Hands-on Lab 3

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**2. TCP Congestion Control**

a. What is the relationship of TCP and IP?

The higher layer, Transmission Control Protocol, manages the assembling of a message or file into smaller packets that are transmitted over the Internet and received by a TCP layer that reassembles the packets into the original message. The lower layer, Internet Protocol, handles the address part of each packet so that it gets to the right destination.

In short, TCP is responsible for the data delivery of a packet and IP is responsible for the logical addressing. In other words, IP obtains the address and TCP guarantees delivery of data to that address. TCP is the "payload" of an IP packet when receiving data, since it's an upper level protocol.

b. Describe the basic ideas of TCP-Reno and TCP-Vegas and compare their differences

TCP-Reno:

Slow start:

At the beginning, the Congestion Window is set to 1 MSS, every time the receiver receives an ACK, it increases the congestion window until there is a packet loss or when it reaches the slow start threshold.

Congestion Avoidance: After the CongWin reaches the threshold, it increase the window size linearly until a packet loss

Fast recovery: When a packet gets lost, half of the current CWND is saved as Slow Start Threshold (SSThresh) and as new CWND, thus skipping slow-start and going directly to Congestion Avoidance algorithm

TCP-Vegas:

TCP Vegas is a TCP congestion avoidance algorithm that emphasizes packet delay as a signal to help determine the rate at which to send packets. It detects congestion at an incipient stage based on increasing Round-Trip Time (RTT) values of the packets in the connection. The algorithm depends heavily on accurate calculation of the Base RTT value. If it is too small then throughput of the connection will be less than the bandwidth available while if the value is too large then it will overrun the connection.

Difference:

TCP Reno relies on the packet loss as a signal to help determine the rate at which to send packets. It detects the congestion in the network only when a packet loss happens. However, TCP Vegas relies on the computation of the RRT to detect congestion. TCP Vegas senses the congestion earlier than TCP Reno, thus decrease the sending rate before Reno.

c. Describe the AIMD (Addictive Increase and Multiplicative Decrease) mechanism which is used in TCP

Additive increase: increase the congestion window by 1 MSS every RTT while there is no packet loss.

Multiplicative Decrease: When a packet gets lost, decrease the congestion window to half the value of the previous value.