

Various Network Conditions generated using Netem tool

Experimental Conditions

All the parameters are tested using a file “200.gif” with filesize as 142.1kB.
Throughput is calculated using the file size and total time taken to transfer the file. $\text{Throughput}(\text{bytes/sec}) = \text{file size} / \text{time taken}$.

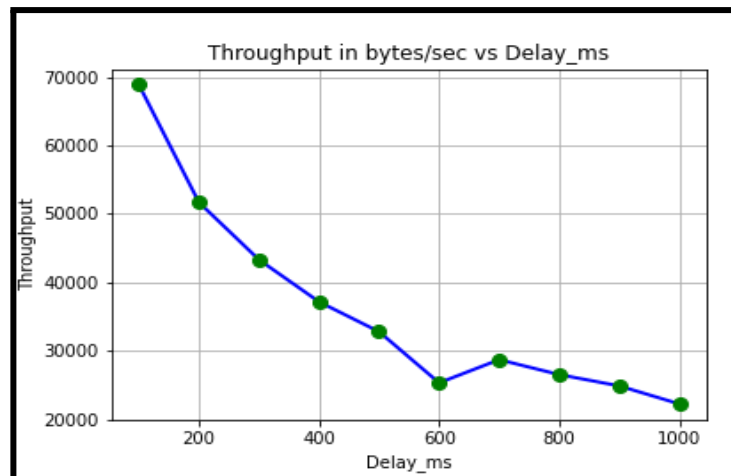
200.gif



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Deepak George	2018A7PS0244H
Shubh Deep	2018A7PS0162H

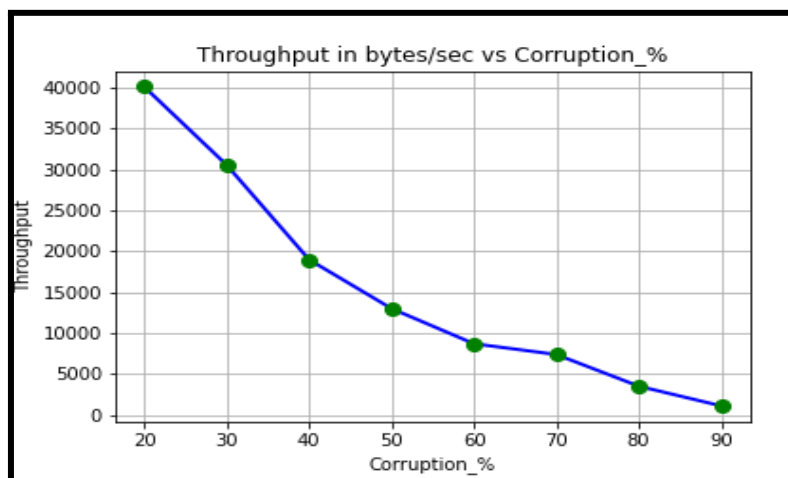
Delay

Handled by :- In the event that high latency conditions are prevalent in the network, if a packet was not transmitted within the retransmission time, that packet alone is retransmitted by the sender (pertaining to selective repeat paradigm).



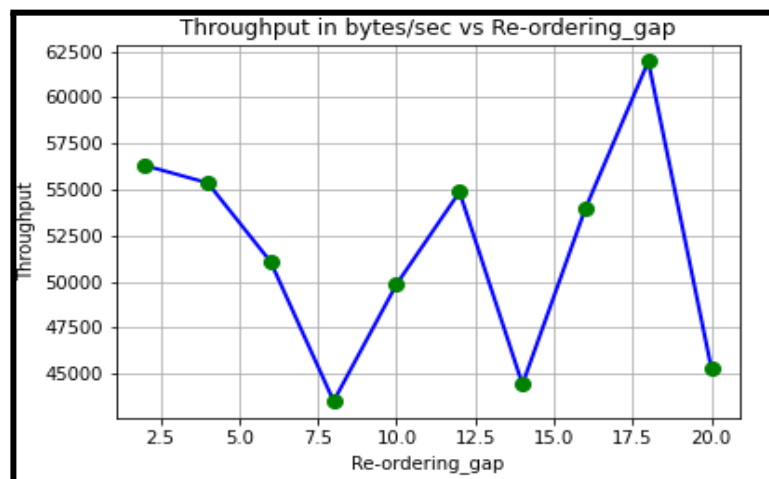
Packet Corruption

Handled by:- On receiving a packet, the receiver calculates the checksum (MD5) and compares it with the checksum in the packet. If the packet is corrupted, the checksums will not match and a NAK segment is sent (NAK bit set).



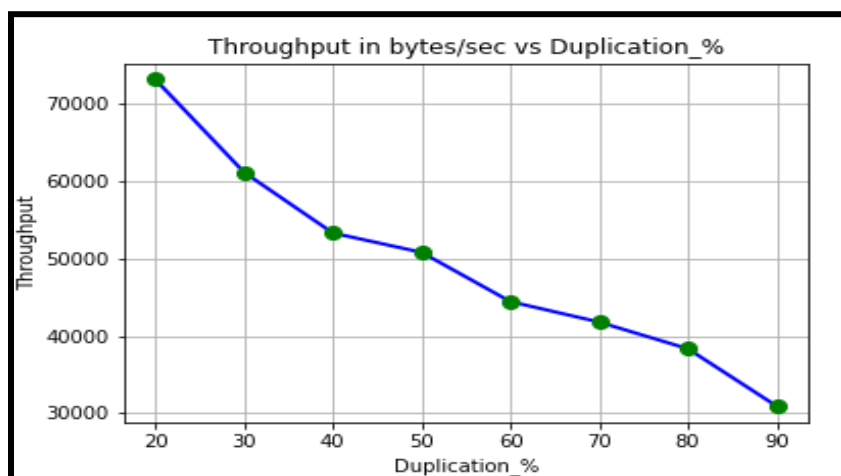
Packet Reordering

Handled by:- 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 to the next not-yet-received packet.



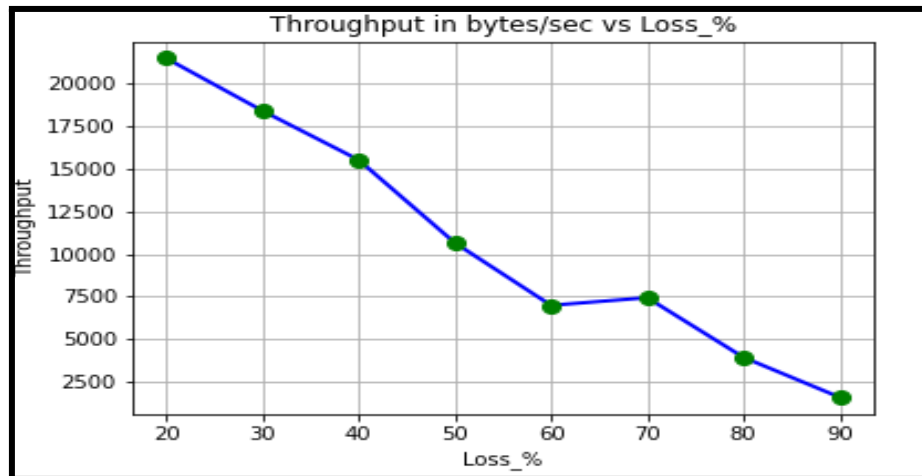
Packet Duplication

Handled by:- If the received packet's sequence number is marked as received in the receiver window/buffer, then we discard the packet (not passed to the application) and send an acknowledgement of the duplicate packet to the sender.



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.



Applying various network conditions simultaneously :-

Delay(ms)	Corruption(%)	Duplication(%)	Reordering gap	Loss(%)	Throughput (bytes/sec)
1	90	-	15	-	1,333.32
200	50	-	14	80	1,342.10
380	70	-	2	30	4,119.23
1	70	-	11	-	4,566.85
1	50	40	14	55	6,620.13
1000	40	-	3	-	7,311.52
100	-	25	-	75	7,684.37
65	65	20	16	-	8,613.70
350	45	40	6	20	10,523.33
1	25	56	7	45	16,577.17
1	-	10	-	25	18,522.83
260	-	30	-	35	21,350.20
475	-	-	4	10	24,059.07
250	-	60	-	40	24,495.20
25	-	35	3	25	25,725.27
300	-	80	-	60	32,421.20
1	35	80	-	5	35,294.53
1	20	55	9	-	35,472.90
45	15	-	1	-	38,221.15
5	-	90	-	60	43,452.52