Computer Networks

Lab – 8

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Here, we experimented with emulation of TCP Congestion Control algorithm. With variable sender's congestion window size (as per congestion control algorithm), we plot the change of CW according to number of updates made to CW.

Also, Go-back-N congestion control method is used without considering cumulative acknowledgments along with separate timeout timer and ACK for each segment.

The main parameters here are (for variable CW size):

- Ki, to alter initial CW.
- Km, multiplier constant of CW during exponential growth phase.
- Kn, multiplier constant of CW during linear growth phase.
- Kf, multiplier constant when timeout occurs.
- Ps, probability of receiving the ACK packet for a given segment before its timeout occurs.

Other variables:

- CW – congestion Window size, variable.
- MSS – Maximum Segment Size
- RWS – Receiver Window Size
- N – parameter with value ceiling ($\frac{CW}{MSS}$)

Again, ssthresh is the Threshold Limit which is considered during complete emulation of Congestion Control Algorithm and is set to 2 KB.

Initial values of all variables:

- Ki = 2
- Km = 1.4
- Kn = 1.0
- Kf = 0.2
- Ps = 0.4

Variation of Congestion Window Size with Ki

The changes in the initial congestion window are caused due to Ki.

The variation in Ki was done with other parameters set as follows:

- Km = 1.4
- Kn = 1.0
- Kf = 0.2
- Ps = 0.4

The iterating values for Ki were:

- Ki for ki_1.txt is 1.
- Ki for ki_2.txt is 2.
- Ki for ki_3.txt is 3.
- Ki for ki_4.txt is 4.

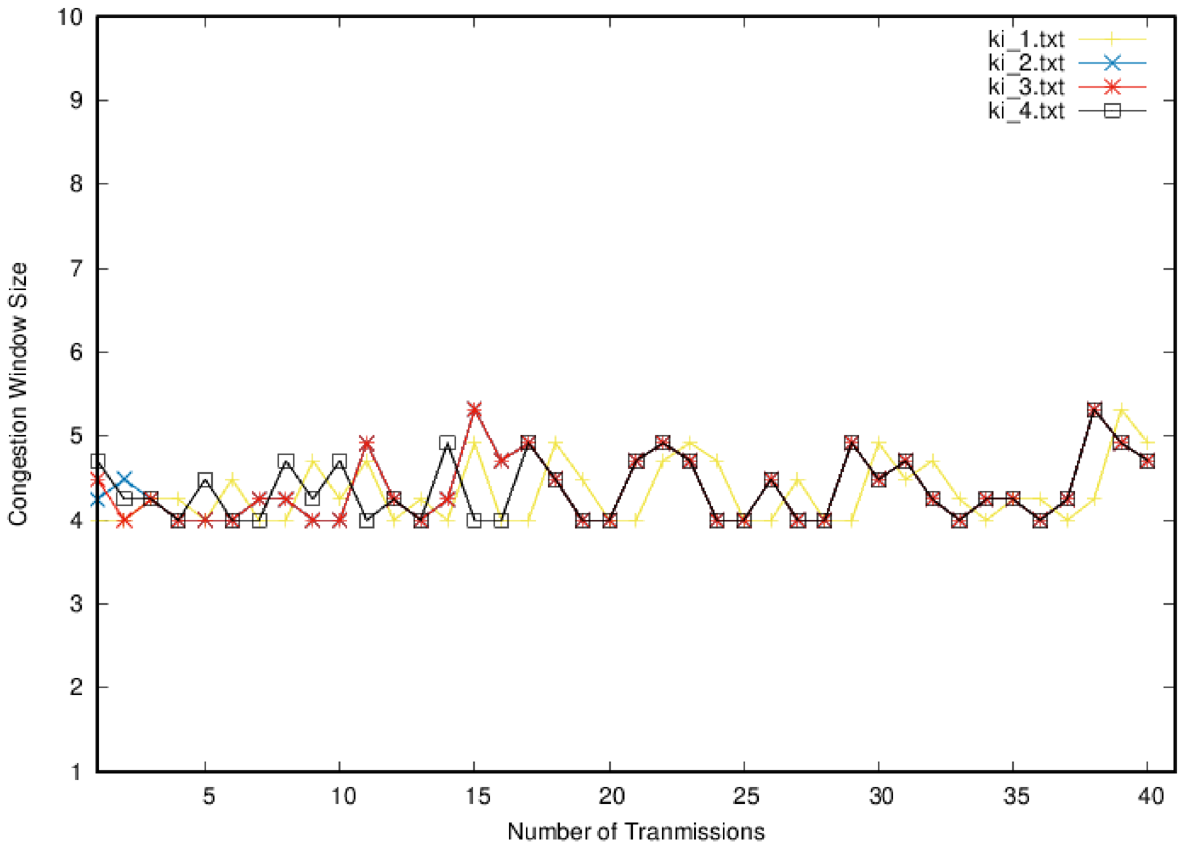
Here, we can conclude that CW is increasing with increasing values of Ki.

This is evident from the equation:

$$CW = Ki * MSS$$

Since Ki is increasing and CW is directly proportional to Ki whilst MSS being constant,

CW also increases.



Variation of Congestion Window Size with Km

The variation in Km was done with other parameters set as follows:

- Ki = 2
- Kn = 1.0
- Kf = 0.2
- Ps = 0.4

The iterating values for Km were:

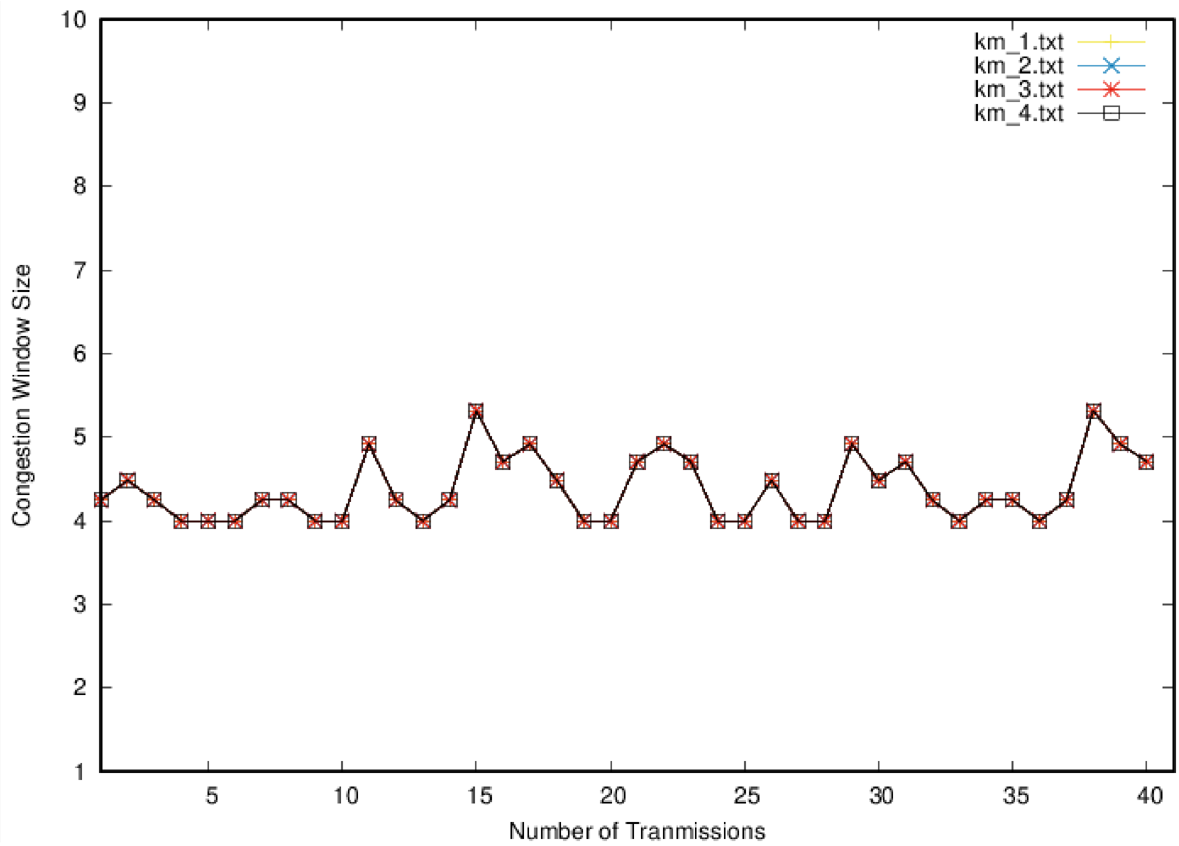
- Km for km_1.txt is 1.2.
- Km for km_2.txt is 1.4.
- Km for km_3.txt is 1.8.
- Km for km_4.txt is 2.0.

Here, we can conclude that CW is exponentially increasing & nearly converges for different values of Km. The variation of Km almost gave same graphs of CW vs. Time.

Using equation:

$$CW = \min(CW + Km * MSS, \qquad RWS)$$

Due to old CW and Km being positive results CW to increase exponentially. Also, it ranges only in between 4 and 7 which is caused due to RWS factor in the equation.



Variation of congestion Window Size with Kn

The variation in Kn was done with other parameters set as follows:

- Ki = 2
- Km = 1.4
- Kf = 0.2
- Ps = 0.4

The iterating values for Kn were:

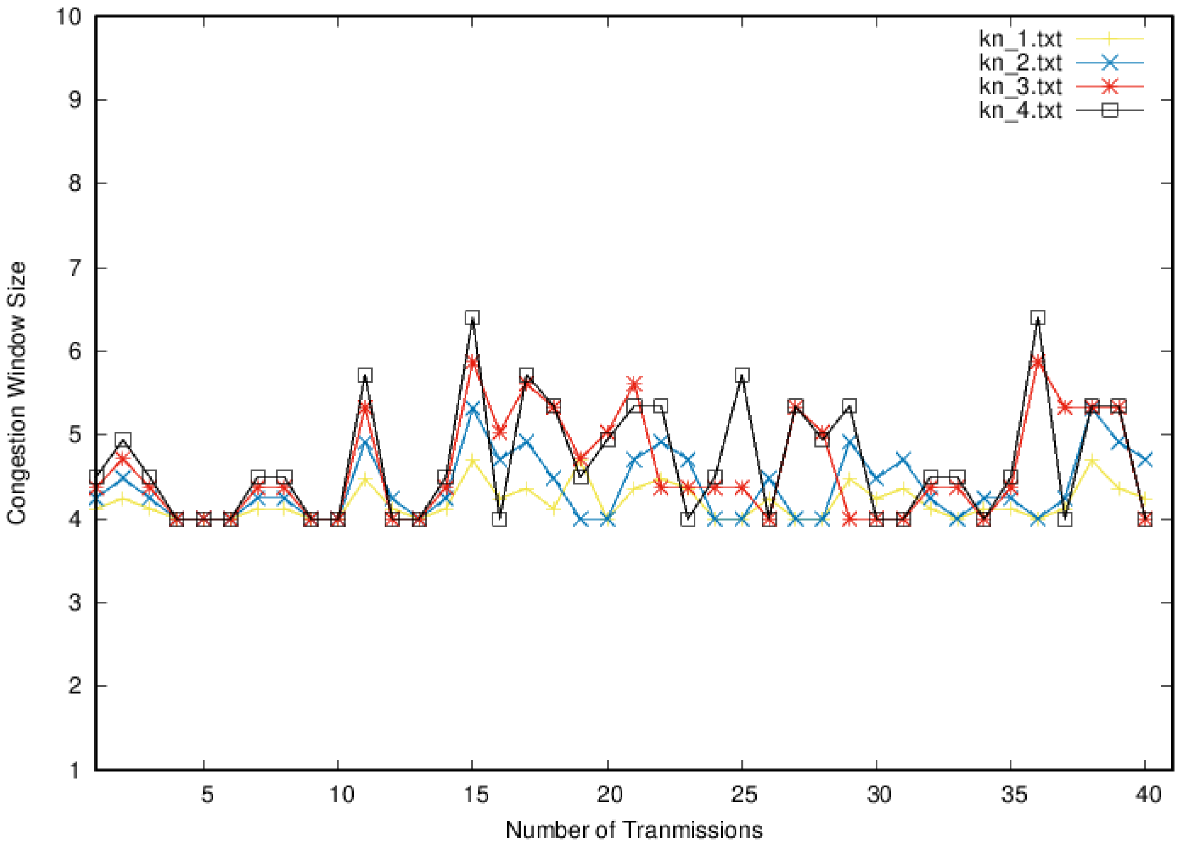
- Kn for kn_1.txt is 0.5.
- Kn for kn_2.txt is 1.0.
- Kn for kn_3.txt is 1.5.
- Kn for kn_4.txt is 2.0.

Here, variation of CW over time is non-uniform. But it is increasing exponentially & converges to same values of CW for different Kn values.

Using equation:

$$CW = \min\left(CW + Kn * \frac{MSS}{CW}, \qquad RWS\right)$$

Due Involvement of other variables like CW and MSS, the variable CW results non-uniform.



Variation of Congestion Window Size with Kf

The variation in Kf was done with other parameters set as follows:

- Ki = 2
- Km = 1.4
- Kn = 1.0
- Ps = 0.4

The iterating values for Kf were:

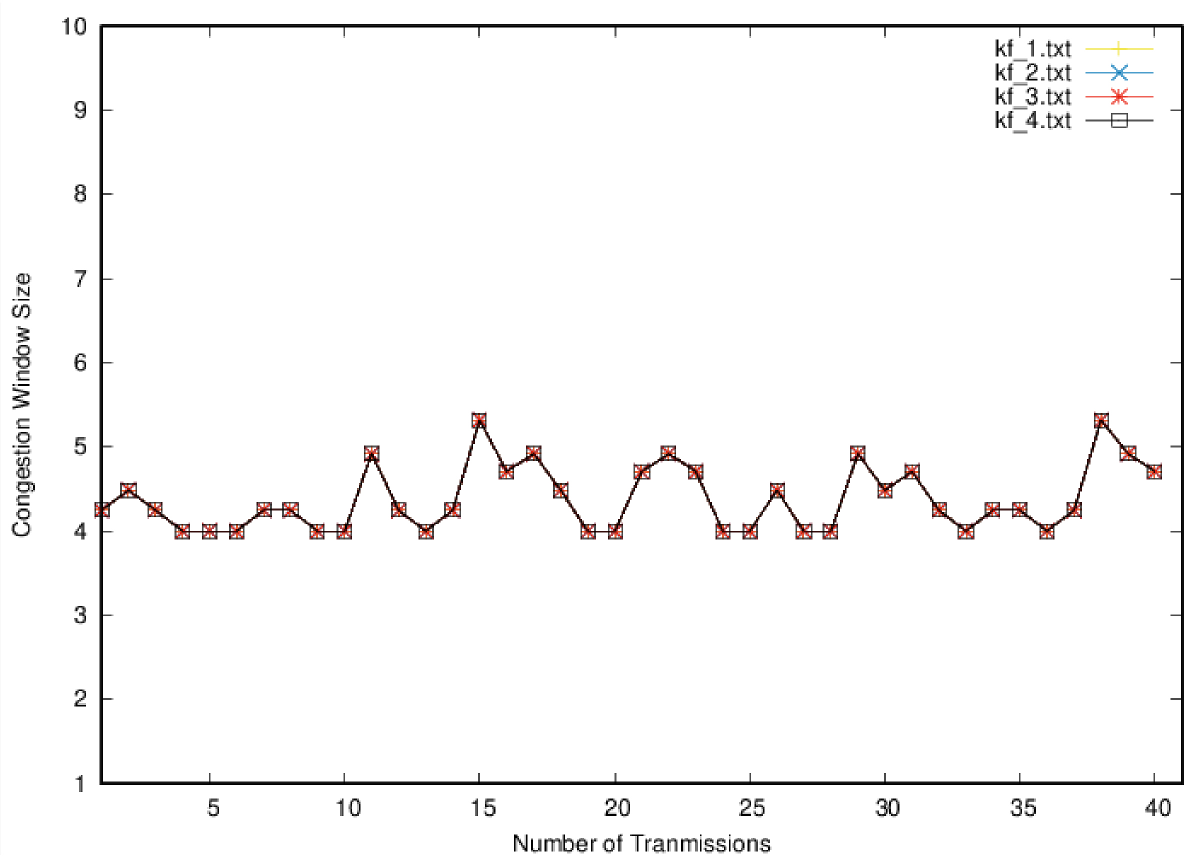
- Kf for kf_1.txt is 0.1.
- Kf for kf_2.txt is 0.2.
- Kf for kf_3.txt is 0.4.
- Kf for kf_4.txt is 0.5.

Here, CW increases uniformly till first congestion being random thereafter.

Using equation:

$$CW = \max(1,\ Kf * CW)$$

rand() contributes significant role to decide if congestion takes place.



Variation of Congestion Window Size with Ps

The variation in Ps was done with other parameters set as follows:

- Ki = 2
- Km = 1.4
- Kn = 1.0
- Kf = 0.2

The iterating values for Ps were:

- Ps for Ps_1.txt is 0.2.
- Ps for Ps_2.txt is 0.4.
- Ps for Ps_3.txt is 0.6.
- Ps for Ps_4.txt is 0.8.

Here, CW varies non-uniformly.

$$Ps \in [0, 1]$$