



## **COMPUTER NETWORKS**

### **ASSIGNMENT 5**

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**TCP (Transmission Control Protocol)** is a connection-oriented communication protocol that helps in the exchange of messages between devices in a network. TCP takes messages from one application/server and divides it into packets, which is then forwarded by the devices in the network.

Congestion happens if the packets beyond the capacity of the network, which is a state in which the traffic of message is too heavy that it affects the response time. Time needed for a packet to reach the destination is increased. There are quite a few negative effects of congestion one of them is that the delay increases affecting the performance negatively. The important aspect of TCP is that it can handle the congestion with help of network congestion-avoidance algorithm. To execute them we are provided with different variants of TCP which are as follows:

- **TCP New Reno**  
New Reno is the extension of Reno in this if congestion occurs, it retransmits the packets and enters a new mechanism that is fast recovery. Its advantage is that it detects multiple packet loss. Moreover, it does not leave the fast recovery until it receives acknowledgment of all packets, present in the window. New Reno has modified congestion avoidance mechanism and has slow start hence, few retransmits only. However, it takes one RTT for detecting packet loss
- **TCP SACK**  
SACK also known as selective acknowledgment is a variant where receiver acknowledges discontinuous blocks of packets which were received correctly. This allows the server to send the selective lost packets When all the outstanding packets are acknowledged, then SACK exits fast recovery and enters next phase which is congestion avoidance. It has slow start, fast retransmit, fast recovery, and have congestion control mechanism along with selective acknowledgement mechanism with immediate acknowledgement. However, it has a problem that selective acknowledgment has difficult implementation.
- **TCP FACK**  
When SACK is developed with Forward Acknowledgement is called TCP FACK. The outcome of FACK is to perform precise congestion control and improve connection throughput during the recovery phase. It decouples congestion control from data recovery hence, attaining more precise control over the data flow in the network. It has slow start, fast retransmit, fast recovery, and have congestion control mechanism along with forward acknowledgement mechanism with immediate acknowledgement. However, it does not avoid unnecessary inflation of congestion window through delay sensing technique.
- **TCP Vegas**  
TCP Vegas is known as one of the best variants. It uses triple duplicate acknowledgments which always result in packet retransmission. Vegas has also introduced a new re-transmission mechanism for lost packets. It also calculates the round-trip transmissions and looks into the time of every transmission to re-transmit them if time is more than expected increasing the pace of detecting packets losses.

It also implements modified slow start and congestion avoidance mechanisms, which finds the correct window before incurring losses. This variant also gives fast retransmit and fast recovery along with multiple packet losses detection. However, it also has a drawback that it does not have any mechanism for rerouting. Although despite that it is still better than variants written above.

- TCP-CUBIC

CUBIC is one of the new and most efficient TCP variants. Its efficiency can be seen by the fact that it is the current default TCP algorithm in Linux. CUBIC less aggressive and systematic, in which the congestion window is a cubic function of time since the last packet loss. This variant also gives fast retransmit and fast recovery along with multiple packet losses detection. TCP CUBIC gets the edge over others on adjustment of congestion window it does.

It can be concluded from the information about different variants that there is none which can overcome the problem of congestion. All have their own pros and cons however, looking at all the parameters it can be seen that Vegas and newly CUBIC provides more efficiency and give better results.