CS3205: Introduction to Computer Networks

Assignment 3

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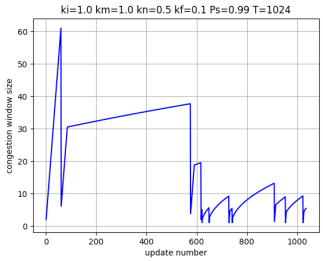
1 Simulation of TCP Congestion control algorithm

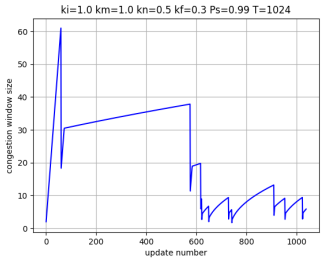
Probability of successfully receiving acknowledgement for a packet before timeout P_s. Congestion window size is plotted against update number for the following parameter combinations:

$K_i \in \{1, 4\}$ $K_m \in \{1, 1.5\}$ $K_n \in \{0.5, 1\}$ $K_f \in \{0.1, 0.3\}$ $P_s \in \{0.99, 0.9999\}$

1.1 Probability of successful acknowledgement $P_s = 0.99$

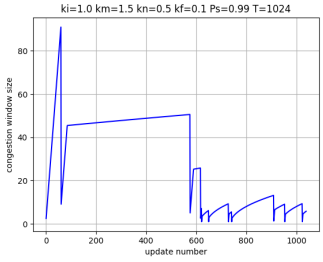


(a) $K_f = 0.1$

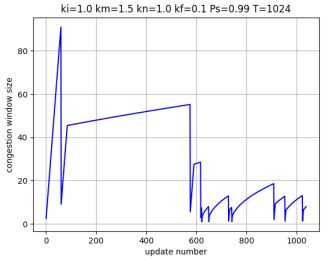


(b) $K_f = 0.3$

Figure 1: Dip on timeout is inversely proportional to K_f



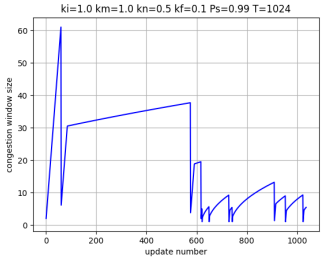
(a) $K_n = 0.5$



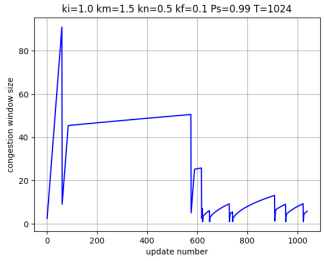
(b) $K_n = 1.0$

Figure 2: Congestion window size change with change in K_n

As observed in Figure 2, congestion window size rapidly increases in linear phase when K_n is higher.



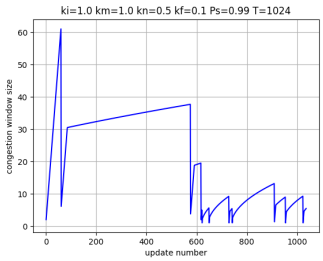
(a) $K_m = 1.0$



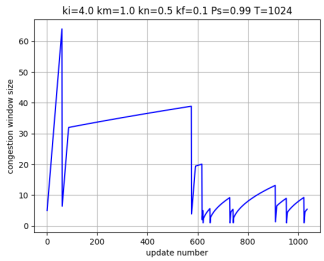
(b) $K_m = 1.5$

Figure 3: Congestion window size change with change in K_i

As shown in Figure 3, during the exponential growth phase of the congestion window size, if K_m is greater, CW rapidly increases as observed in Figure 3(b).



(a) $K_i = 1.0$



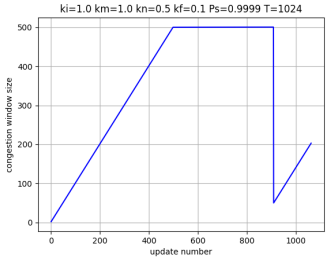
(b) $K_i = 4.0$

Figure 4: Congestion window size change with change in K_i

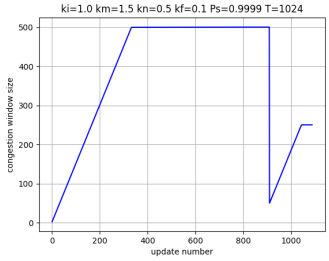
As shown in Figure 4, higher K_i initializes the congestion window size to a higher value, apart from this, no significant difference is observed in these plots.

1.2 Probability of successful acknowledgement $P_s = 0.9999$

The plots obtained for $P_s = 0.9999$ are mostly similar because transmission success is very high.



(a) $K_m = 1.0$

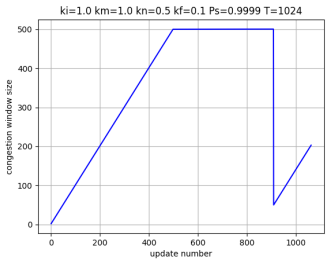


(b) $K_m = 1.5$

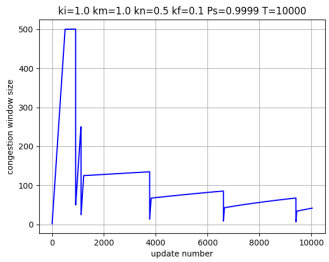
Figure 5: CW grows more rapidly during exponential phase when K_m is higher

As observed in Figure 5, threshold is crossed in 320 updates when $K_m = 1.5$ whereas it took 480 updates when $K_m = 1$

Number of segments to be transmitted is varied and the following plots are obtained:



(a) $T = 1024$



(b) $T = 10000$

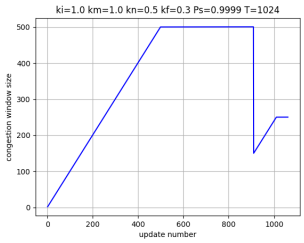
Figure 6

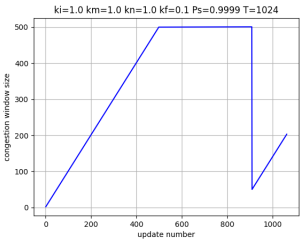
1.3 Conclusion

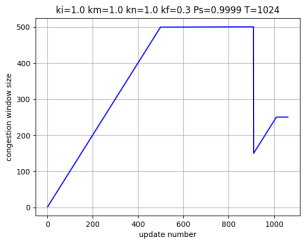
- Most of the updates are in linear growth phase since CW rapidly increases in the exponential phase.
- On timeout, CW decrease is inversely proportional to K_f, if it is too small then a huge penalty is imposed for even a single packet loss which might affect the performance.

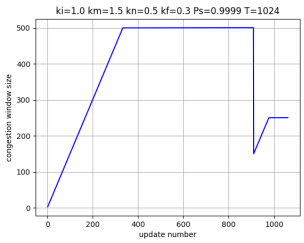
1.4 Other Plots

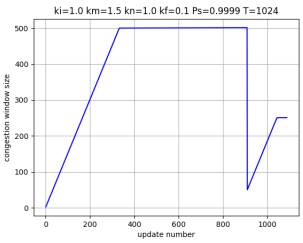
All the remaining combinations of the plots are as follows:

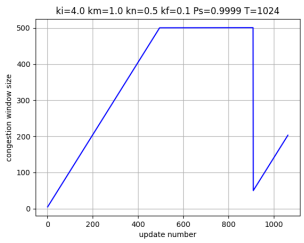


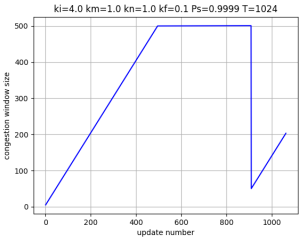








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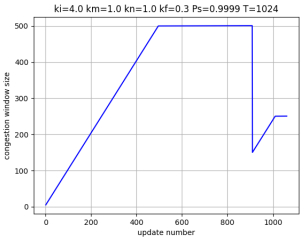
congestion window size
update number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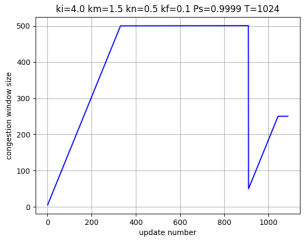
congestion window size
update number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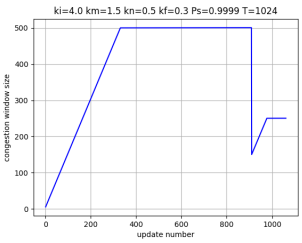
congestion window size
update number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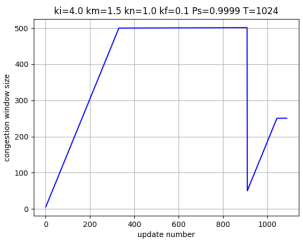
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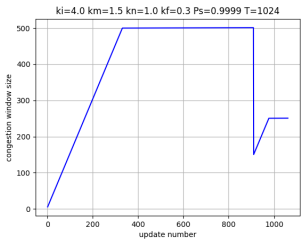
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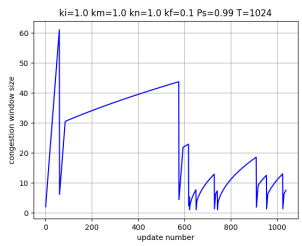
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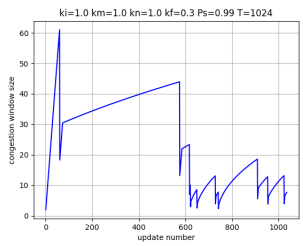
congestion window size
update number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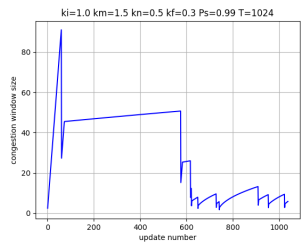
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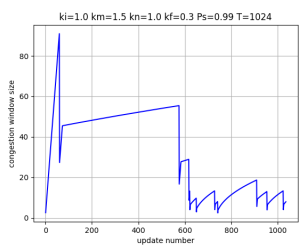
ki=1.0 km=1.5 kn=1.0 kf=0.3 Ps=0.99 T=1024
congestion window size
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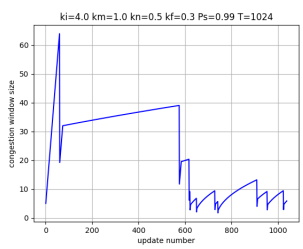
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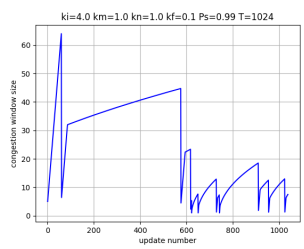
congestion window size
update number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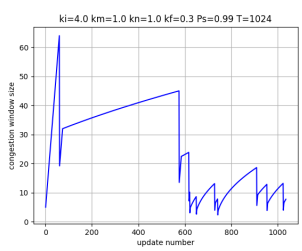
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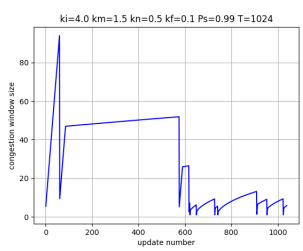
update number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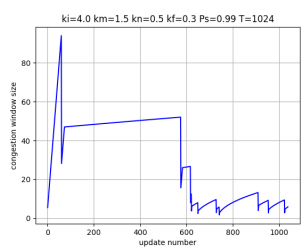
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update number