Performance Report

Group Members:

Thakur Shivank Singh	- 2018A7PS0439H
M. Nikhil Chandra	- 2018A7PS0260H
R.V. Srinik	- 2018A7PS0266H
Nitin Chandra	- 2018A7PS0188H
Tejas Rajput	- 2018A7PS0253H

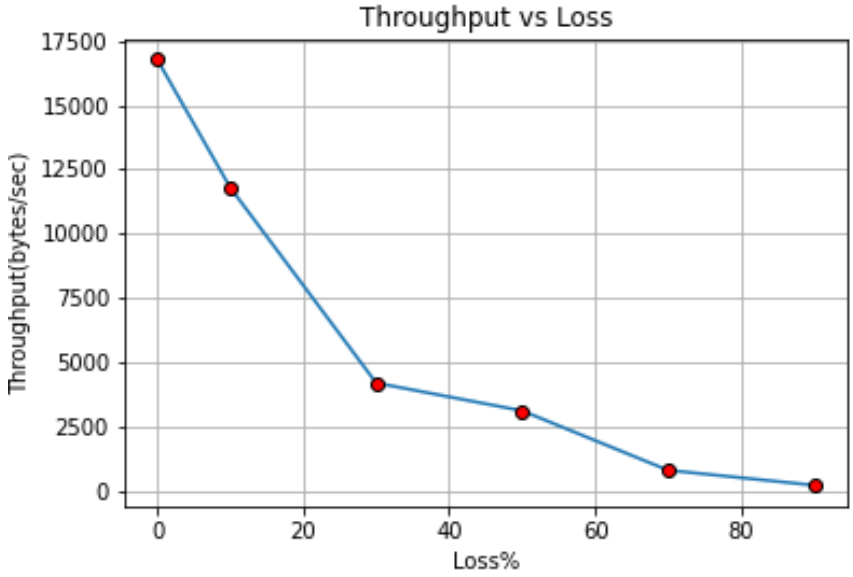
Specifications:

Window Size = 1000
Timeout = 3 secs
File Size = 1,56,697 bytes

After successful file transfer, the file size from both the Client side(file received) and Server side(file sent) is logged.
Throughput is calculated based on the file size and execution time (in Bytes/sec) for various network conditions like Packet Loss, Packet Corruption, Packet Reordering and Delay. These conditions were emulated on localhost using the *netem* tool.

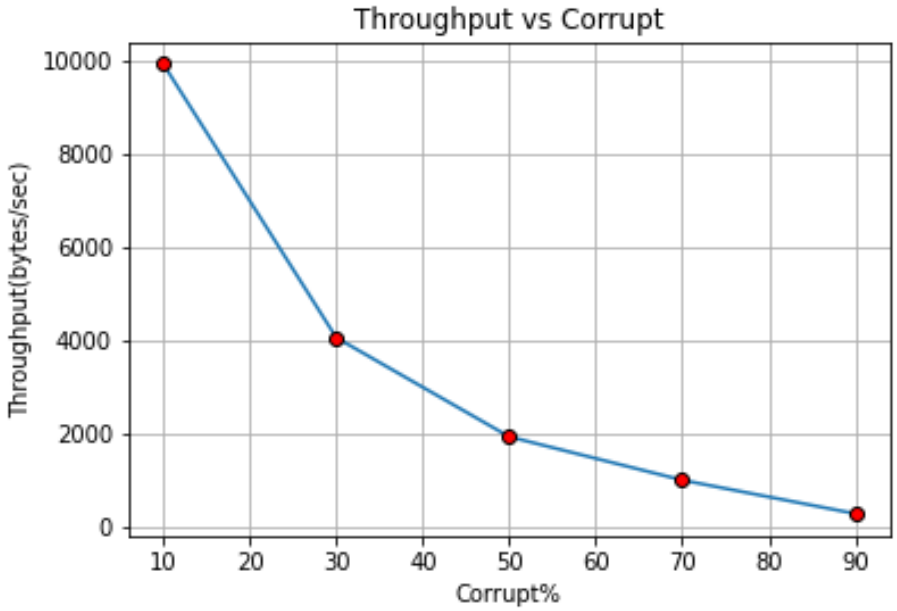
Throughput vs Packet Loss

If the receiver is expecting a certain packet, and this packet is lost during transmission, the sender will wait for the acknowledgement of the packet it had transmitted for the duration given in the retransmission timeout value field. Once this timeout period has elapsed, the packet will be re-transmitted, and the sender will await acknowledgement of the sent packet.
The plot shows that as the Packet Loss % increases, the Throughput decreases steadily due to multiple retransmissions by the Sender when either data packet or ACK packet is lost and reaches timeout.



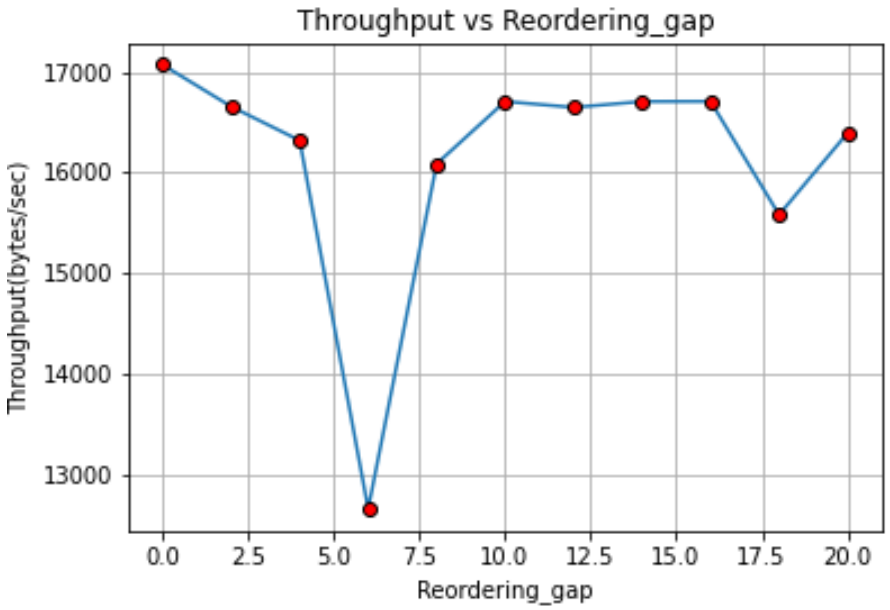
Throughput vs Packet Corruption

On receiving a packet, the receiver calculates the checksum using the md5 hash and compares it with the checksum stored in the packet. Both the values are compared and if they are not equal, the packet is deemed corrupted, and is discarded. The NAK bit is set and the packet is sent to the server.
The plot shows that throughput decreases as packet corruption is increased. This happens because the server keeps receiving NAKs, and hence re-transmits packets over and over again leading to decrease in throughput.



Throughput vs Packet Reordering

According to the Selective Repeat Paradigm, the receiver acknowledges all correctly received packets and these are buffered as needed for eventual in-order delivery to the upper layer.
The out-of-order ACK-ed packets are buffered and eventually when missing packets are received, we deliver the buffered in-order packets to the application layer and advance the window.
The netem tool uses a fixed sequence and reorders every Nth packet based on the gap given, delay and correlation percentage. The throughput remains fairly consistent as packets are accepted and stored in the buffer even when received out-of-order.



Throughput vs Packet Delay

In the event that high latency conditions are prevalent in the network, if a packet was not transmitted within the time, there is a retransmission time-out for that particular packet, and that packet alone is retransmitted by the sender.
The throughput decreases as the network delay increases, as the data packets now take significantly longer to reach the client due to network latencies.