

High level of view of “analysis_pcap_tcp.py”:

I defined two classes for this project: Packet and Flow. Packet is used to parse the buffer information to get each human readable network packet; Flow is used to store all packets for the same tcp connection and then finish the required task for each flow. I maintain two global lists: packets and flows to store the processed packets and flow for following task. My project finished all required tasks for one flow first, and then move to the next one.

Answers:

Task A-1:

3 TCP flows are initiated from the sender

These are the results for flow 1

Task A-2-1:

Transaction 1:

Sender: sequence = 705669103 acknowledge = 1921750144 receive window = 3

Receiver: sequence = 1921750144 acknowledge = 705669127 receive window = 3

Transaction 2:

Sender: sequence = 705669127 acknowledge = 1921750144 receive window = 3

Receiver: sequence = 1921750144 acknowledge = 705670575 receive window = 3

Task A-2-2:

Throughput is 42.01113 Mbps

Task A-2-3:

The packets sent of this flow is 6977

The loss of this flow is 3

Hence the loss rate is 0.00043

Task A-2-4:

Estimated RTT is 0.07354 second

Theoretical throughput is 9.38044 Mbps

Task B-2:

Number of triple duplicate ack = 2

Number of timeout = 1

These are the results for flow 2

Task A-2-1:

Transaction 1:

Sender: sequence = 3636173852 acknowledge = 2335809728 receive window = 3

Receiver: sequence = 2335809728 acknowledge = 3636173876 receive window = 3

Transaction 2:

Sender: sequence = 3636173876 acknowledge = 2335809728 receive window = 3

Receiver: sequence = 2335809728 acknowledge = 3636175324 receive window = 3

Task A-2-2:

Throughput is 10.28337 Mbps

Task A-2-3:

The packets sent of this flow is 7068

The loss of this flow is 94
Hence the loss rate is 0.01330

Task A-2-4:
Estimated RTT is 0.08860 second
Theoretical throughput is 1.39998 Mbps

Task B-2:
Number of triple duplicate ack = 3
Number of timeout = 91

These are the results for flow 3

Task A-2-1:
Transaction 1:
Sender: sequence = 2558634630 acknowledge = 3429921723 receive window = 3
Receiver: sequence = 3429921723 acknowledge = 2558634654 receive window = 3
Transaction 2:
Sender: sequence = 2558634654 acknowledge = 3429921723 receive window = 3
Receiver: sequence = 3429921723 acknowledge = 2558636102 receive window = 3
Task A-2-2:
Throughput is 11.85205 Mbps

Task A-2-3:
The packets sent of this flow is 729
The loss of this flow is 0
Hence the loss rate is 0.00000

Task A-2-4:
Estimated RTT is 0.07327 second
Theoretical throughput is infinity
Task B-2:
Number of triple duplicate ack = 0
Number of timeout = 0

Explain:

Task A-2-1: sequence means the start point of my current sending data; acknowledge means the start point of data I expect to receive; receive window means the receive window size is 3*16384 (scaling)

Task A-2-2:
Throughput = total data size / time difference
For computing throughput, I count the whole packet which includes all three headers: TCP header, IP header, and link header. Time difference is the difference between the first packet and the last packet. In addition, I only consider the packets from sender to receiver.

Task A-2-3:
I use the number of retransmission to identify the number of packet. As the above question, I only consider the packet from sender to receiver.

Task A-2-4:
Theoretical throughput is smaller than empirical throughput. This is because the TCP congestion control has evolved over the years and bandwidth environments are different. So the old formula and loss rate theory does not fit current network.