TCP Variants Analysis

Course: Fundamentals of Computer Networks

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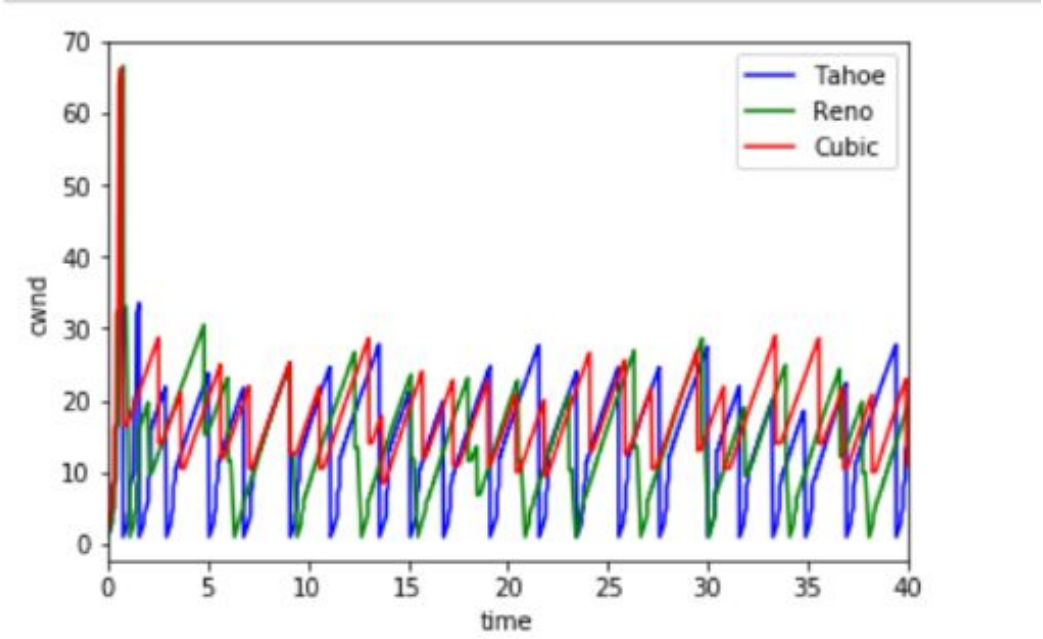
Experiment 1: Analysis of Performance Metrics

Congestion Window v/s Time

Tahoe is unscalable as we are moving the start to 1MSS every time a loss occurs.

Reno reduces the threshold to cwnd and start to half of cwnd.

Cubic growth function for cwnd calculation. This is highly scalable especially for the flows with large RTTs.

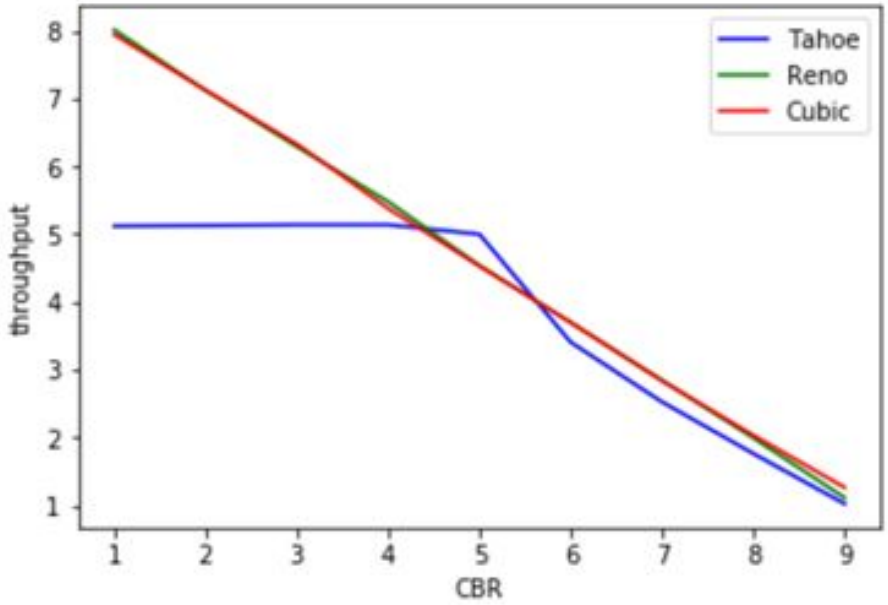


Throughput with CBR

Tahoe waits till the third duplicate ACK is received(packet is dropped) for retransmission and starts the cwnd from slow start phase. As a result exhibits a bad throughput compared to others.

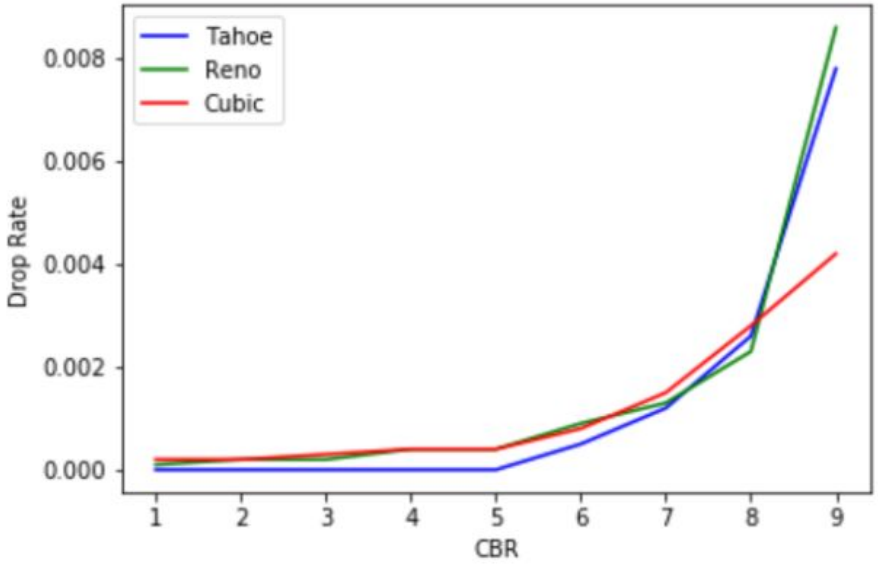
Reno overcomes the above problems by fast recovery. Better than Tahoe.

Cubic's throughput is better than reno and Tahoe.



Drop Rate with CBR

Reno has highest drop rate compared to tahoe and cubic. Cubic has the least drop rate.



Experiment 2: Fairness Analysis

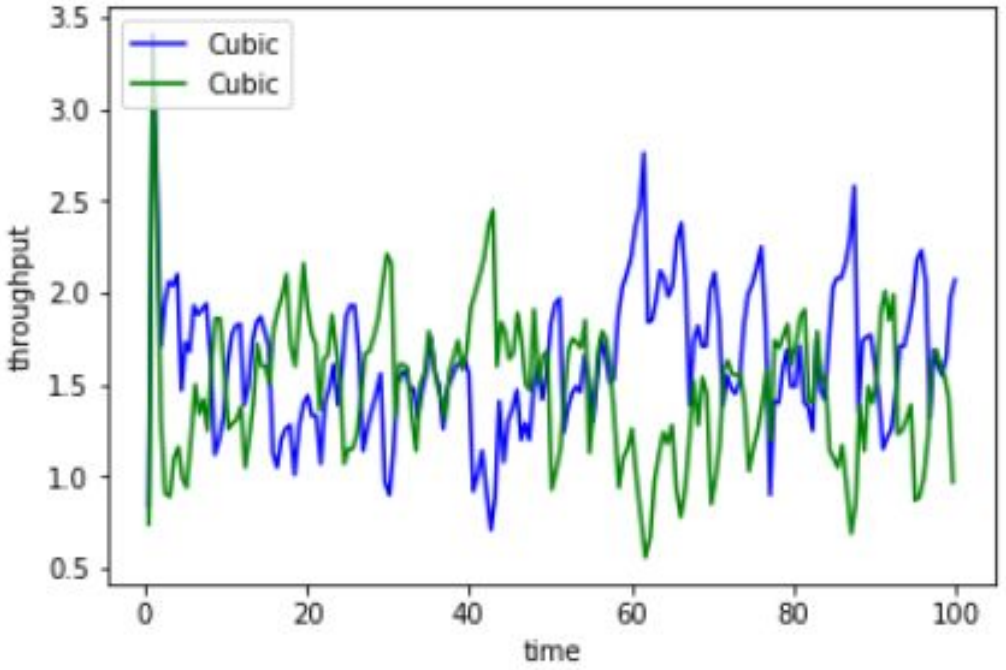
CUBIC with CUBIC

Cubic is fair enough to other cubic flows.

Less aggressive.

Converges with time.

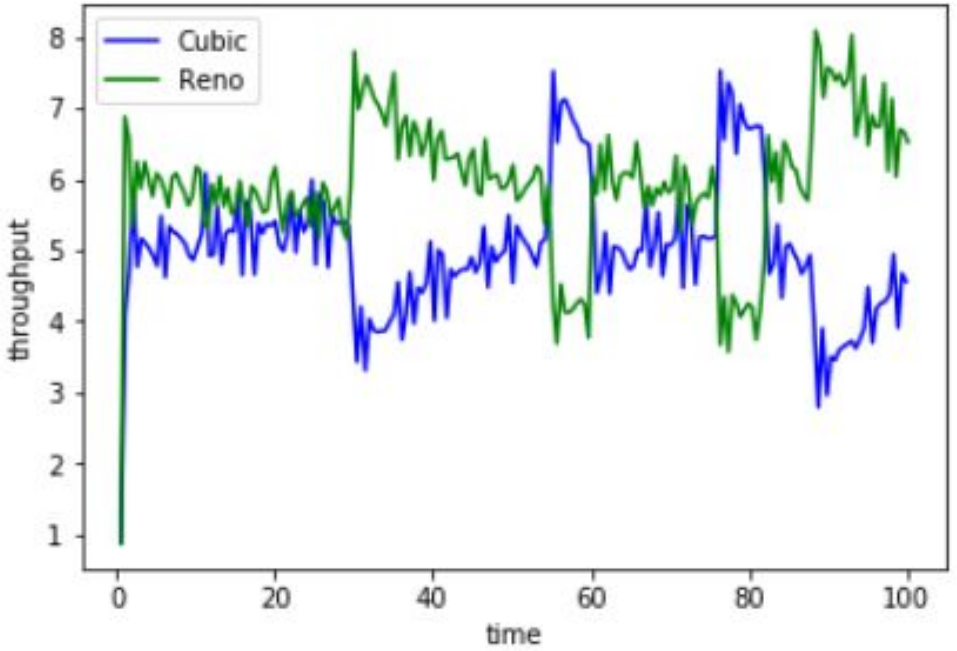
The window growth function doesn’t depend on RTT and hence is fair for flows with different RTTs.



Cubic with Reno

Reno is more aggressive than Cubic due to different link utilization.

Not fair to each other.

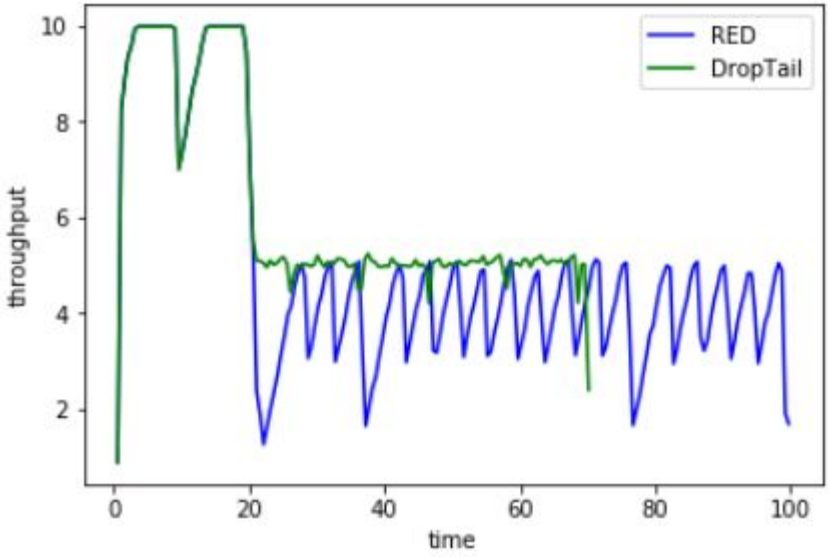


Experiment 3: Impact of Queuing Methods: RED and Drop-Tail

Throughput with Time

Drop tail doesn't allow to reduce the cwnd in a steady manner while RED allows the network links to slow down at a steadier rate.

Thus, performance of TCP Cubic is better under RED than Drop Tail.



Changes in TCP Cubic Implementation

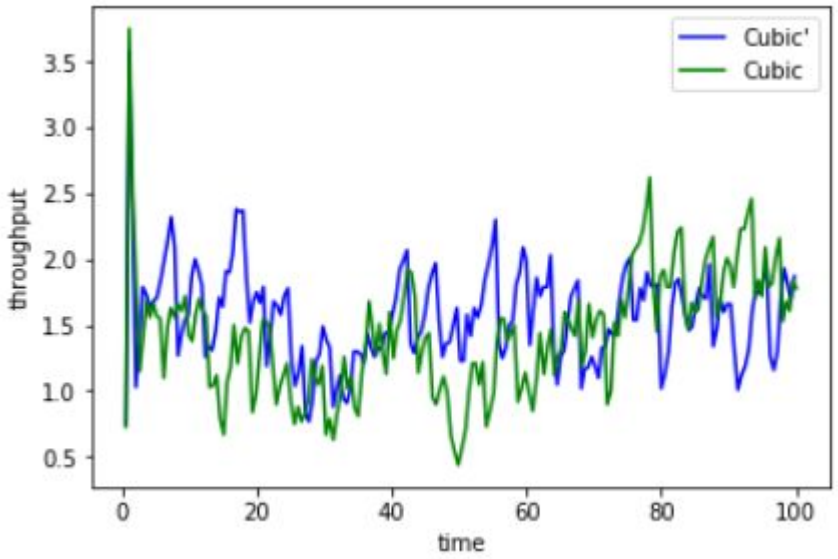
Added a parameter- alpha which controls the increase of cwnd after every ack.

Experimented with alpha and beta value to understand the impact of cwnd increase and multiplicative decrease on tcp cubic's fairness with another tcp cubic flow.

In addition to exposing these values, we scaled the value of K by multiplying with x*RTT to make the window more scalable and improve RTT fairness.

Cubic modified with Cubic original

Better throughput than original cubic.



Thank you!