CS 536 – Lab 5

This assignment is the group effort of the following team members -

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Distribution of duties –

Ashwani Agarwal –
Implemented the server (concurrency and send-receive logic), the producer-consumer logic of the client, some utility methods, and some part of performance evaluation.

Rishabh Chaddha –
Implemented the logic for updating lambda (Methods C and D) in the client, the sleep logic in the server, bonus question method (new control flow), the write-up and some part of performance evaluation.

(Problem descriptions from the next page)

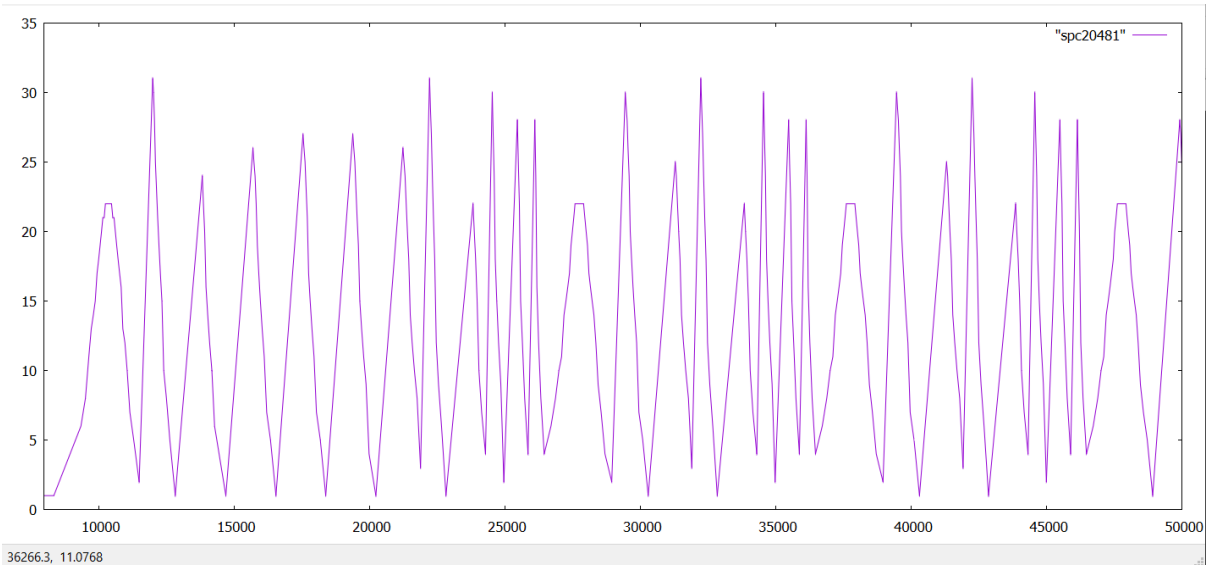
Problem 1 (main implementation for methods C and D)

Graphs for Method C

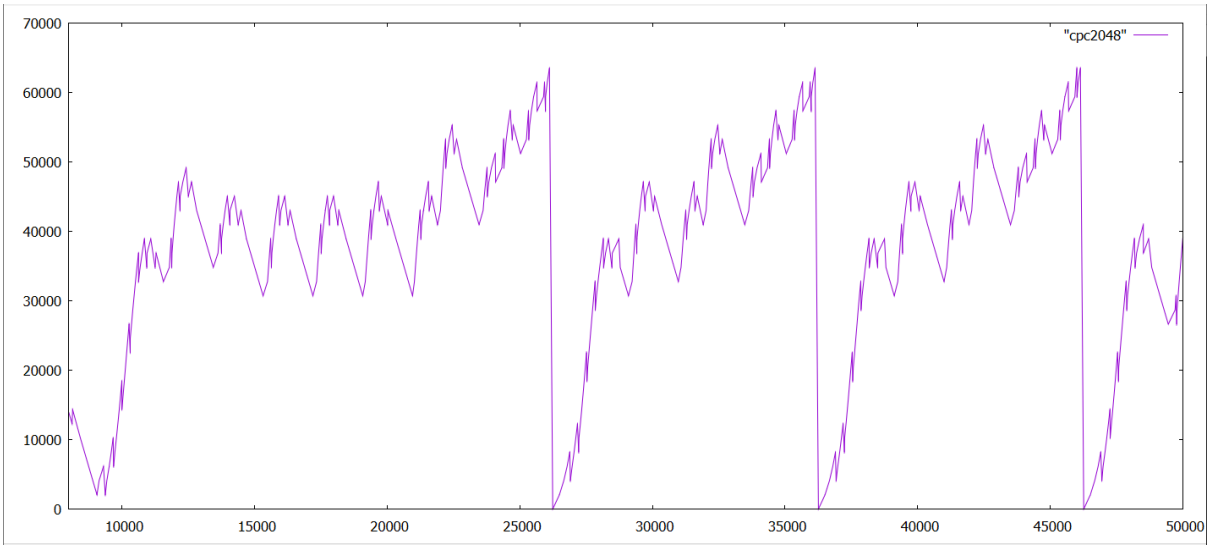
Method - Method C

Parameters - Epsilon = 0.2, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

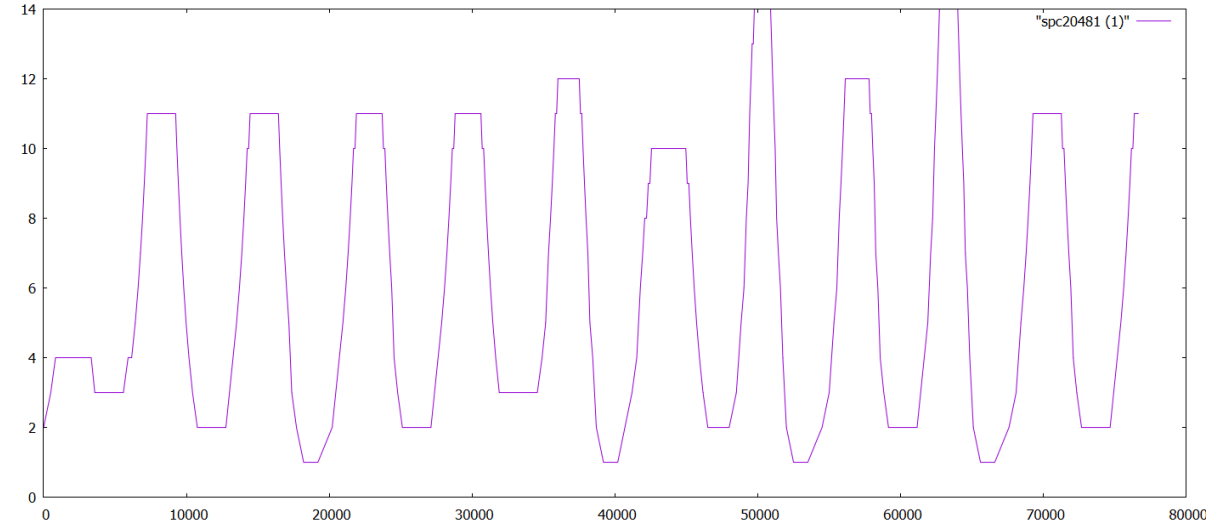


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

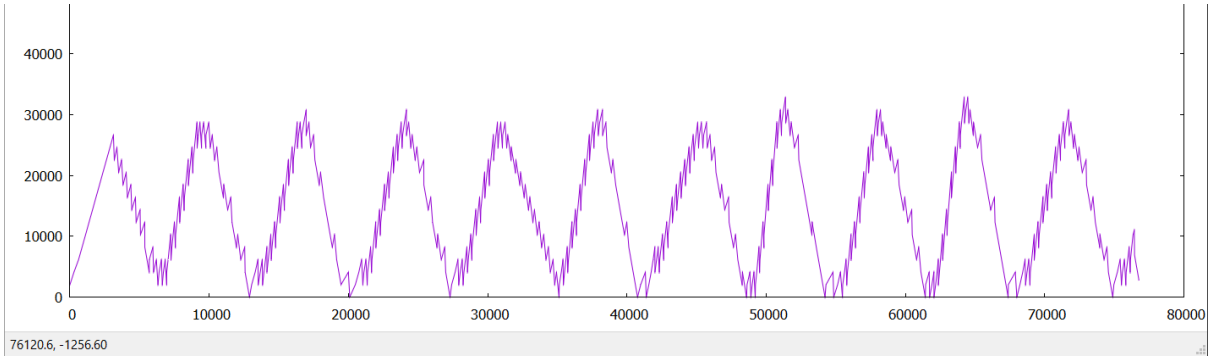


Method - Method C
Parameters - Epsilon = 0.1, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

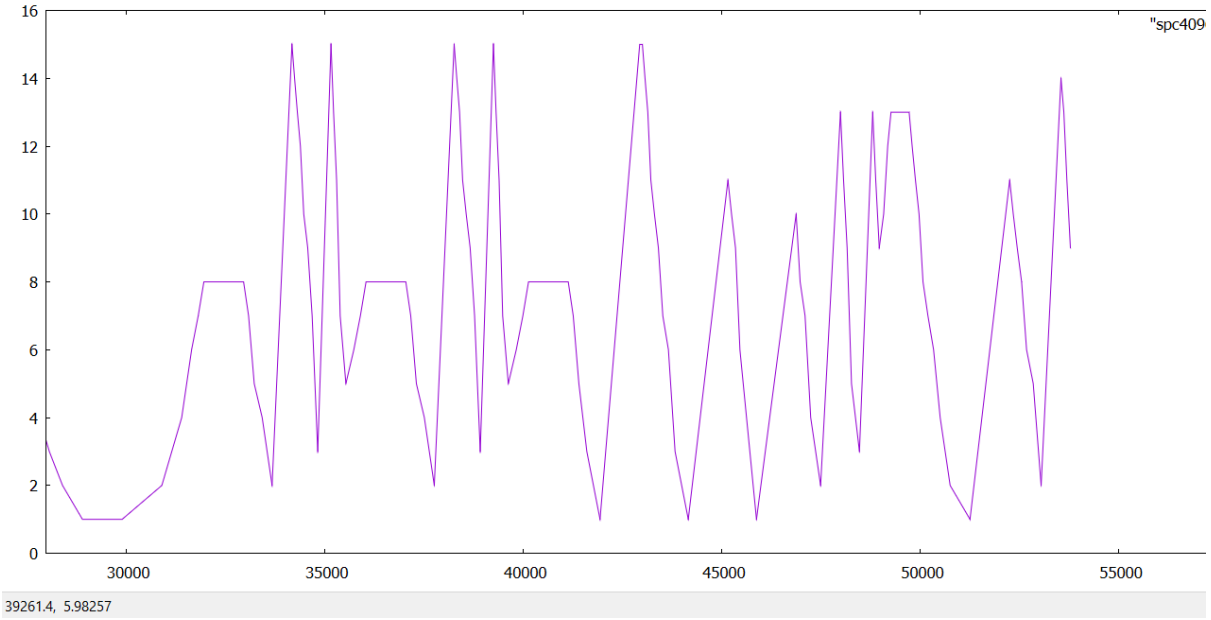


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

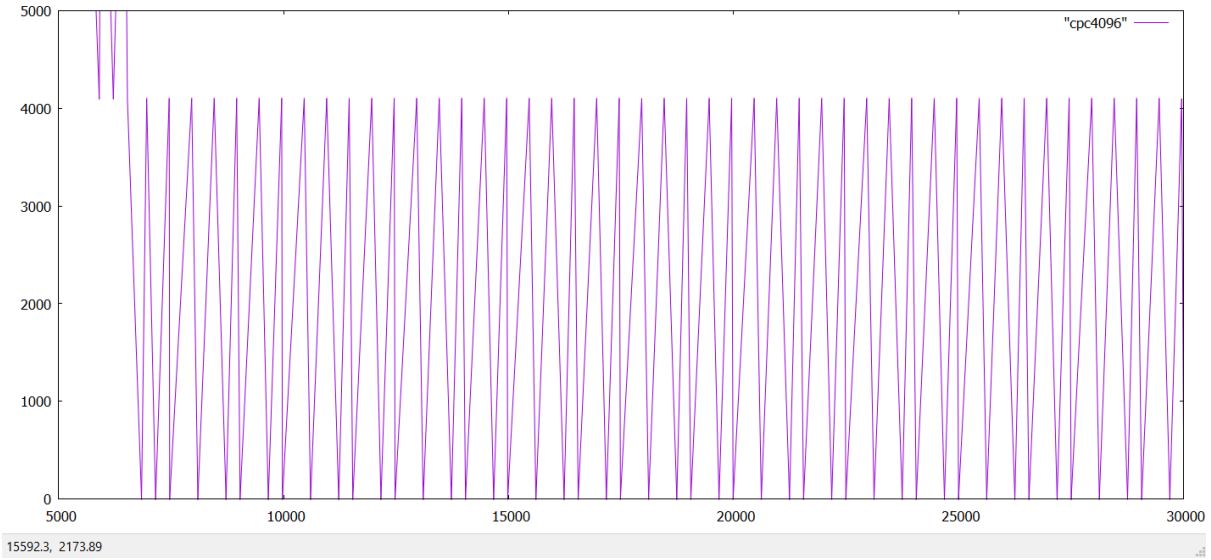


Method - Method C
Parameters - Epsilon = 0.2, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 4096

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

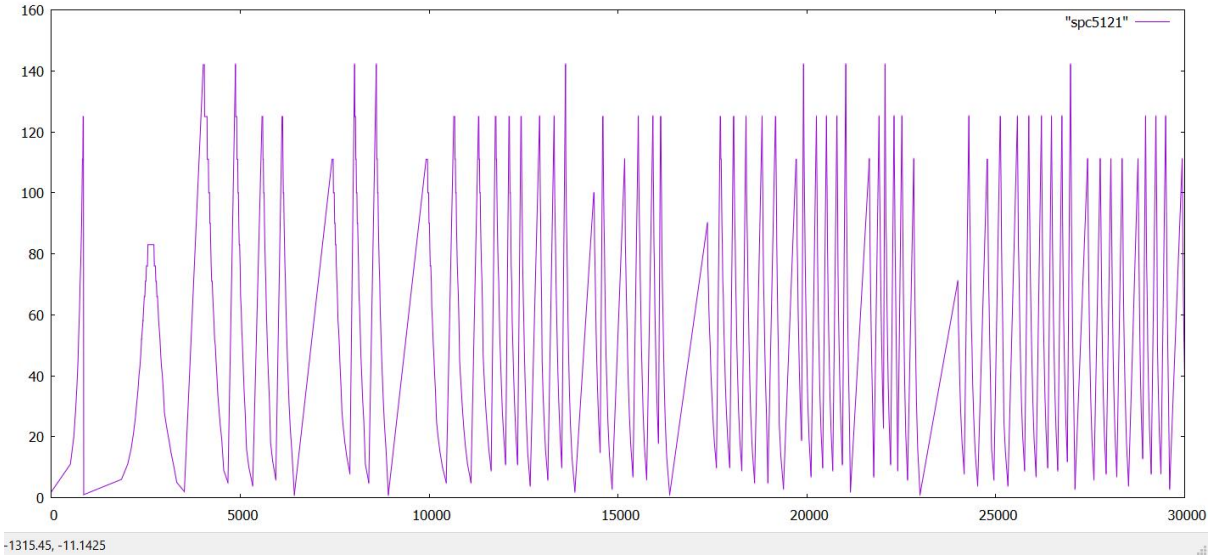


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

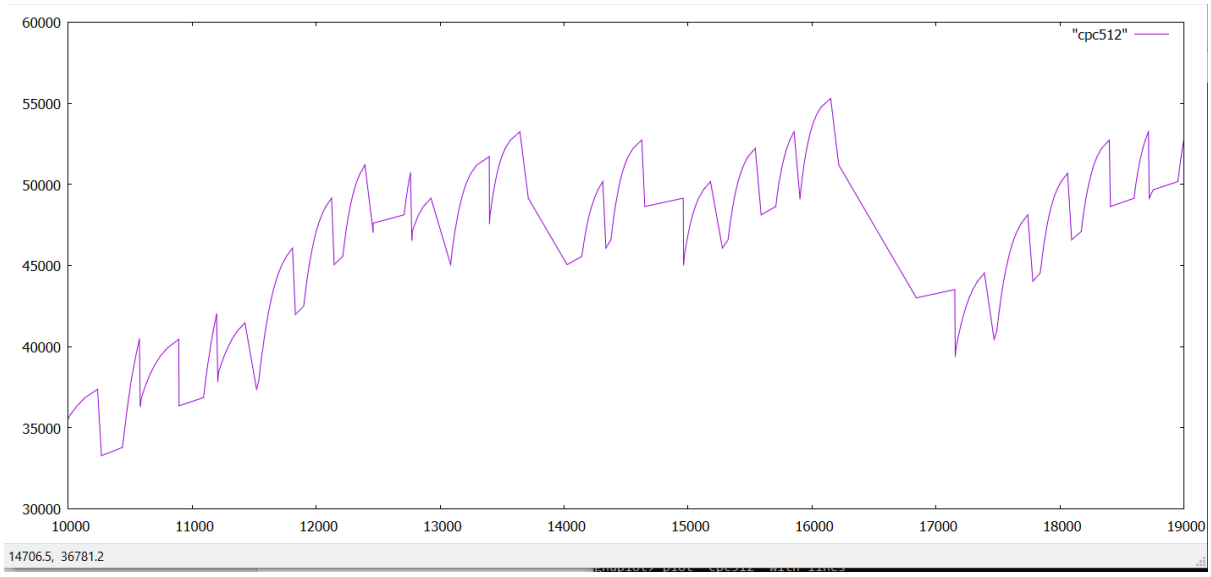


Method - Method C
Parameters - Epsilon = 0.2, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 512

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

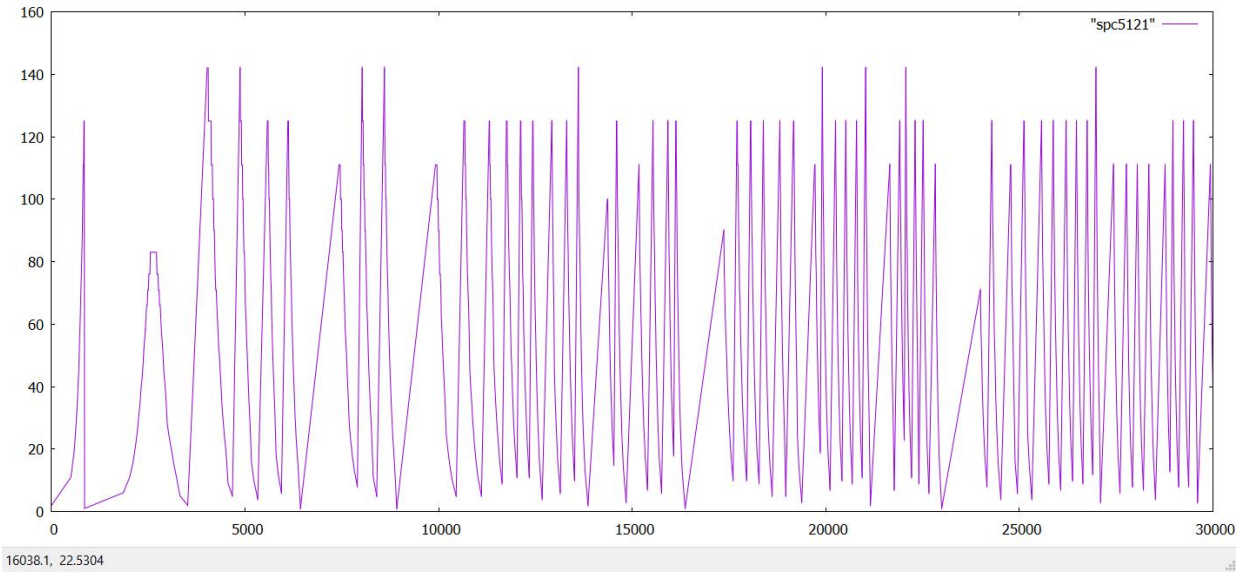


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

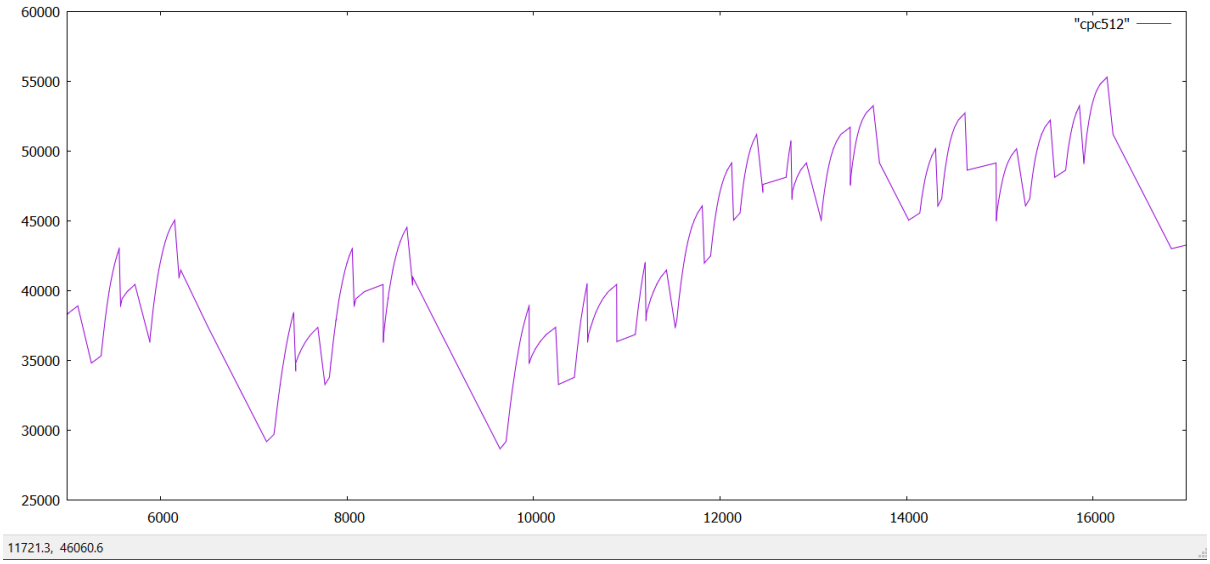


Method - Method C
Parameters - Epsilon = 0.1, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 512

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



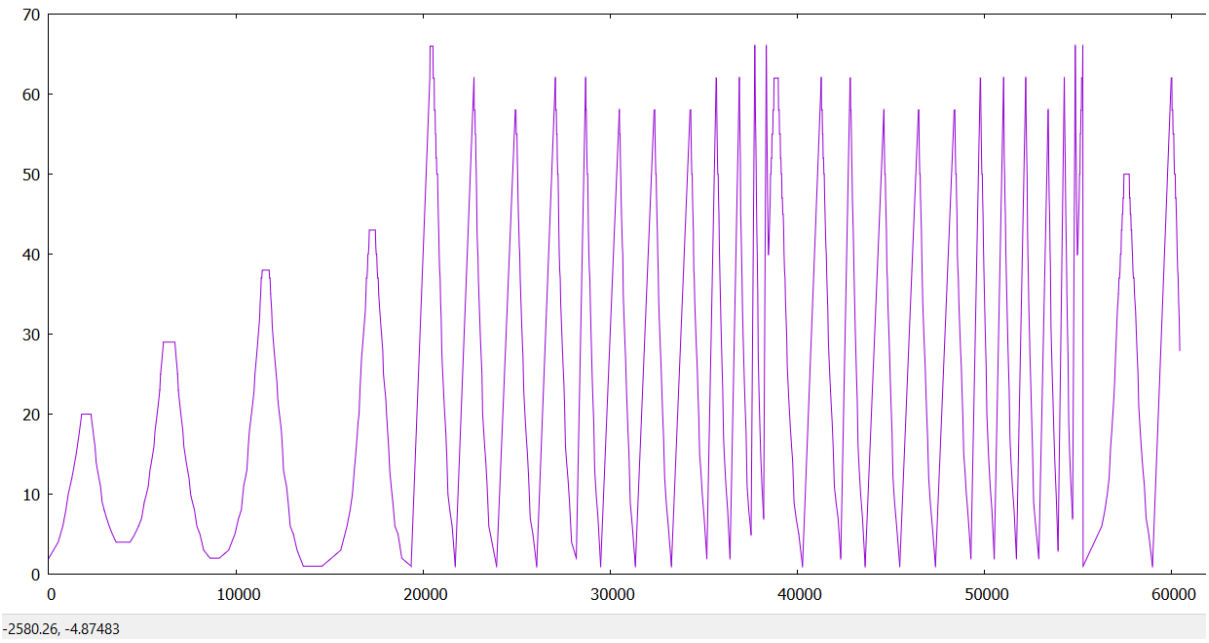
Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



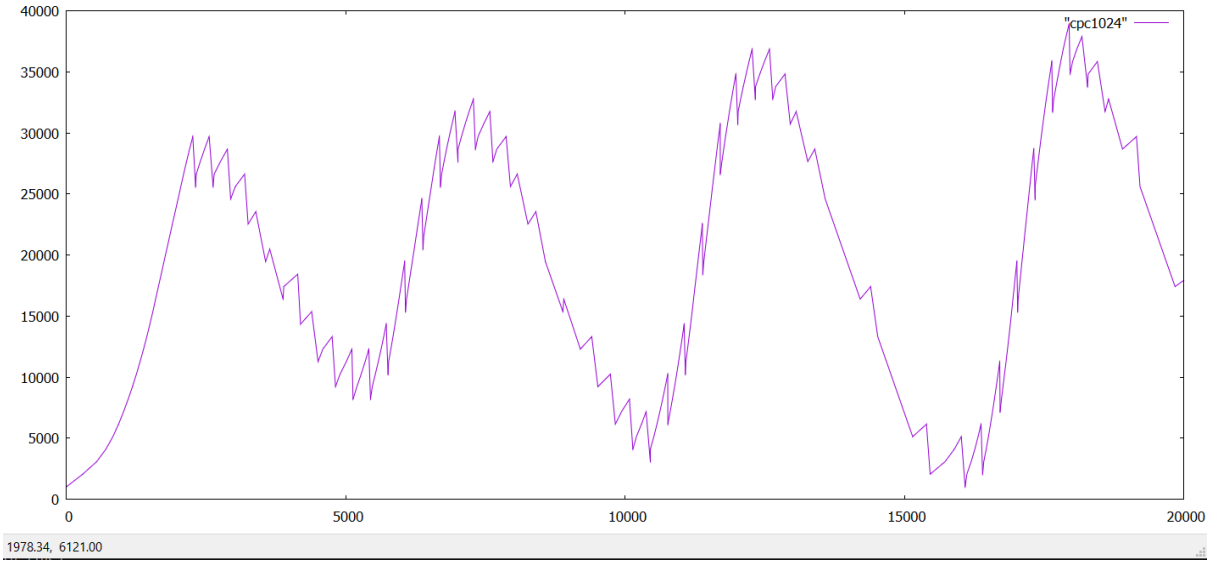
Method - Method C

Parameters - Epsilon = 0.1, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 1024

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



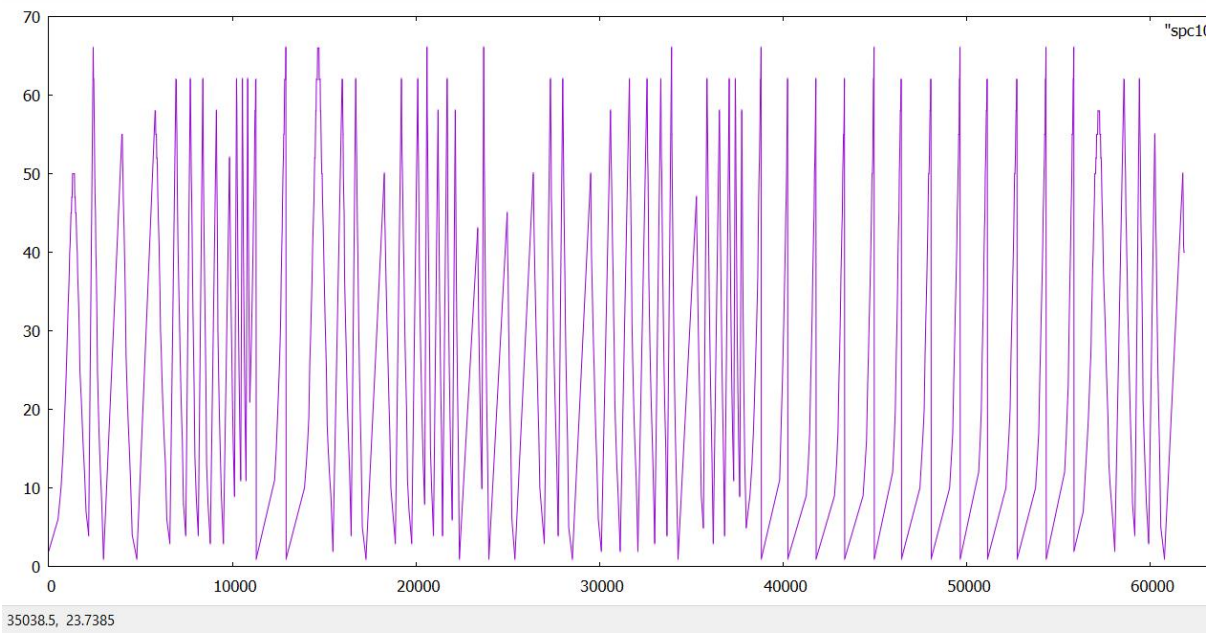
Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



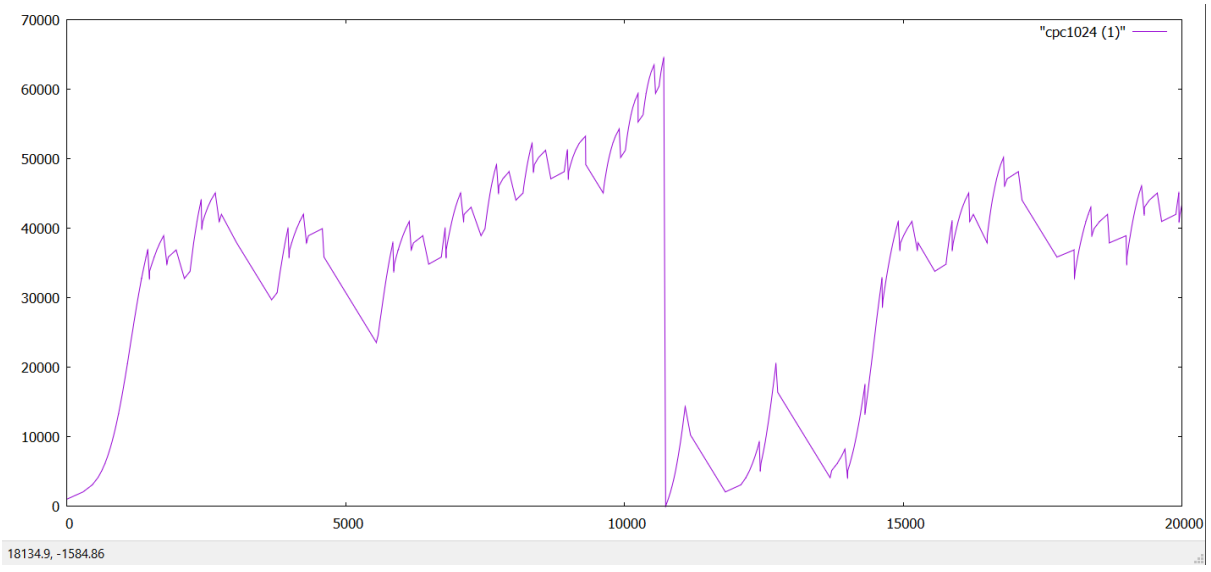
Method - Method C

Epsilon = 0.2, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 1024

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

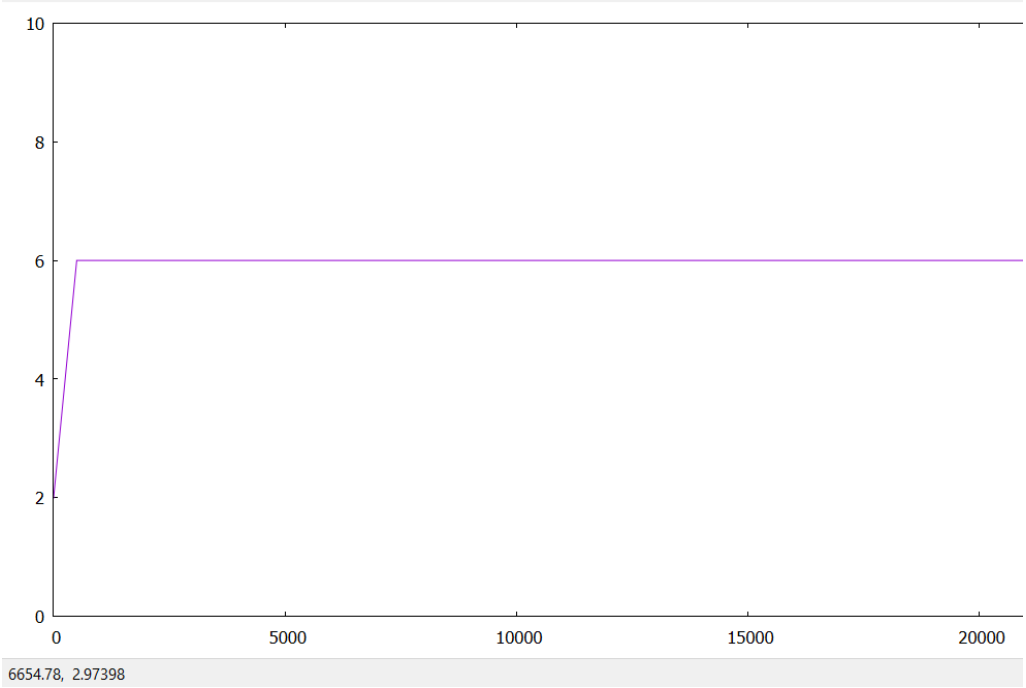


Graphs for Method D

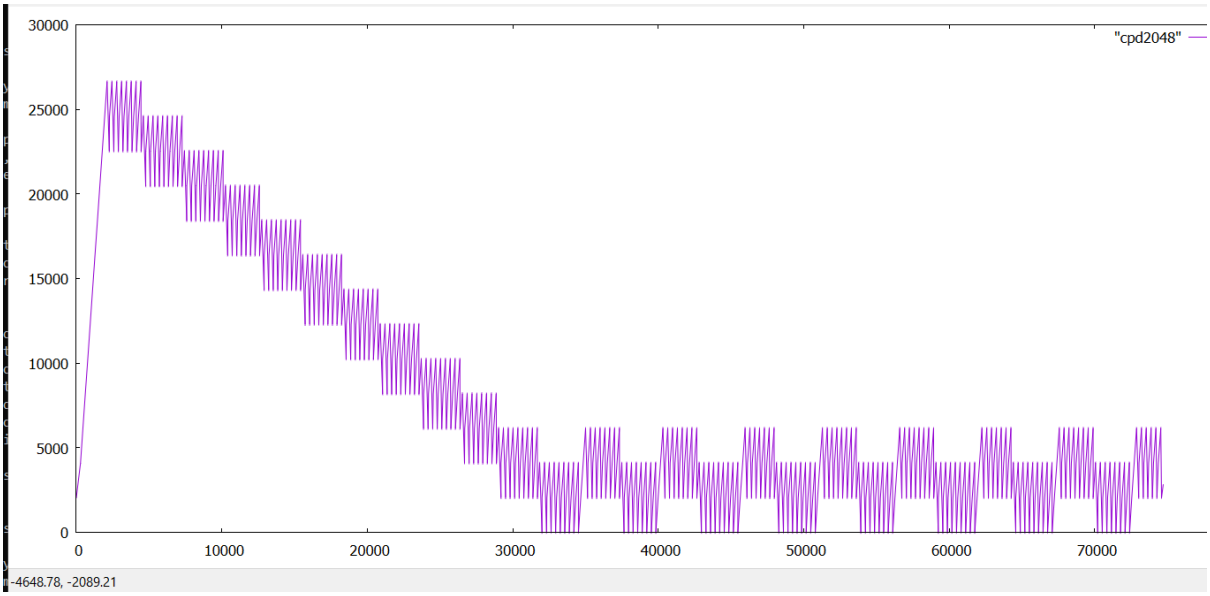
Method - Method D

Parameters - Epsilon = 0.2, Beta = 1.0, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

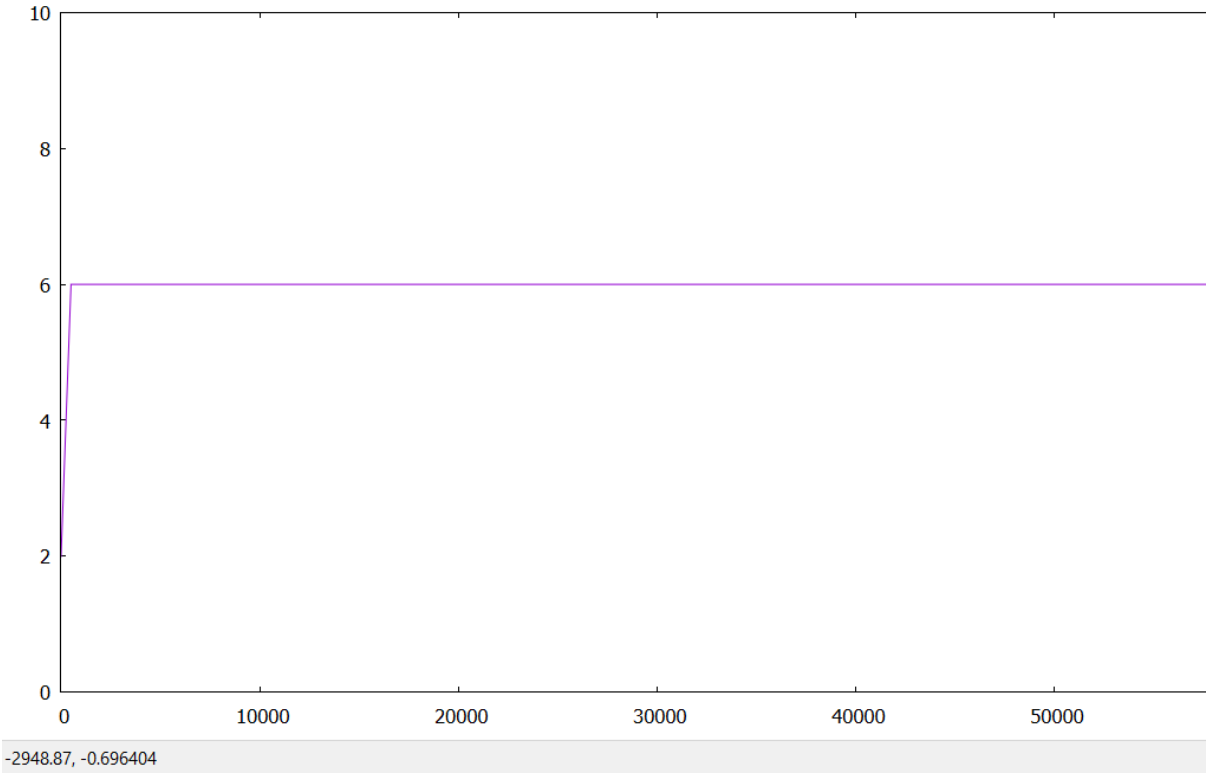


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

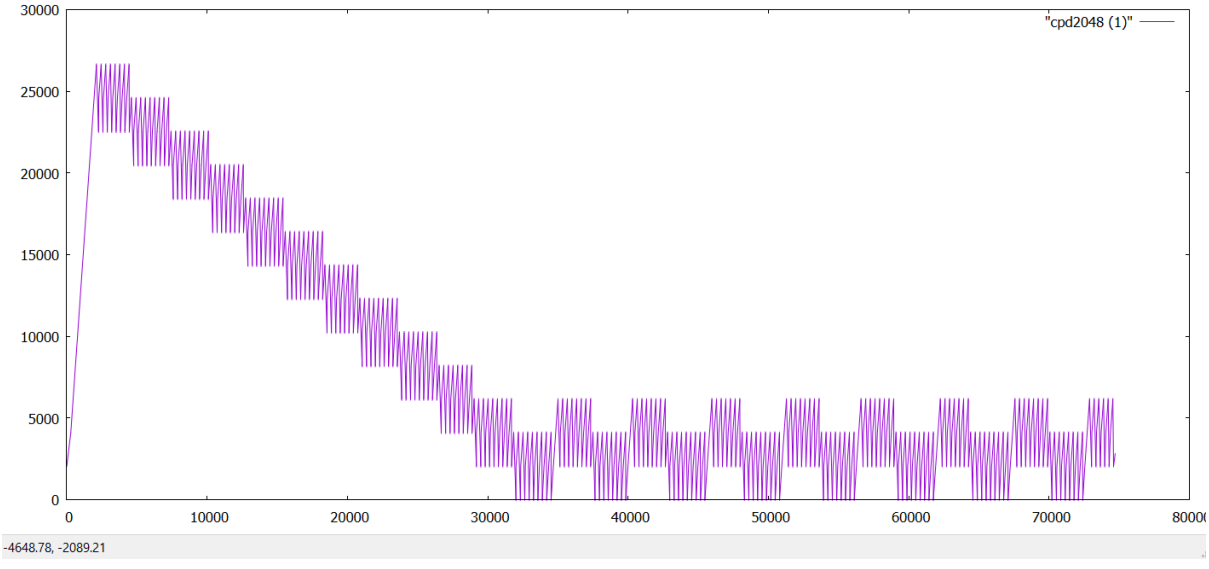


Method - Method D
Parameters - Epsilon = 0.1, beta = 1.0 Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

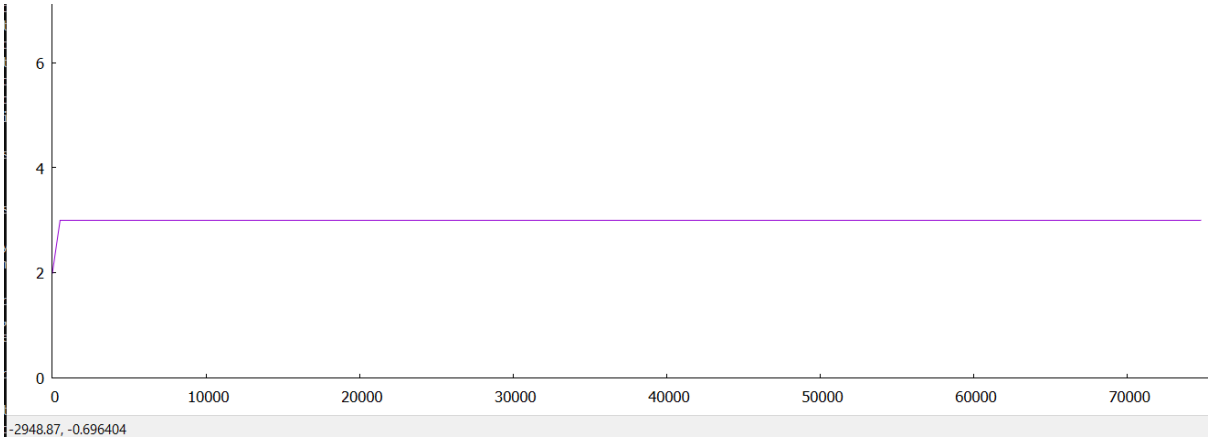
Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



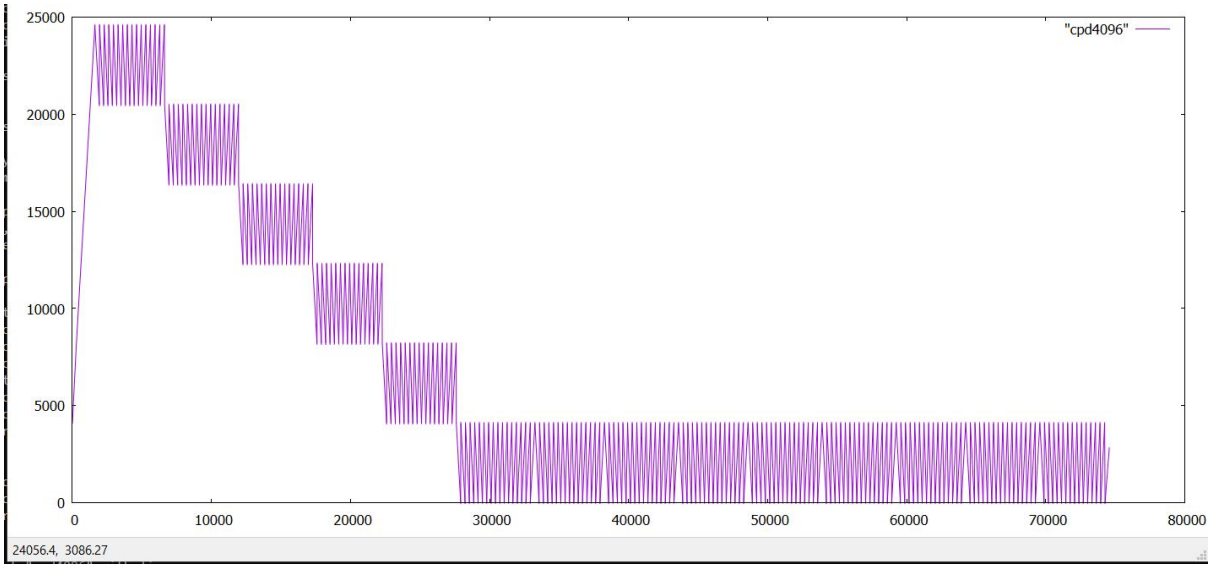
Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



Method - Method D
Parameters - Epsilon = 0.2, beta = 1.0 Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 4096
Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

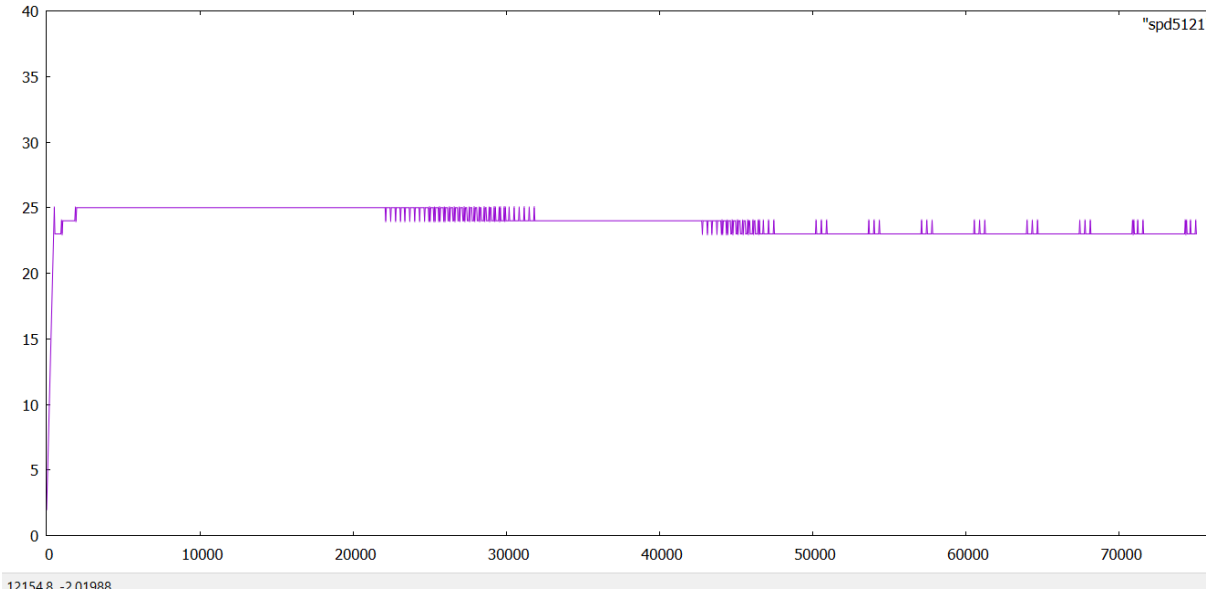


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

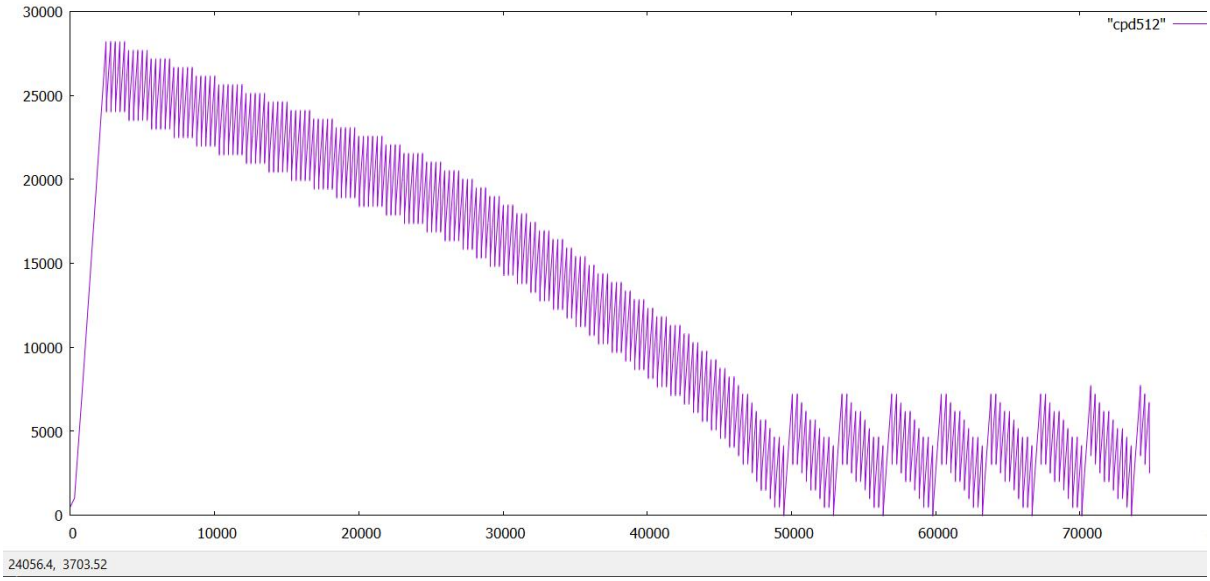


Method - Method D
Parameters - Epsilon = 0.5, beta = 1.1 Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 512

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

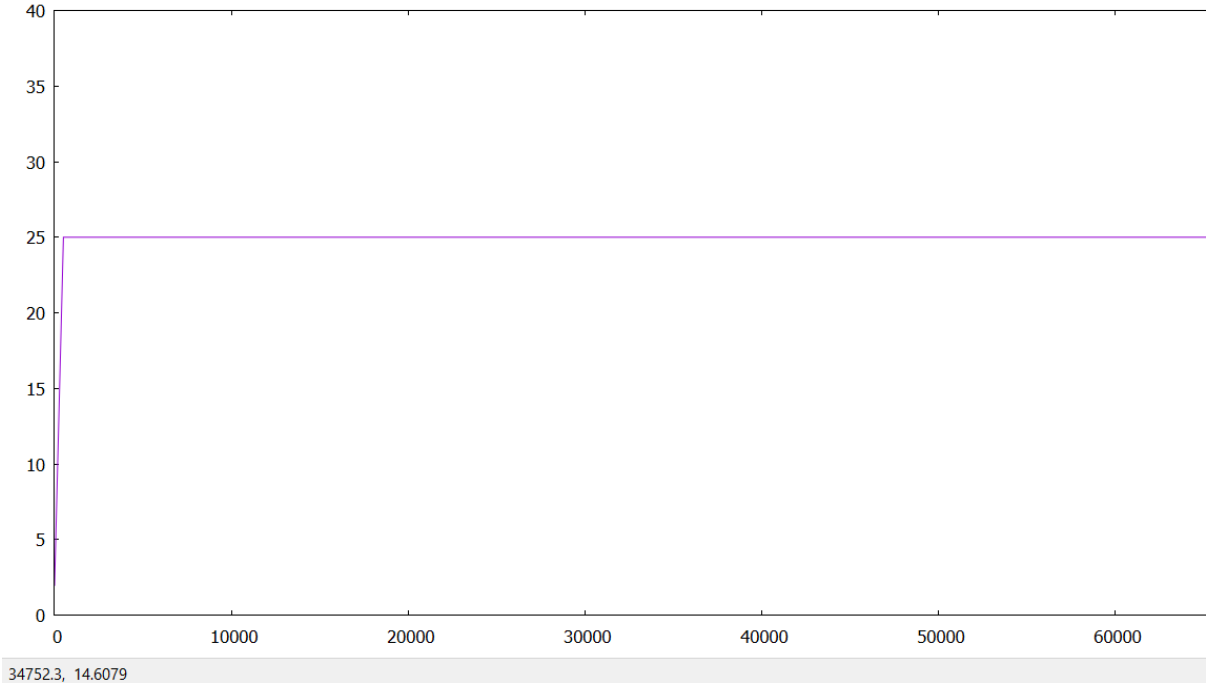


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)

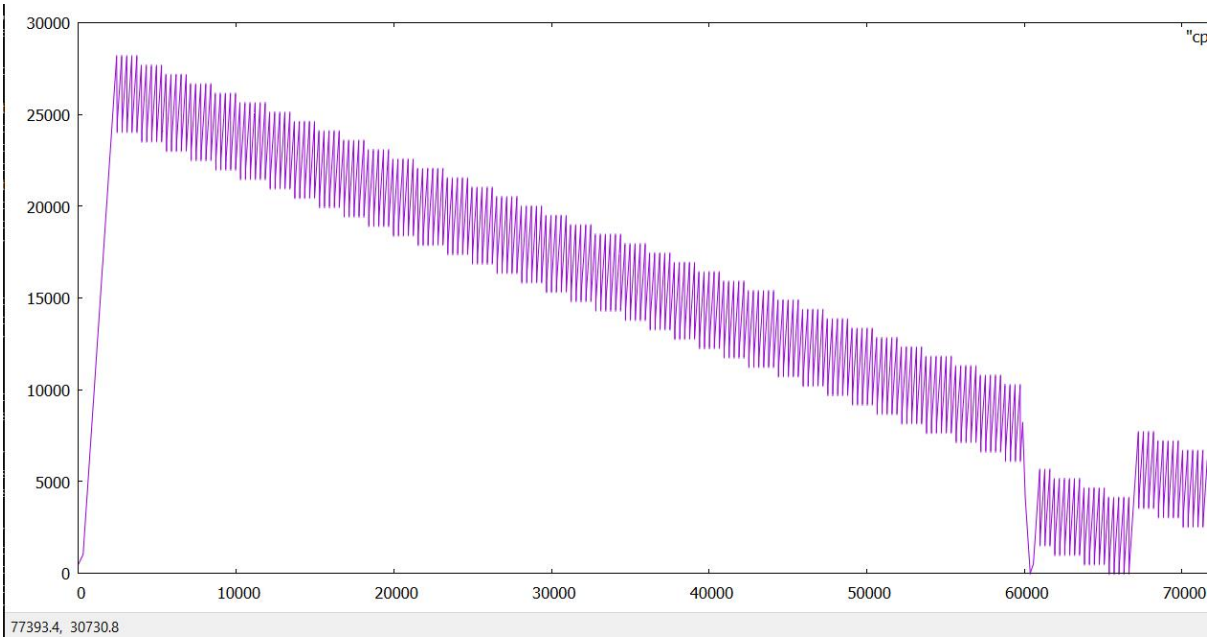


Method - Method D
Parameters - Epsilon = 0.1, beta = 1 Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 512

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



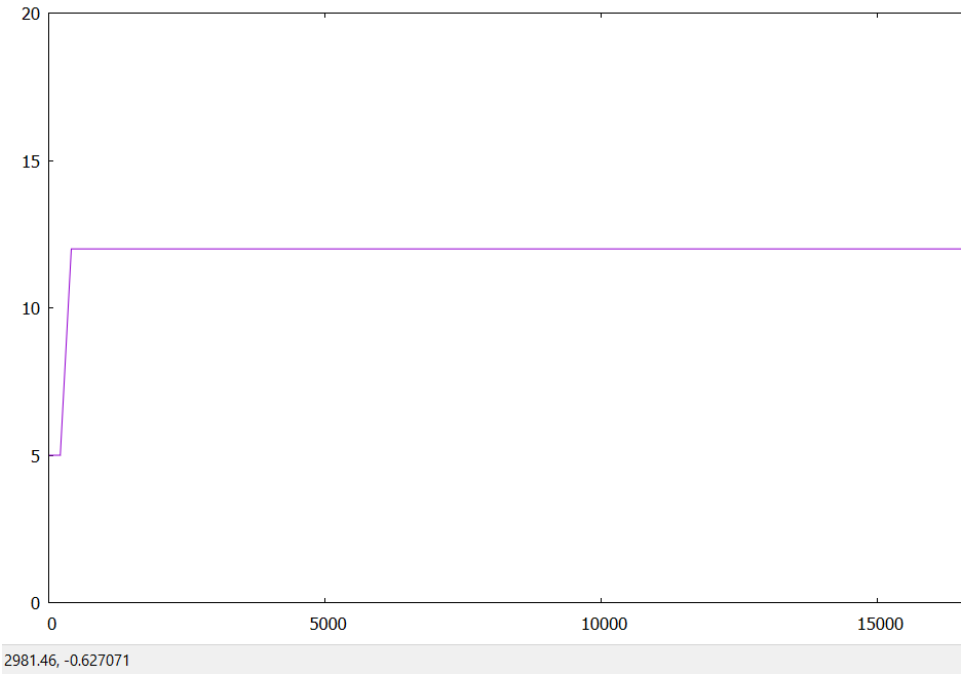
Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



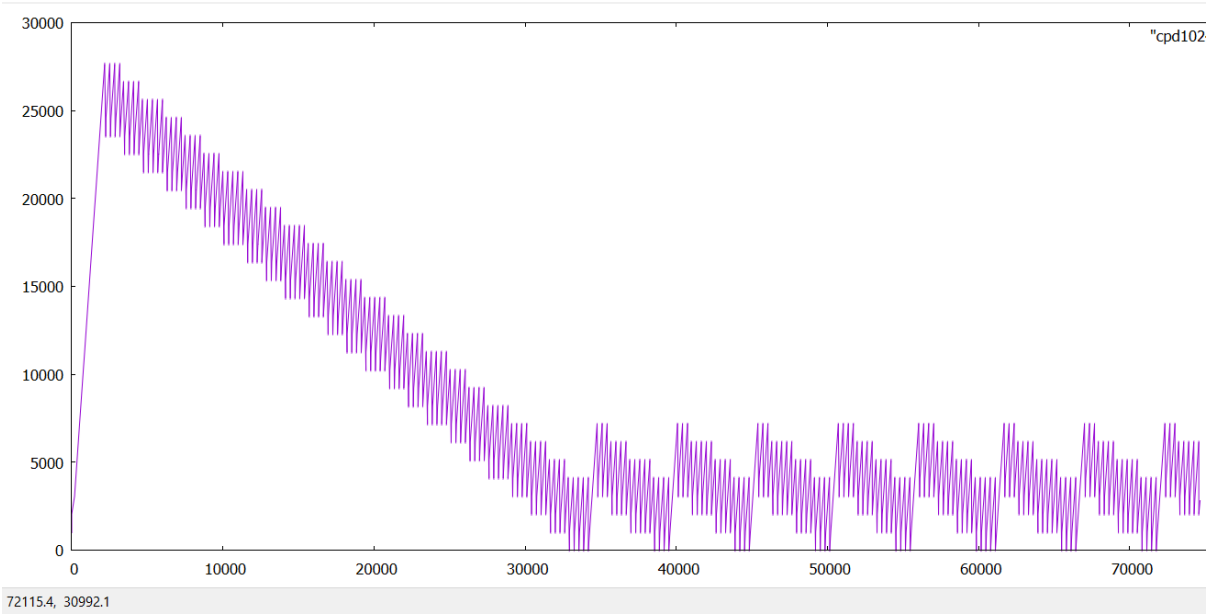
Method - Method D

Parameters - Epsilon = 0.1, Beta = 1.0, Lambda = 5, TargetBuf = 24576, BufferSize = 49152, BlockSize = 1024

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



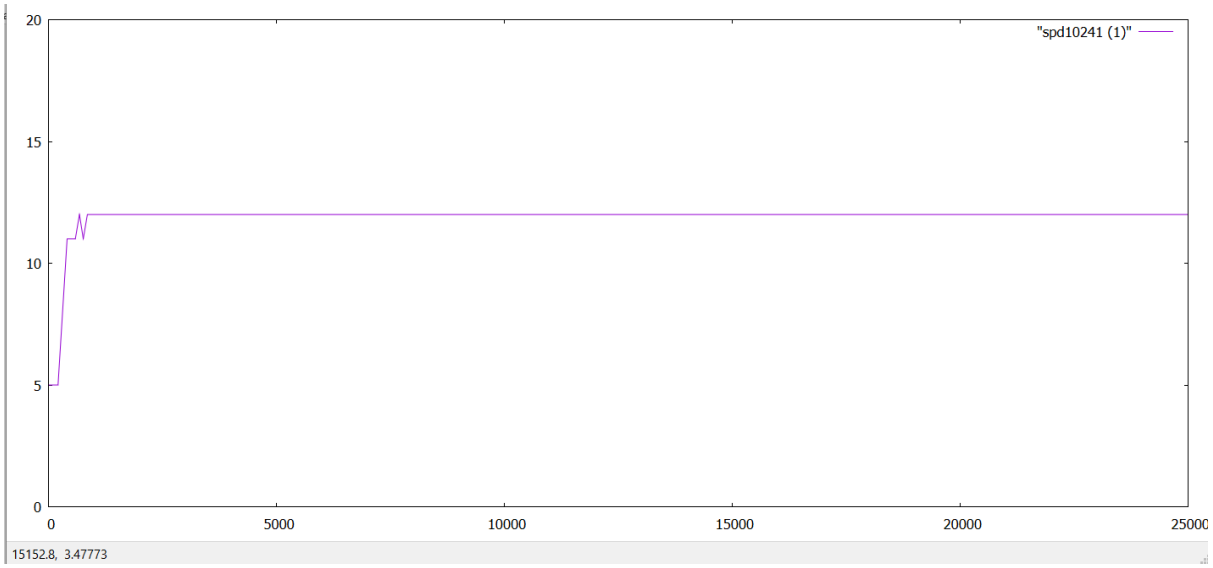
Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



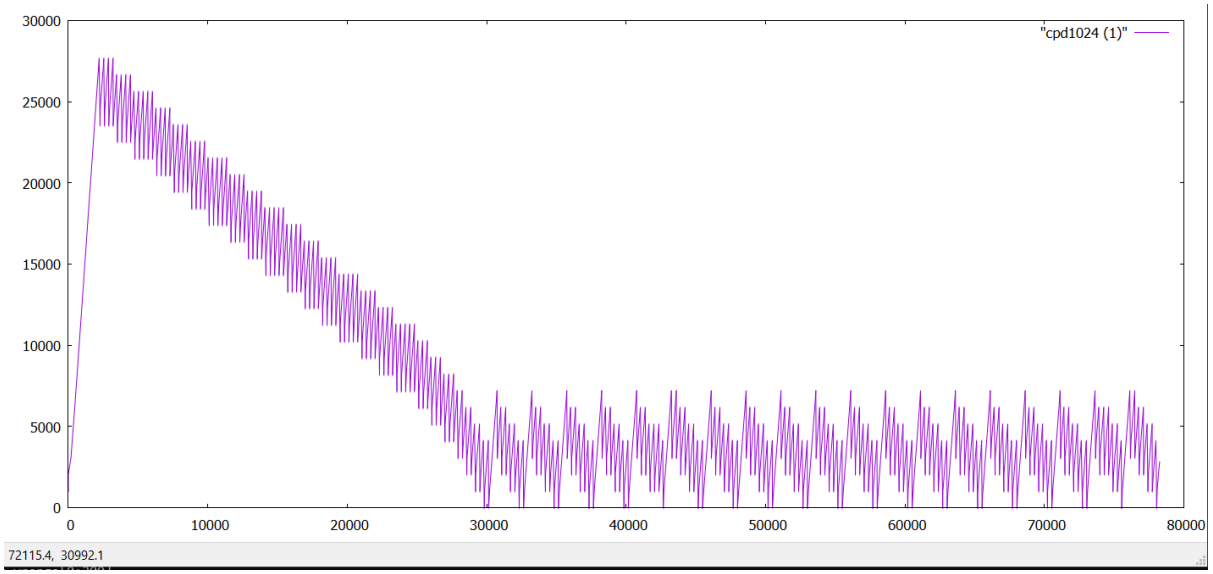
Method - Method D

Parameters - Epsilon = 0.5, Beta = 1.1, Lambda = 5, TargetBuf = 24576, BufferSize = 49152, BlockSize = 1024

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



Inference from graphs –
For method C, for various combinations of the parameter epsilon, the value of lambda with respect to time keeps on oscillating.
According to the graphs, method D seems to be a superior method as after a point of time, the value of lambda converges with very few fluctuations.
For the current implementation, the best value of epsilon is 0.1 for method C, and for method D, the best value for the epsilon, beta pair comes out to be (0.1,1.0).

Problem 2 – (Bonus Implementation Method E)

Intuition for getting a method better than method D –
In method D, it can be seen that often times when the buffer occupancy is lower than target buffer occupancy, the value shoots up too much. The new approach that we have come up with improves upon this thing. This can be solved by increasing the lambda at a low pace when buffer occupancy is lesser than the target buffer size so that the lambda value does not shoot up too abruptly
Let Q(t) be the buffer occupancy at any given time t and Q^* be the target buffer occupancy, then,
In the new approach,
The new recommended approach works as following:

When Q(t) < Q^*

lambda = lambda + epsilon * (Q^* - Q(t)) - beta*(lambda – **alpha***gamma)

The multiplication of parameter alpha to gamma ensures that the lambda value increases slowly in this case.

When Q(t) > Q^*

lambda = lambda + epsilon * (Q^* - Q(t)) - beta*(lambda –gamma)

This makes the lambda drop faster so that the buffer is never congested with more incoming flux than it can be consumed.

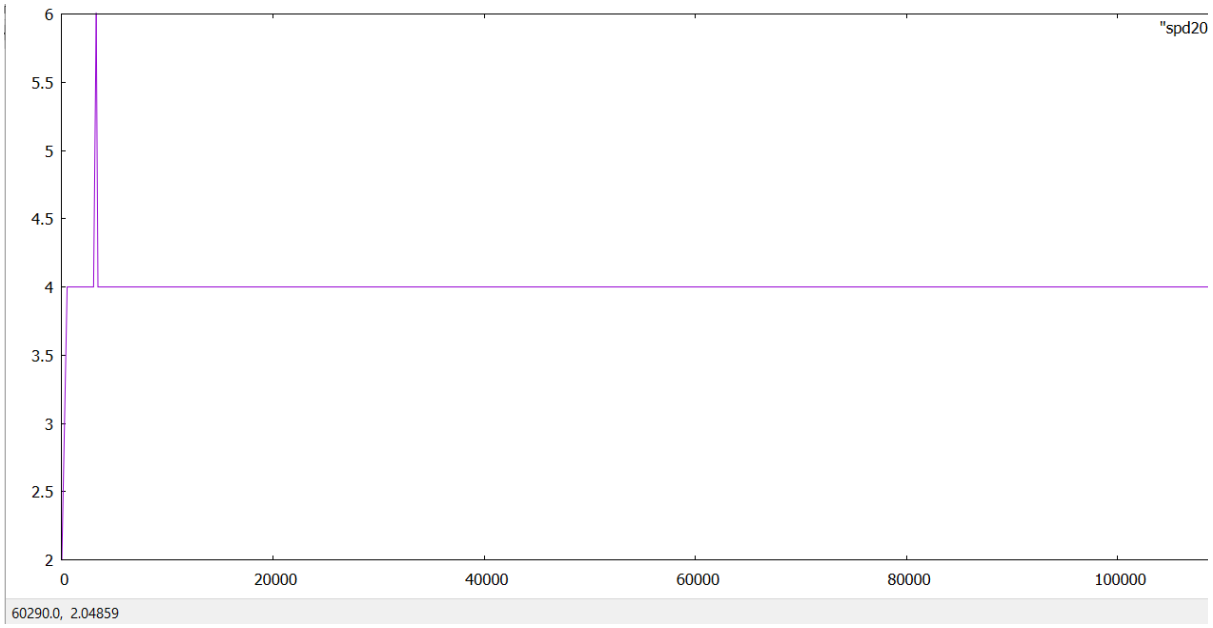
Below are some plots for method E (from the next page)

Graphs for Method E

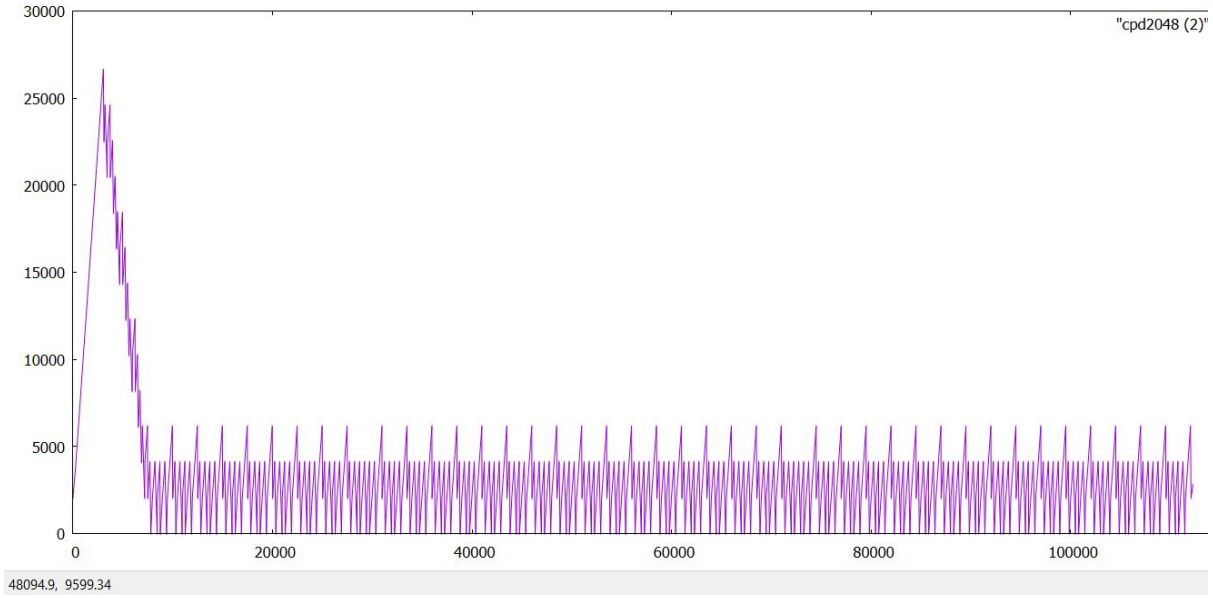
Method - Method E

Parameters - Epsilon = 0.1, Beta = 1.0, alpha = 0.75, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)

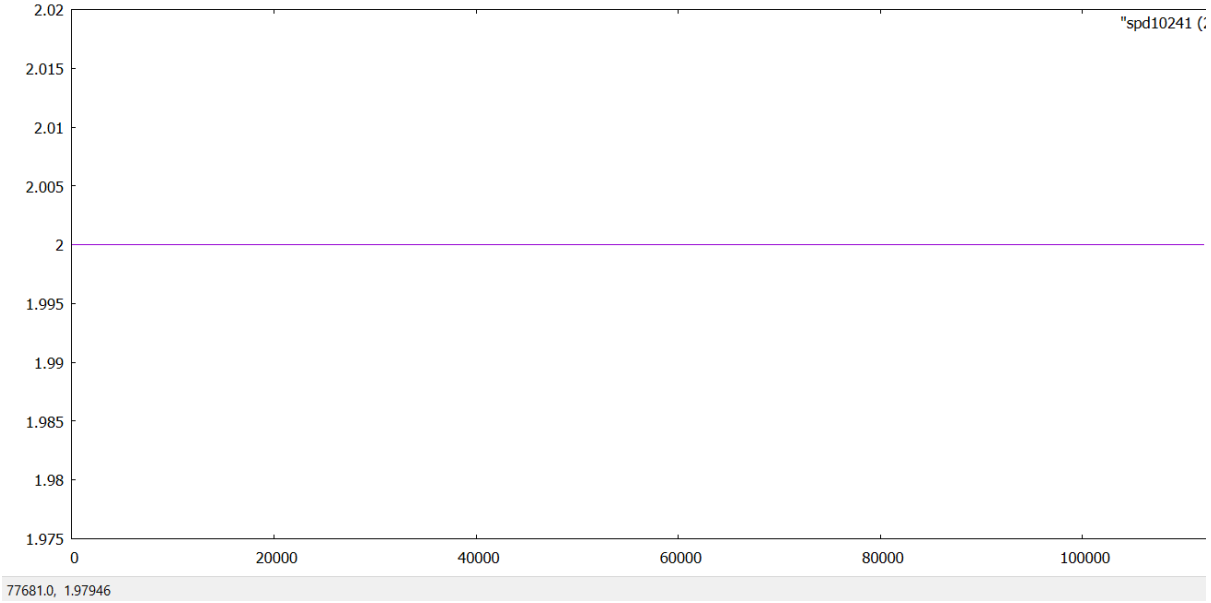


Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)



Method - Method E
Parameters - Epsilon = 0.1, Beta = 1.0, alpha = 0.75, Lambda = 2, TargetBuf = 24576, BufferSize = 49152, BlockSize = 2048

Graph from the server side log file (Lambda (in packets) in the y-axis and time(in milliseconds) in the x-axis)



(in this case, the algorithm found the correct lambda in the beginning itself)

Graph from the client-side log file (Buffer occupancy (in bytes) in the y-axis and time(in milliseconds) in the x-axis)