CS 681 Project

Simulation of a Closed Loop System

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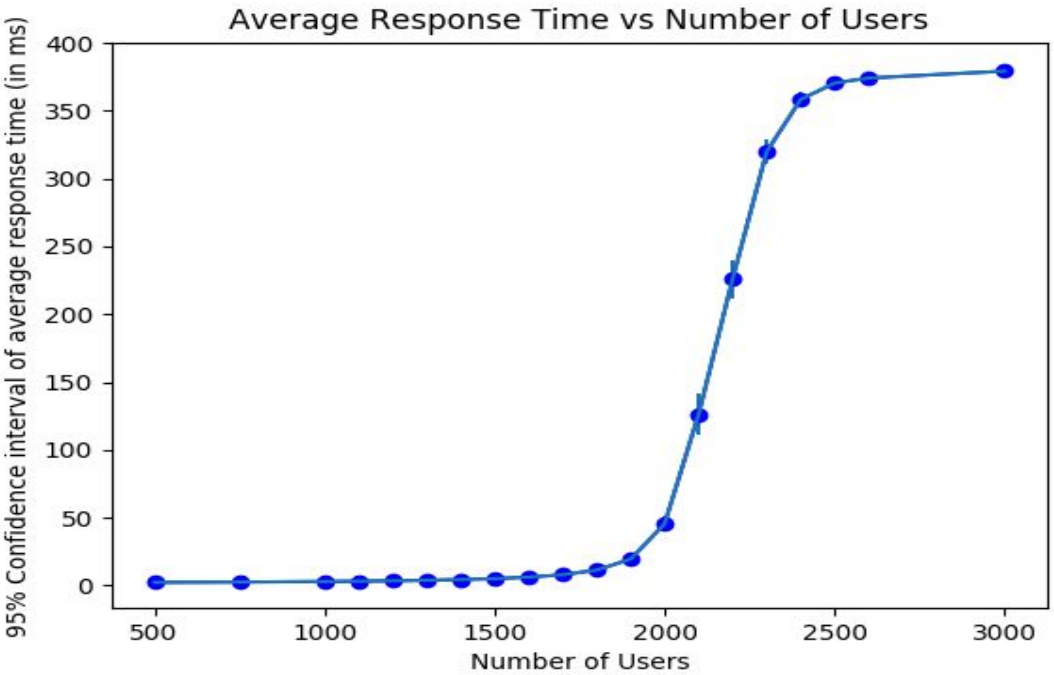
Configuration of system

```yaml
num_runs: 3
num_cores: 2
num_threads: 128
max_request_queue_length: 250
policy: roundRobin
# policy: fcfs
quantum_size: 0.4

# Stopping criterion is the number of requests to generate (need not finish)
stopping_criterion: 200000
context_switch_overhead:  0.005

think_time_distribution:
  name: c+exp
  params:
    c: 1500.0
    lambd: 0.002

service_time_distribution:
  name: exponential
  params:
    lambd: 0.5

timeout_distribution:
  name: c+exp
  params:
    c: 500.0
    lambd: 0.002
```

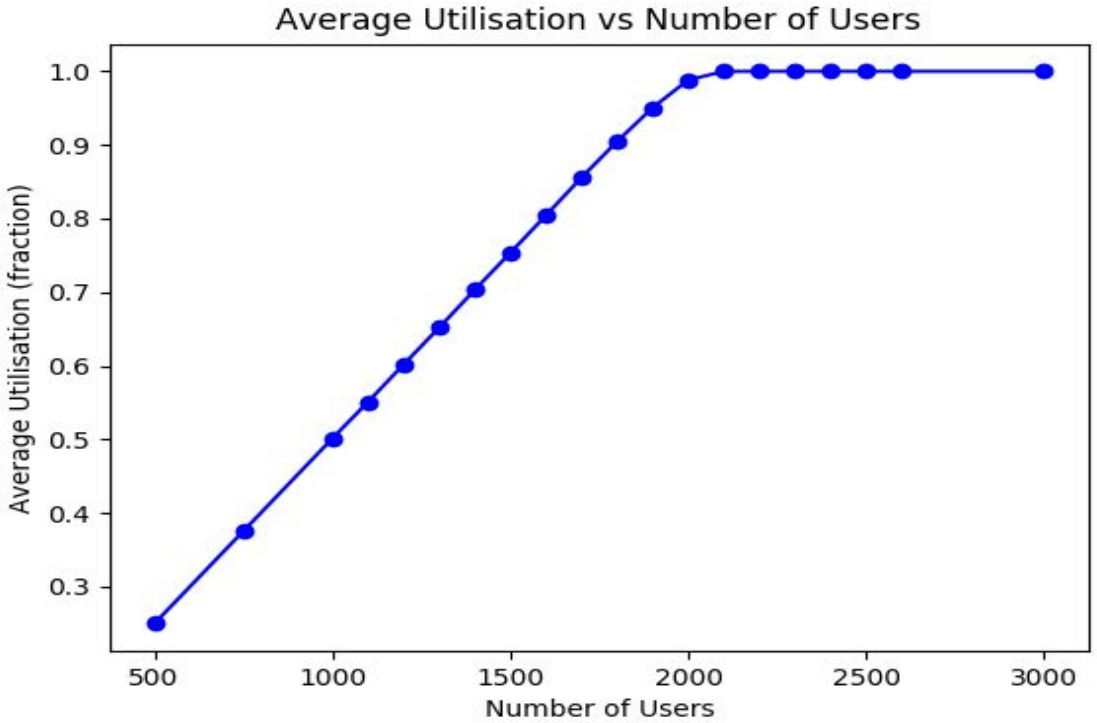
Average Response Time



Average response time increases and then saturates as the number of users increase. This is expected.

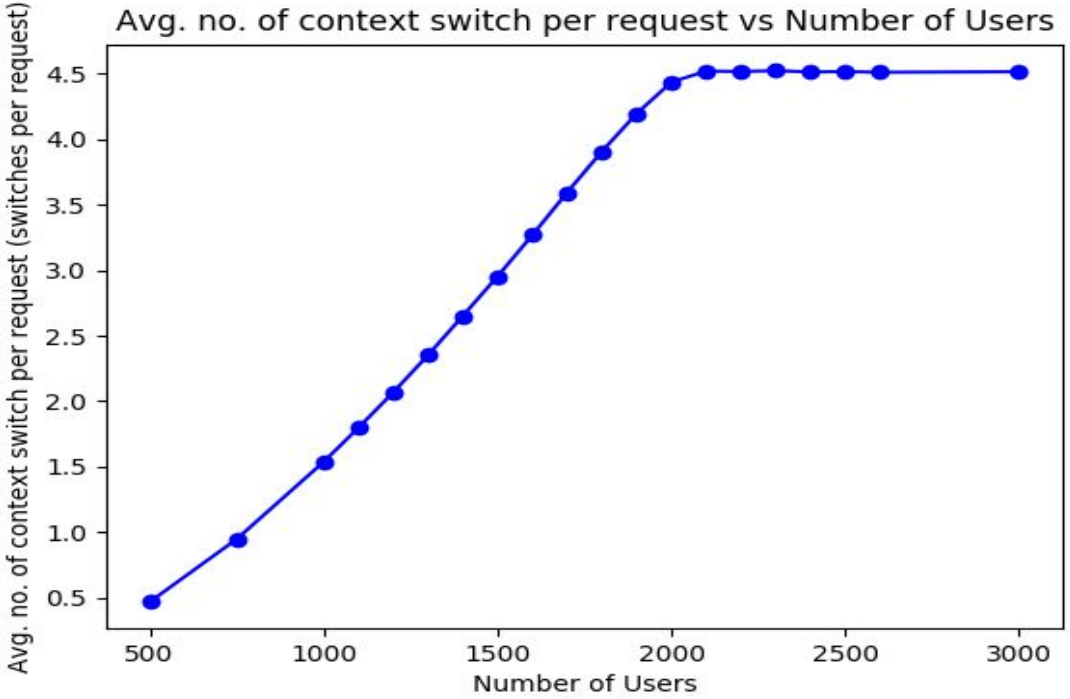
It saturates because the requests are dropped as number of users increase.

Average Utilisation



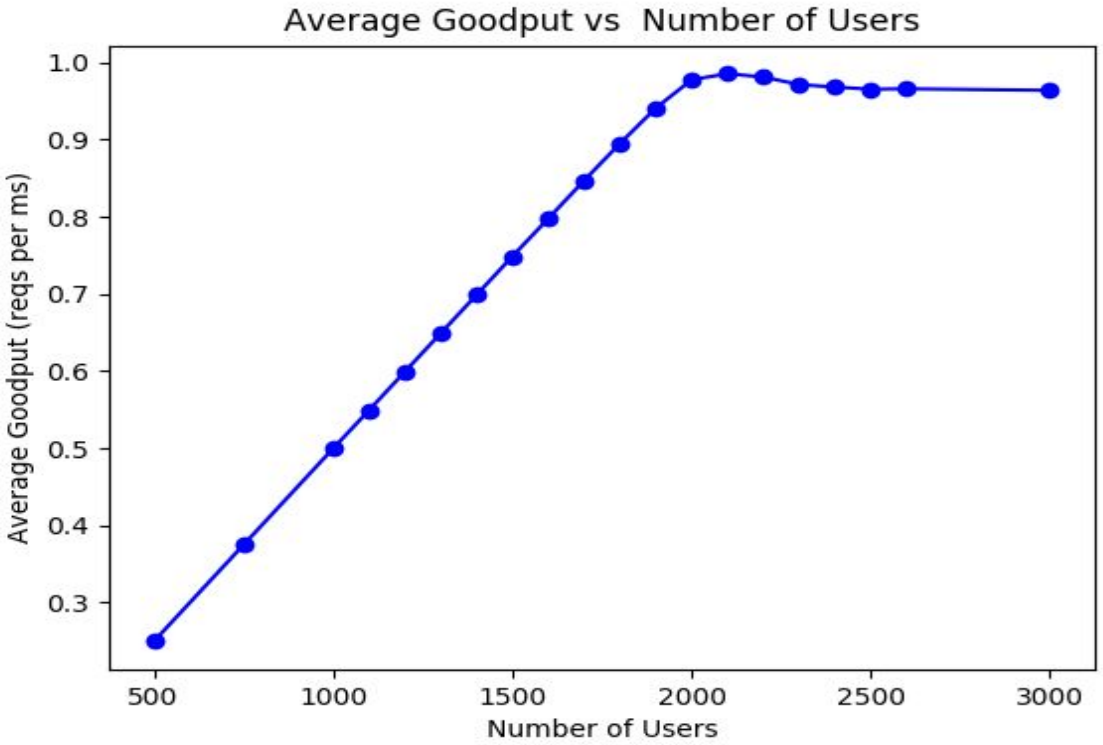
Average utilisation increases and then saturates to 1 as the number of users increase.

Avg Number of Context Switches per Req



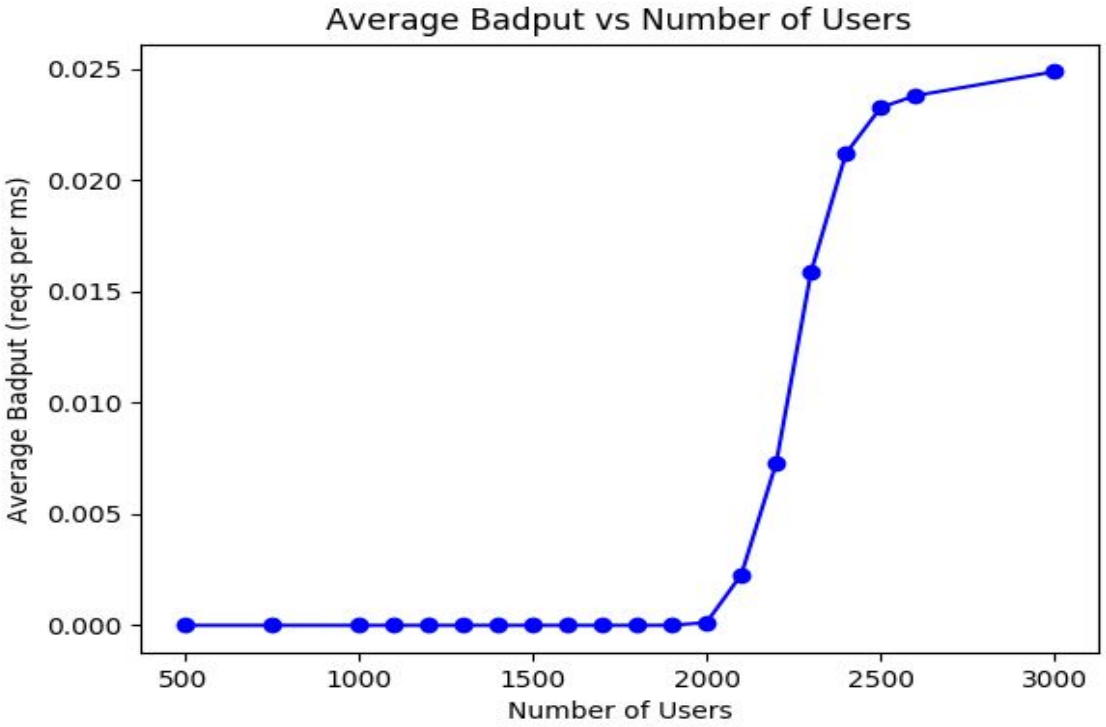
This also increases and then saturates as the number of users increase. Initially, when the load is low, less number of context switches happen. When it is high, it saturates because the number of threads are fixed.

Average Goodput (at Writing)



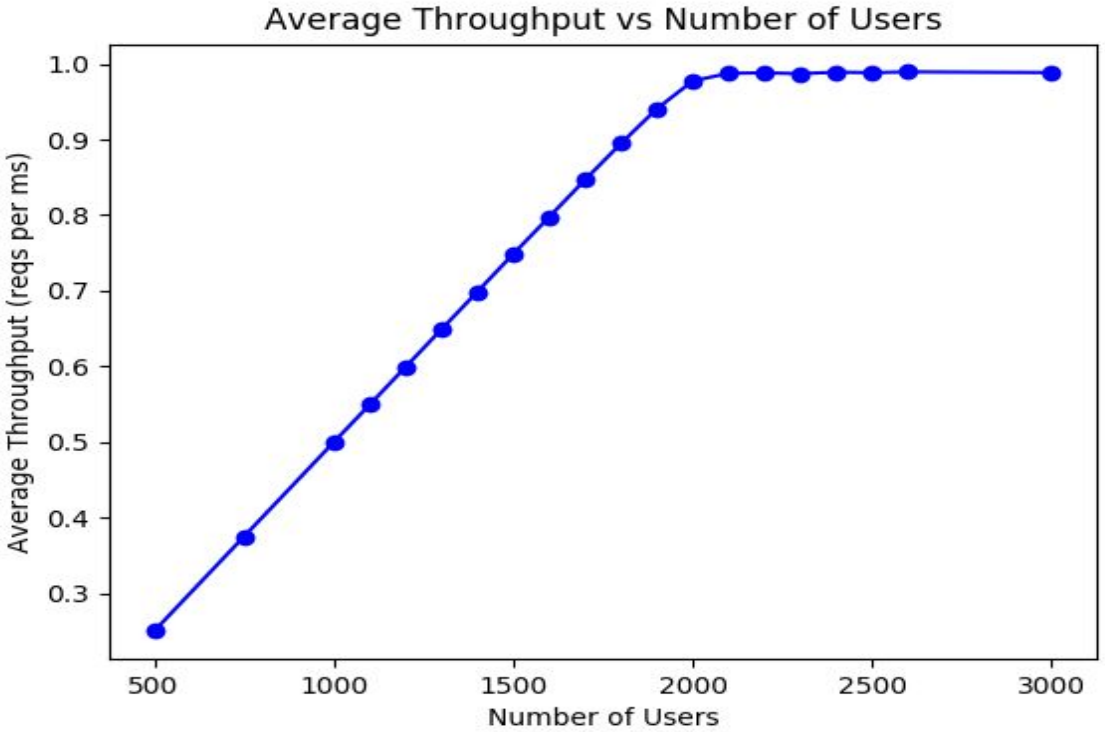
Average Goodput increases with the number of users.

Average Badput



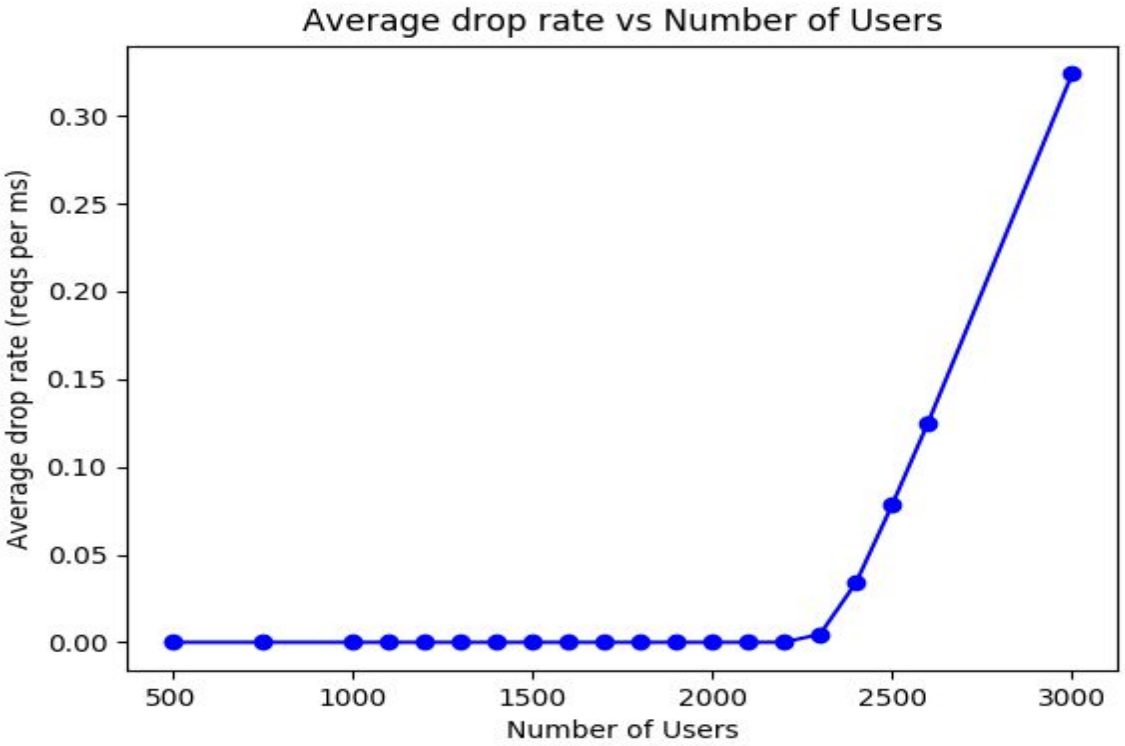
Average badput also increases with the number of users. When the load is low, timeouts are very less, so badput is also less. However, when the load increases, the chance of timeout also increases, indicating a higher badput.

Average Throughput



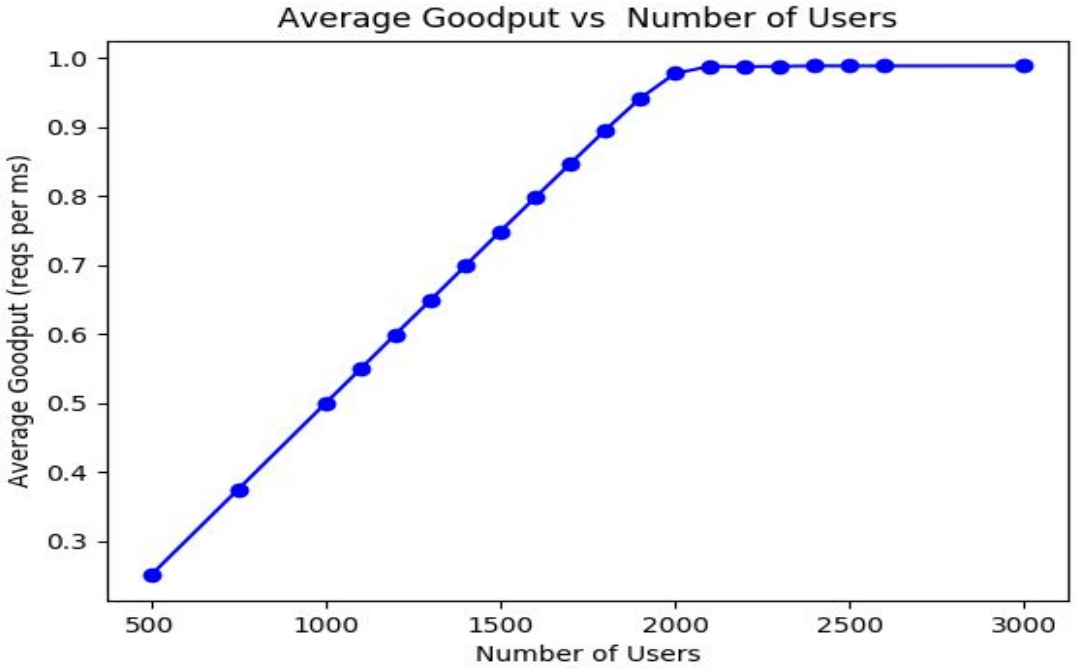
Average throughput increases and then saturates as the number of users increase. This is expected.

Average Drop Rate



The average drop rate increases with the number of users. When, the load is low, very less number of drops occur (almost 0) , but as the users increase , more and more requests are being dropped.

Goodput (before writing)



If we change timeout to be deterministic with value = 100ms. Then corresponding values are as follows for number of users to be 1500 and 3000 respectively:


```
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$ python3 overall_script
500
750
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$ python3 plot.py
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$ python3 main.py 1500
#################################### Statistics ####################################
Observation time                          :  [133654.38851194238, 133443.37478956312]
Avg. drop rate                            :  [0.0, 0.0]
Avg. goodput                              :  [0.7481834387433145, 0.7493815272410302]
Avg. badput                               :  [1.4963968054227375e-05, 0.0]
Avg. throughput                           :  [0.7481984027113687, 0.7493815272410302]
Avg. no. of context switch per request    :  [2.9317, 2.93237]
Avg. utilization                          :  [0.75064066353676, 0.75423113064721]
Avg. response time                        :  [4.919824936266314, 4.898532344576107]
Avg. no. of users in system               :  [3.681171245080222, 3.6708429138289564]
#################################### Averages ####################################
Observation time                          :  133548.88165075274 in ms
Avg. drop rate                            :  0.0 reqs per ms
Avg. goodput                              :  0.7487824829921723 reqs per ms
Avg. badput                               :  7.481984027113687e-06 reqs per ms
Avg. throughput                           :  0.7487899649761995 reqs per ms
Avg. no. of context switch per request    :  2.932035 switches per req
Avg. utilization                          :  0.752435897091985 fraction
Avg. response time                        :  4.90917864042121 in ms
Avg. no. of users in system               :  3.676007079454589 number
##################################################################################
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$
```

```
Avg. badput                                 :  7.481984027113687e-06 reqs per ms
Avg. throughput                             :  0.7487899649761995 reqs per ms
Avg. no. of context switch per request      :  2.932035 switches per req
Avg. utilization                            :  0.752435897091985 fraction
Avg. response time                          :  4.90917864042121 in ms
Avg. no. of users in system                 :  3.676007079454589 number
################################################################################
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$ python3 main.py 3000
##################################### Statistics #####################################
Observation time                            :  [76137.0057001654, 76197.0374372587]
Avg. drop rate                              :  [0.32191967328637344, 0.3238183639398945]
Avg. goodput                                :  [0.0, 0.0]
Avg. badput                                 :  [0.9915020863479531, 0.9885686180650276]
Avg. throughput                             :  [0.9915020863479531, 0.9885686180650276]
Avg. no. of context switch per request      :  [4.502622863955491, 4.518094681783182]
Avg. utilization                            :  [1.0, 1.0]
Avg. response time                          :  [378.2310443808812, 379.3956044107149]
Avg. no. of users in system                 :  [374.93073586596694, 374.99976489939934]
##################################### Averages #####################################
Observation time                            :  76167.02156871205 in ms
Avg. drop rate                              :  0.322869018613134 reqs per ms
Avg. goodput                                :  0.0 reqs per ms
Avg. badput                                 :  0.9900353522064904 reqs per ms
Avg. throughput                             :  0.9900353522064904 reqs per ms
Avg. no. of context switch per request      :  4.510358772869337 switches per req
Avg. utilization                            :  1.0 fraction
Avg. response time                          :  378.8133243957981 in ms
Avg. no. of users in system                 :  374.96525038268317 number
################################################################################
joker@lenovo:~/Desktop/final_version/Discrete-event-simulation/Code/TimeoutAtWriting$
```