**Simulation 4 – Project Report**

Submitted by:

Rahul Sethi

Masters in Computer Science

Student Id: 200241349

**Description:**

The objective of this project is to use our simulation model that we developed in project 3 to gain insights into the behavior of the system. Specifically, we will obtain curves of the 95th percentile of the end-to-end delay and of the probability that the server of the client queue (hereafter referred to as the client server) is idle as a function of the thresholds TL and TH. Based on these curves we will determine the best values of the thresholds TL and TH that minimize the 95th percentile of the end-to-end delay and at the same time the probability that the client server is idle is less or equal to 0.01

**Technology Used:**

The language used to code the simulation: C++. No external libraries are used and everything is made from scratch.

**Algorithm:**

* The code for the Simulation Project 3 remains intact.
* Modifications:
  + For each event it was checked if the client queue was idle.
  + If(idle){

idleTime.push( make\_pair( mcl , 0) );

else{

idleTime.push( make\_pair( mcl , 1) );

}

* + At the end it was divided into batches of given batch size.
  + Probability was calculated for each batch.
  + Then total mean of for all the batch’s probabilities was calculated = Pmean.

**Calculations:**

* Values: N- 90000, DH- 1, DL- 2, Mean service time in the infinite server queue- 10, Mean service time in the client queue- 1.5
* Code was run for various different values for TL and TH.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sr No. | TL | TH | Mean Probability | Mean Delay Time |
| 1 | 1 | 2 | 0.00559707 | 13.2574 |
| 2 | 1 | 5 | 0.0028821 | 13.2573 |
| 3 | 1 | 8 | 0.00179843 | 13.2572 |
| 4 | 1 | 11 | 0.00125973 | 13.2572 |
| 5 | 1 | 14 | 0.000949269 | 13.2571 |
| 6 | 1 | 17 | 0.00075261 | 13.2571 |
| 7 | 4 | 5 | 0.000619515 | 13.2571 |
| 8 | 4 | 8 | 0.000524902 | 13.2571 |
| 9 | 4 | 11 | 0.00045504 | 13.2571 |
| 10 | 4 | 14 | 0.000401869 | 13.2571 |
| 11 | 4 | 17 | 0.000360389 | 13.2571 |
| 12 | 7 | 8 | 0.000327356 | 13.2571 |
| 13 | 7 | 11 | 0.000300589 | 13.2570 |
| 14 | 7 | 14 | 0.000278573 | 13.2570 |
| 15 | 7 | 17 | 0.000260231 | 13.2570 |
| 16 | 10 | 11 | 0.000244775 | 13.2570 |
| 17 | 10 | 14 | 0.000231621 | 13.2570 |
| 18 | 10 | 17 | 0.000220326 | 13.2569 |
| 19 | 13 | 14 | 0.000210551 | 13.2569 |
| 20 | 13 | 17 | 0.00020203 | 13.2570 |
| 21 | 16 | 17 | 0.000194555 | 13.2571 |

**Graph:**

The below graph shows trend for mean probability and mean delay time for different values of TL and TH.

(Mean End to end Delay Time)

(Mean probabilities if client queue is idle)