe suggest slow start and congestion avoidance mechanism. TCP Reno and TCP New Reno both are the extended versions of Tahoe. TCP Vegas is modification of Reno. It builds on the fact that proactive measures to encounter congestion are much more efficient than reactive ones.TCP SACK is an extension of TCP RENO and it works around the detection of multiple lost packets, and retransmission of more than one lost packet per RTT problems face by TCP RENO and TCP New RENO [2].

II. LITEATURE SURVEY

1. Harjinder Kaur and Gurpreet Singh:- In this research paper authors discuss on TCP Congestion Control and Its Variants. They compare the TCP variants for instance Reno, NewReno, FACK, SACK, Vegas, RBP and Asym using some performance parameters. They select the best TCP in the specific platforms [1].
2. Md. Shohidul Islam et al: - In this research author discuss the “TCP Variants and Network Parameters: A Comprehensive Performance Analysis”.This paper include some parameters like propagation delay, bandwidth, Time to live, round trip time, rate of packets sending and so on to check the performance of TCP variants. In this author select the best version of TCP in each parameter. Such analysis is helpful in selecting the suitable TCP for certain criteria [3].
3. Yuvaraju B N and Dr. Niranjan N Chiplunkar: - This paper is on “Scenario Based Performance Analysis of Variants of TCP Using NS2 – Simulator”. It checks the performance of TCP Tahoe, TCP Reno, TCP New

Reno, TCP SACK, TCP FACK and TCP Vegas under different scenarios. At the last this research paper concludes that TCP Vegas is better than other TCP variants for sending data and information [4].

4. NehaBathlaet al: -"Estimating Performance of TCP Alternatives in Wireless Environment" thispaper compares TCP variants on the basis of different parameters using AODV routing protocol on NS-2. After obtaining results is shown that TCP Vegas have higher efficiency and better performance than other TCP variants [5].
5. Subramanya P et al: - This paper is on "Performance Evaluation of High Speed TCP Variants in Dumbbell Network" and it uses dumbbells network for calculating the performance of TCP variants. According to this paper the performance of TCP variants depends on the congestion in the network and TCP New Reno performs very well for congestion control [6].
6. AbhishekSawarkar and HimanshuSaraswat: - In this paper authors discuss "Performance Analysis of TCP variants". It contains the three experiments in terms of throughput, latency and packet dropped ratio [7].

III. TCP VARIANTS

- TCP RENO
- TCP New RENO
- TCP SACK
- TCP FACK
- TCP VEGAS

3.1TCP RENO

TCP Reno uses the same mechanism as TCP Tahoe like slow starts and the coarse grain retransmit timer. However it adds some features over it

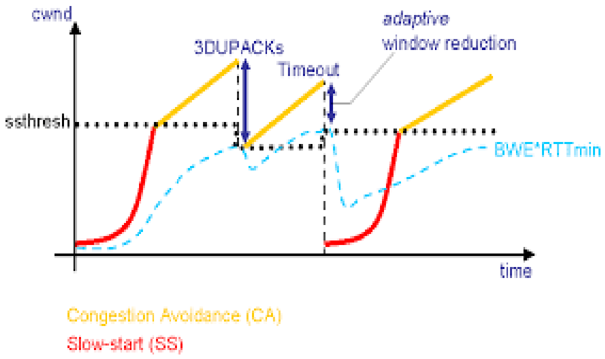

Fig 3.1 fast re-transmit

(i) lost packets are detected earlier.

(ii) the pipeline is not emptied every time a packet is lost.

Reno requiresthat we receive immediate acknowledgement whenever a segment is received.

TCP RENO suggests a new mechanism Fast Re-Transmit. Whenever 3 duplicate packets are received then it is the sign of the packet loss. So the solution is that we retransmit the packet with waiting for timeout [8].

3.2. TCP New RENO

TCP New RENO is an extended version of TCP RENO. TCP NEW Reno has the following abilities over TCP RENO:

- It has the ability to detect the multiple packet loss.
- It does not leave the fast recovery phase until all unacknowledged packets are acknowledged at the time of fast recovery.
- When multiple packets are lost then TCP RENO does not reduced congestion window size many times.

But it cannot detect multiple packet loss in single window [9].

3.3. TCP SACK

TCP SACK is Selective Acknowledgement. In TCP SACK acknowledged only selected packets that are lost during the transmission. It has a block of selectively acknowledged packets. Thus it makes the TCP SACK, different form TCP Reno. When all outstanding packets are acknowledged then it enters in the congestion avoidance phase and leaves the fast recovery [5].

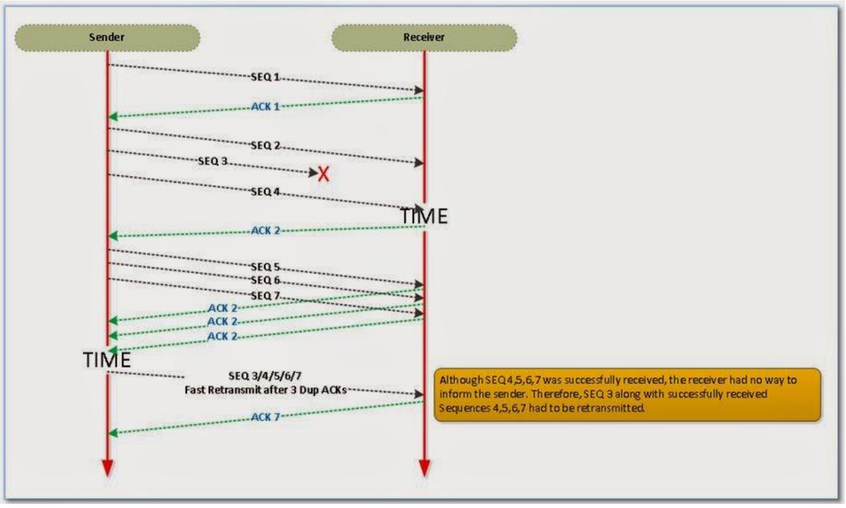

Fig 3.2. TCP SACK

3.4. TCP FACK

TCP SACK with forward acknowledgement is called TCP FACK. To estimate the amount of data in the transit it uses the FACK option. When congestion is occurs then it uses an efficient way to halve the congestion window. Congestion window is immediately halved to estimatethe correct congestion window that should be further decreased [10].

3.5. TCP VEGAS

TCP Vegas was introduced by Brakmo et al. Bandwidth estimation scheme is the best feature provided by the TCP Vegas. Previous studies show that TCP Vegas achieves higher efficiency than the other TCP variants [11]. TCP Vegas updates the congestion window from the following equations:

(1) expected_rate = cwnd(t)/base_rtt

Where cwnd(t) is the current congestion window size and base_rtt is the minimum RTT of that connection.

(2) actual_rate = cwnd(t)/rtt

Where rtt is the present round-trip time

(3) diff = expected_rate – actual_rate

The source estimates the backlog in the router queue from the difference

(4) Using this value of diff, the congestion window value (cwnd) is adjusted as:

cwnd +1 if diff < α

cwnd –1 if diff > β

cwnd = cwnd otherwise

The TCP Vegas is an extended version of Reno. To control the congestion in the network TCP Vegas uses proactive measures rather than reactive measures. It uses an algorithm to check for timeouts. It also overcomes the problem of requiring enough duplicate acknowledgements to detect a packet loss. Vegasuses modified slow start mechanism. It can detect congestion even before packet losses occur, but it also retains the other mechanisms of Reno and Tahoe. Overall, the Vegas has a new retransmission mechanism, a modified slow start algorithm and congestion avoidance scheme [12].

IV. PARAMETERS UNDER STUDY

- Number of packets dropped
- Number of packets sent
- Delivery ratio
- Average Throughput
- Total Jitter
- Total Delay
- Average Jitter
- Average Delay

(i) **Number of packets dropped:** It is failure of transmitting packets to arrive at their destination. It is calculated as: Number of packets dropped= total no. of packets sent-total no. of packets received

(ii) **Number of packets sent:** It is total number of packets successfully reached at destination.

(iii) **Delivery Ratio:**Delivery Ratio= no. of packets successfully delivered/ total no. of packets sent

(iv) **Average Throughput: -** Averagethroughput is the rate at which data flow past some measurement point in the network. It can be measured in bits/sec, bytes/sec or packets/sec.

(v) **Total delay:**Total delay= packet generation time/packet receiving time.

(vi) **Total Jitter: -** Variations in delay of receiving packets, called jitter. It is the variation in latency as measured in the variability over time of the packet latency across a network

(vii) **Average Delay: -** The average delay a packet takes to travel from sender to the receiver side node. A delay is introduced due to the queuing of packets at the interface of node, time transmission and due to buffering during route discovery.

(viii) **Average Jitter: -**It is time variation between subsequent packets arrived. Main causes of jitter are network congestion or route changes [13].

V. PERFORMANCE ANALYSIS

Here we show the graphs that are produced after the research. In these graphs we represent the comparison of given parameters with the number of nodes. Graphs show how the number of nodes affects the performance of TCP variants.

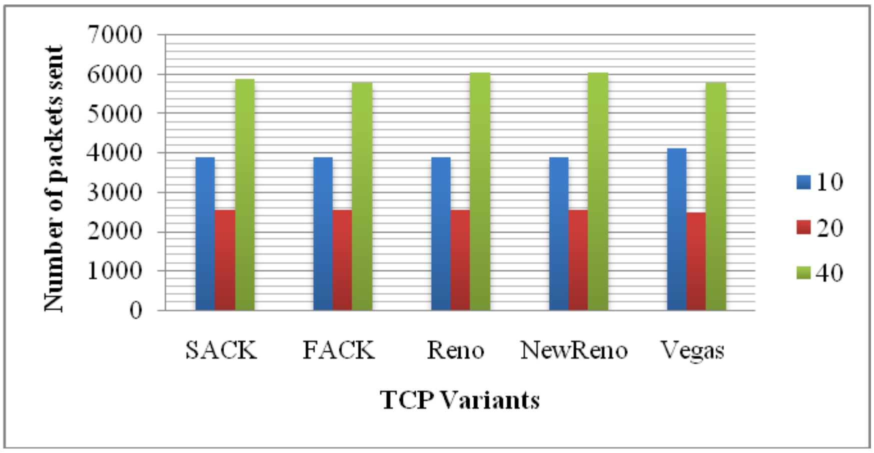

Fig 3.3 number of packets sent vs. TCP variants

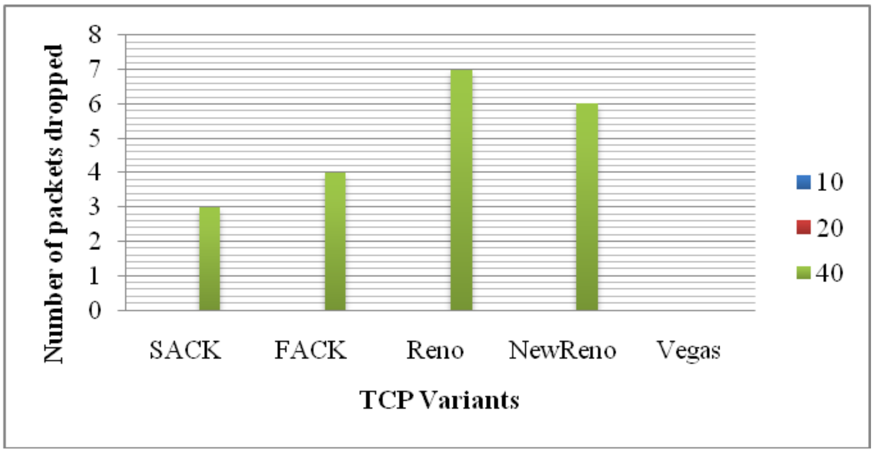

Fig. 3.4 number of packets dropped vs. TCP variants

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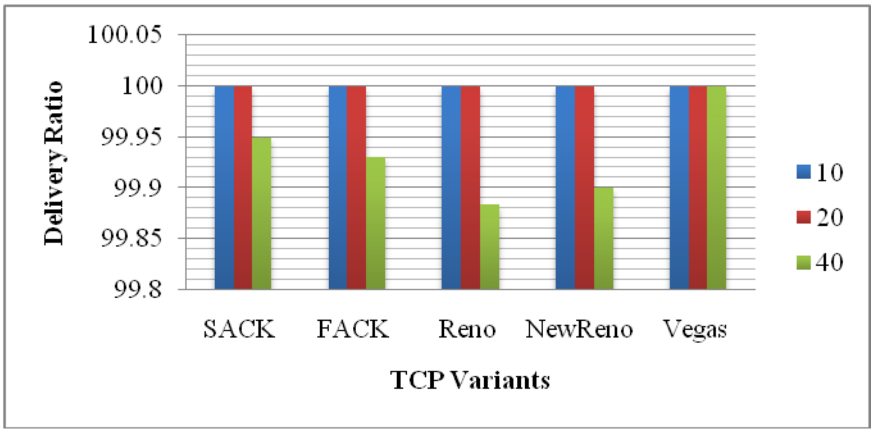

Fig. 3.5 delivery ratio vs. TCP variants

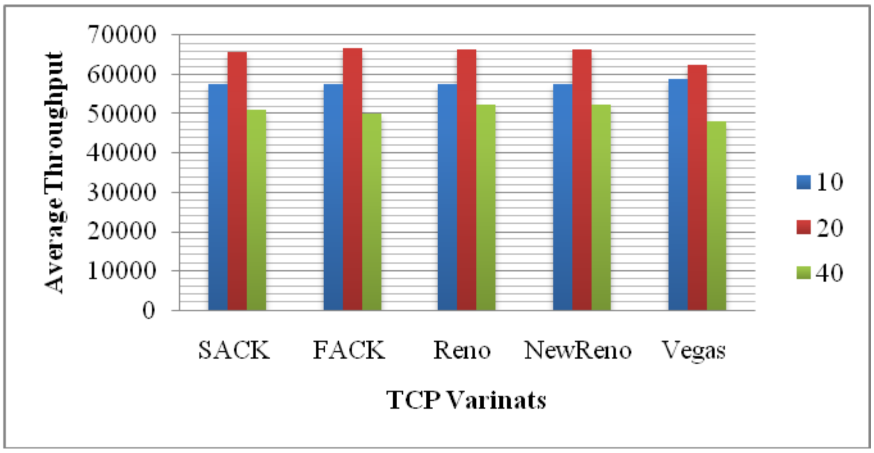

Fig. 3.6 average throughput vs. TCP variants

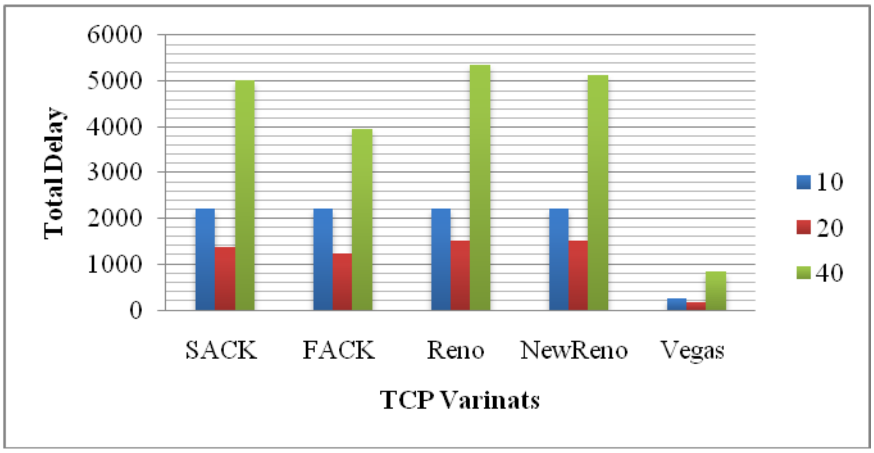

Fig. 3.7total delay vs. TCP variants

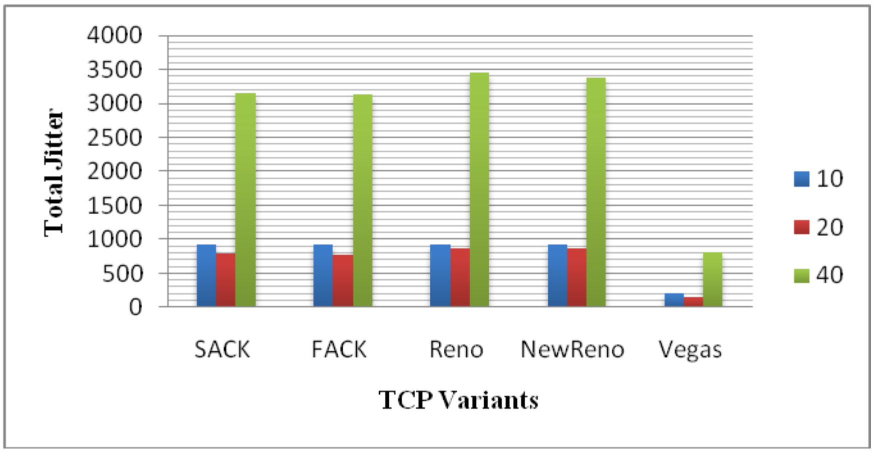

Fig. 3.8total jitter vs. TCP variants

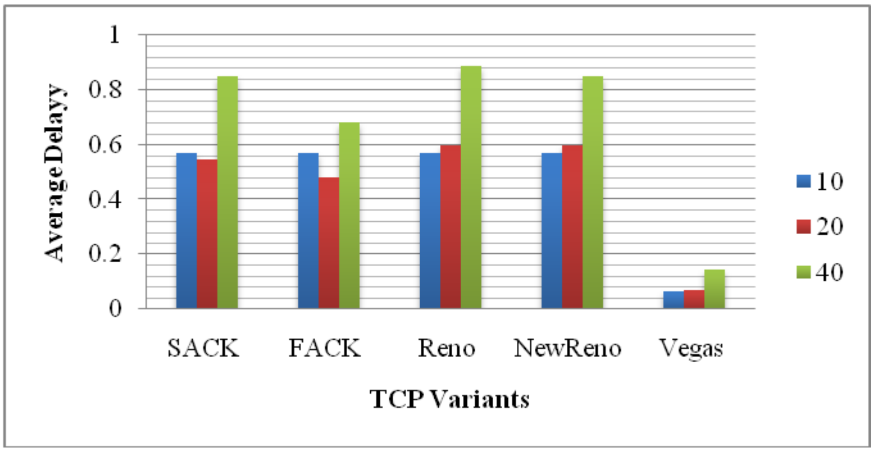

Fig. 3.9average delay vs. TCP variants

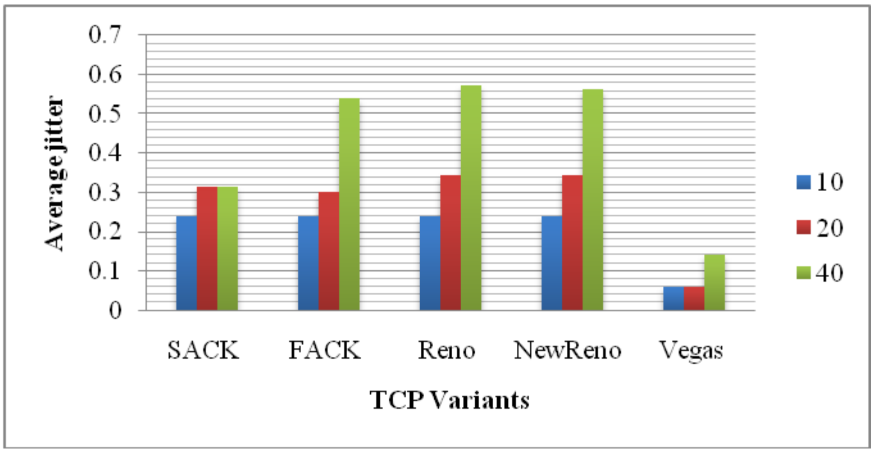

Fig 3.10 average jittervs. TCP variants

VI. RESULT

Here we select the best TCP on the basis of above mentioned parameters. Each variant reacts differently under different parameters. If a variant has low performance in a parameter, then it can be possible that the variant has the highest performance in another parameter. Table1 depicts more about it: -

Table 6.1 Best TCP Variant Based On Parameters

PARAMETERS	BEST TCP
No. of Nodes vs. No of Packets Dropped	Vegas
No of Nodes vs. No. of packets sent	NewReno
No. of Nodes vs. Average Throughput in bytes/Sec	NewReno
No. of Nodes vs. Delay	Vegas
No. of Nodes vs. Jitter	Vegas

VII. CONCLUSION

In this paper we work on five TCP variants Reno, New Reno, SACK, FACK and Vegas. All these variants are same, but the difference is in their congestion control mechanism. If there is no congestion they all will have same output. This paper will help to select the best TCP variants under specific platforms.

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