

CS 421 Computer Networks  
Programming Assignment 2  
Report

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# Plots

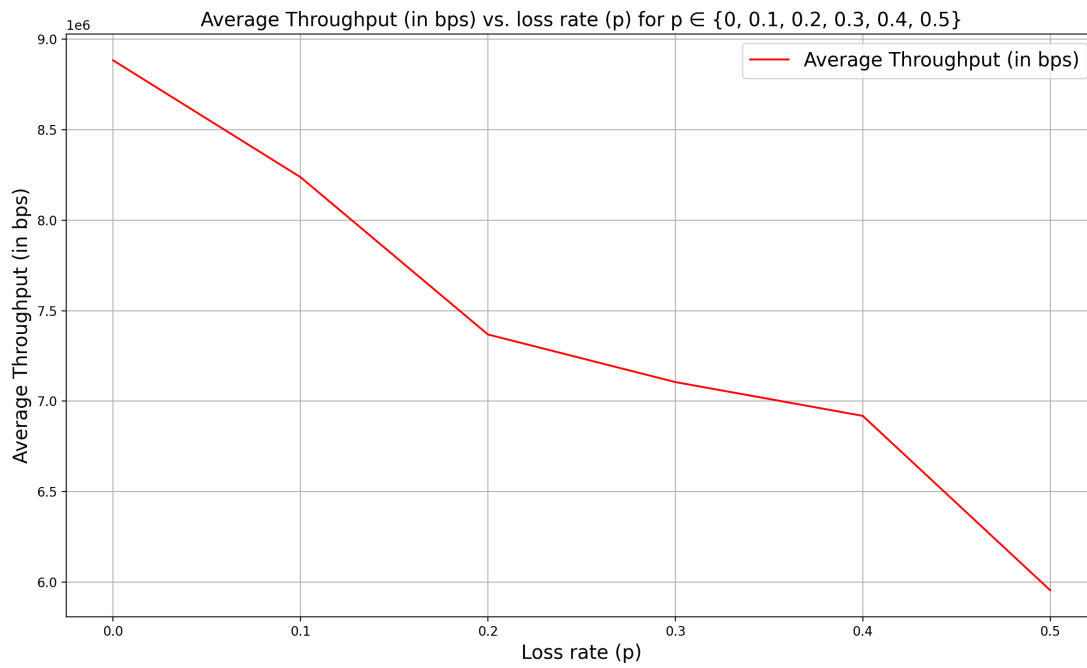


Figure 1: Figure for Average Throughput (in bps) vs. loss rate (p) for  $p \in \{0, 0.1, 0.2, 0.3, 0.4, 0.5\}$

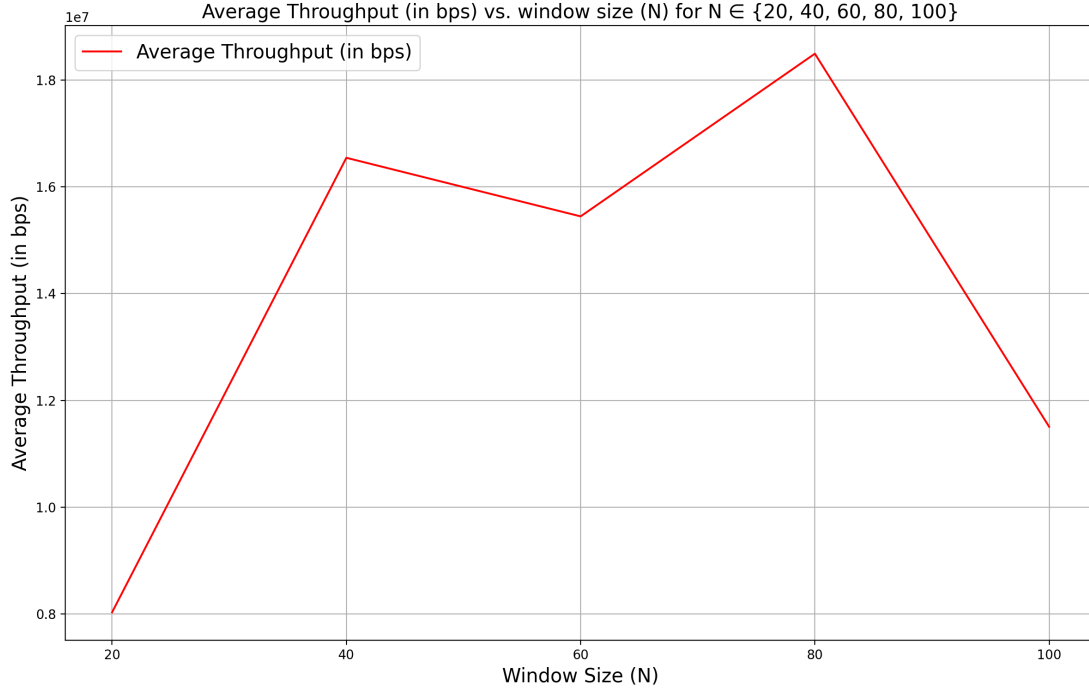


Figure 2: Figure for Average Throughput (in bps) vs. window size (N) for  $N \in \{20, 40, 60, 80, 100\}$

## Discussion

The average throughput of the file transfer decreases as the probability for the occurrence of a loss packet increases. This result is intuitive in the sense that sender receives the packet acknowledgment in a discontinuous way, the acknowledgements that are not received by the sender causes delay in the total transfer time as well as decrease of the throughput. After the transmission of the window, the socket at the sender host waits the acknowledgement that corresponds to the base of the window, during this phase sender window is not updated, the packets with the sequence number that exceeds the window range will not be send. The window may not be updated within the timeout or the window will get updated by a subsequent acknowledgement since cumulative acknowledgement is valid; however, both cases results in increase in time, the effect could be observed in Figure 1.

In the second graph, till window size of 80, average throughput rises with an decreasing rate and when the application performed with a window size of 100 we achieved a lower throughput. The probability of the loss acknowledgments is 0.1 for this graph, according to the shape of the line, the increase at the beginning could be inferred to the maximization of the sender utility. Since cumulative acknowledgement is used through the transfer of the packets, the negative effect of loss acknowledgements are neglected till a certain threshold. While the size of the window is being incremented between 20 and 80, the sender increased its utility by sending more number of packets until the time that first acknowledgement is received. On the other hand, a disadvantage of a large window size in Go-Back-N procedure is that sender discards a significant amount of segments that is transmitted correctly when timeout occurs. Exceeding the threshold which is window size of 100 with the rest of the parameters kept constant enabled to observe this effect in the second figure.