Linnæus University
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Performance Engineering

[Subtitle]

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1 Introduction

This report shows the results of the mathematical representation of the behaviour from the system proposed, a model created with JMT and the results got by it.

2 Calculations

$$T = length\ of\ time\ we\ observe\ the\ system$$

$$A_k = number\ of\ session\ arrives\ we\ observe\ for\ source\ k$$

$$C_k = number\ of\ session\ completions\ we\ observe\ at\ source\ k$$

$$B_k = total\ amount\ of\ time\ during\ which\ the\ source\ k\ is\ busy\ (B < T)$$

$$N_k = X_k \times R_k = average\ number\ of\ jobs\ in\ the\ system$$

$$R_k = average\ source\ k\ residence\ time\ per\ job$$

$$\lambda_k = \frac{A_k}{T} = arrival\ rate$$

$$X_k = \frac{C_k}{T} = throughput\ rate$$

$$U_k = \frac{B_k}{T} = utilization$$

$$S_k = \frac{B_k}{C_k} = mean\ service\ time\ per\ completed\ job\ in\ the\ system$$

$$V_k = \frac{C_k}{C} = mean\ number\ of\ visits\ per\ completed\ job$$

$$D_k = V_k \times S_k = mean\ demand\ time\ per\ completed\ job\ in\ the\ system$$

Server	S	X	U
Web Server	0.03 s	1.5	0.045
Winner Payment Server	1	0.375	0.375
Database	0.08		
Betting Server	0.199	1.050	0.2091

2.1 Web Server

$$T = 5\ days = 5 \times 24 \times 60 \times 60 = 432000\ s$$

$$C_1 = 648000$$

$$S_1 = \ 30\ ms = 0.03\ s$$

$$B_1 = C_1 \times S_1 = 648000 * 0.03 = 19440$$

$$X_1 = \frac{C_1}{T} = \frac{648000}{432000} = 1.5$$

$$U_1 = \frac{B_1}{T} = \frac{19440}{432000} = 0.045$$

2.2 Winner Payment Server

$$C_2 \ = \ C_1 \times 0.25 = 648000 \times 0.25 = 162000$$

$$U_2 = 0.375$$

$$X_2 = \frac{C_2}{T} = \frac{162000}{432000} = 0.375$$

$$B_2 = U_2 \times T = 0.375 \times 432000 = 162000$$

$$S_2 = \frac{B_2}{C_2} = \frac{162000}{162000} = 1$$

2.3 Player Engagement Server

$$C = 2\ iterations$$

$$C_3 \ = \ C_1 \times 0.75 \times C = 648000 \times 0.75 \times 2 = 972000$$

$$S_3 = 400\ ms = 0.4\ s$$

2.4 Database

$$C_4 = C_3 = 972000$$

$$V_4 = \frac{C_4}{C_1} = \frac{972000}{648000} = 1.5$$

$$D_4 = 120\ ms = 0.12\ s$$

$$S_4 = \frac{D_4}{V_4} = \frac{0.12}{1.5} = 0.08$$

2.5 Betting Server

$$N_5 = 0.265$$

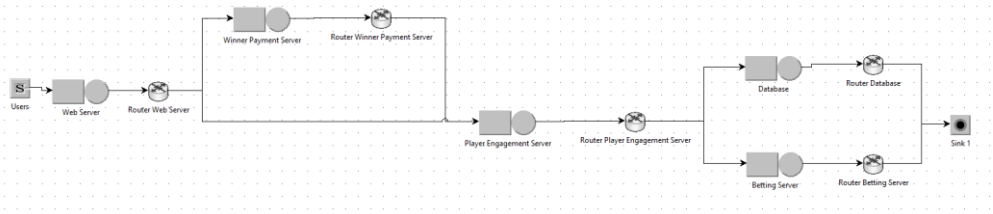
$$R_5 = 0.2525\ s$$

$$U_5 = 0.2091$$

$$X_5 = \frac{N_5}{R_5} = \frac{0.265}{0.2525} \approx 1.050$$

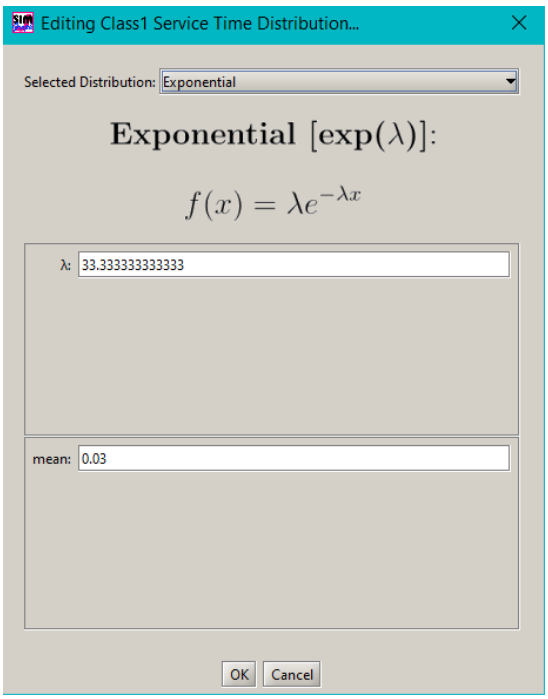
$$S_5 = \frac{U_5}{X_5} = \frac{0.2091}{1.050} \approx 0.199$$

3 Model

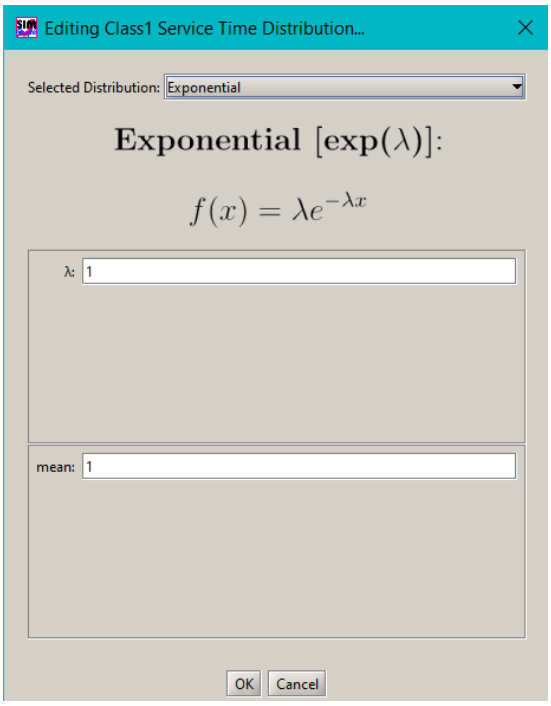


3.1 Service Time

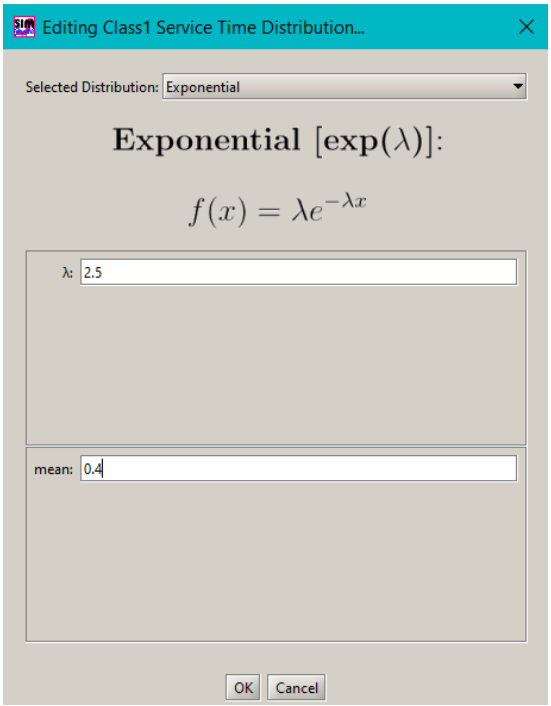
3.1.1 Web Server



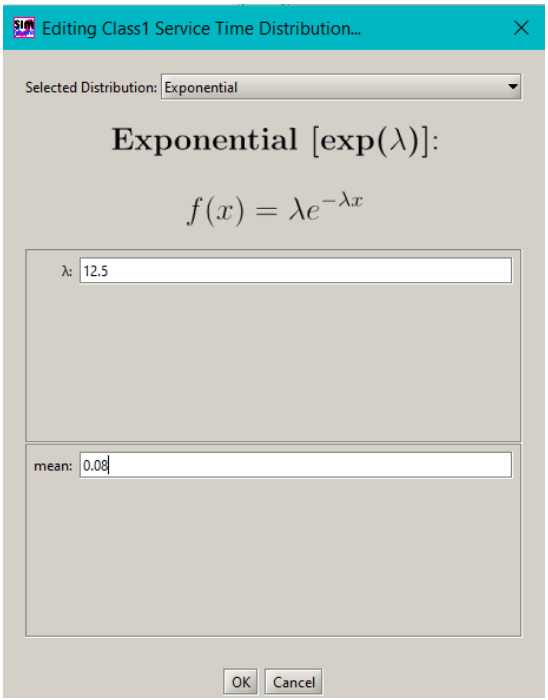
3.1.2 Winner Payment Server



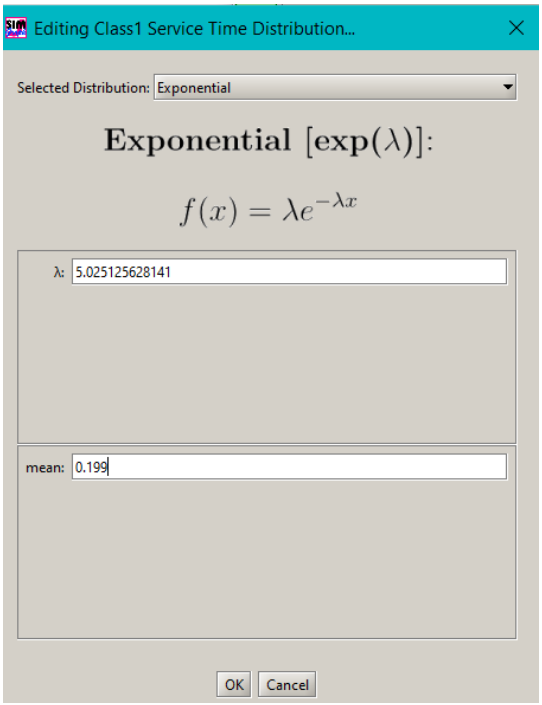
3.1.3 Player Engagement Server



3.1.4 Database

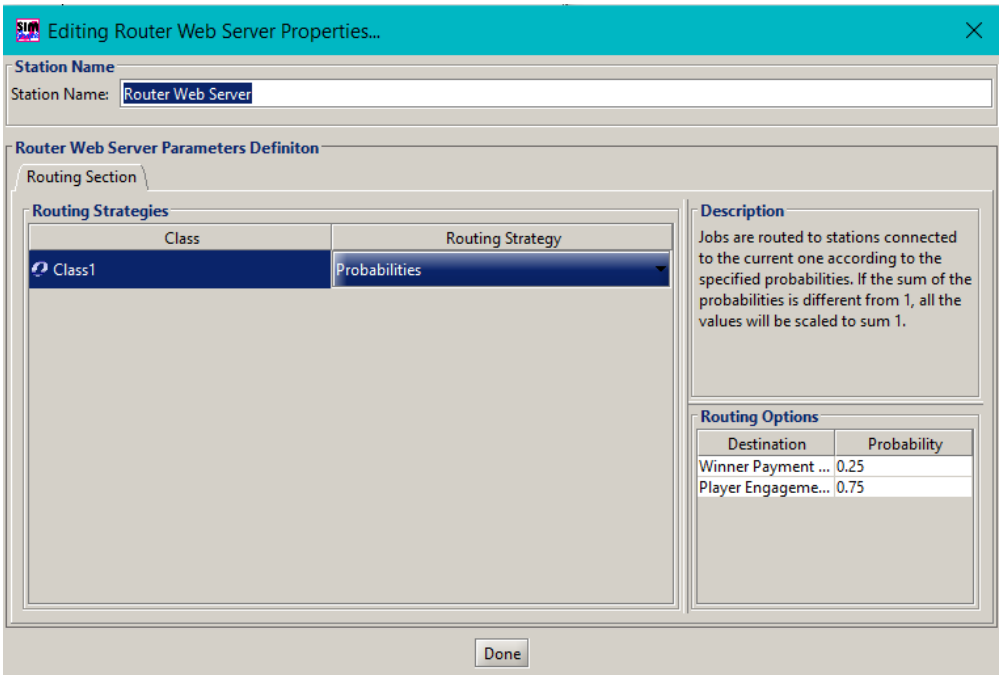


3.1.5 Betting Server



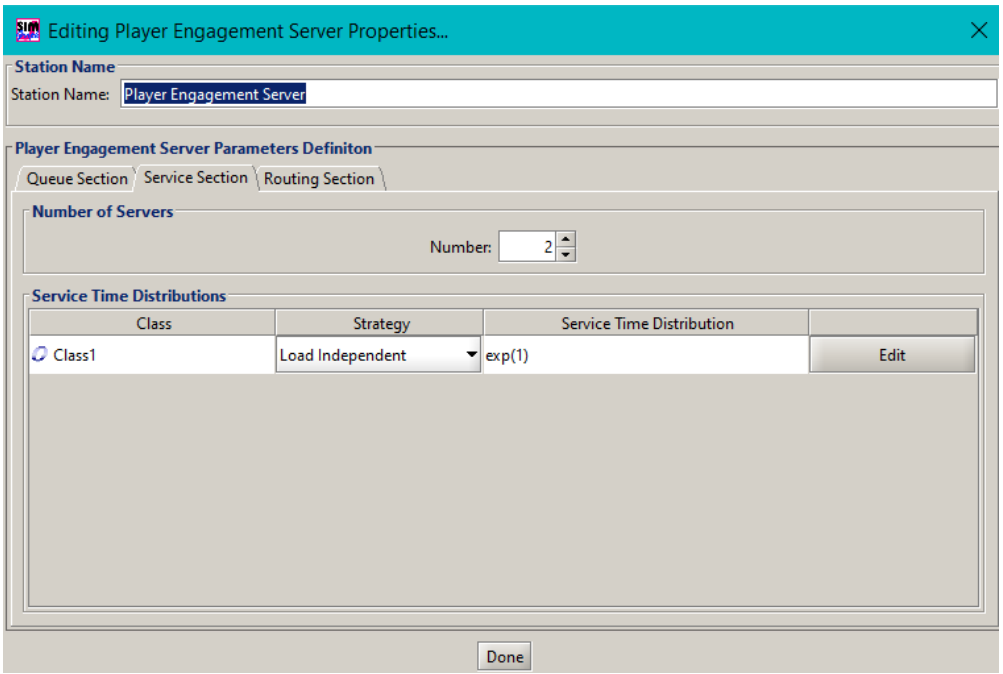
3.2 Routing Probabilities

3.2.1 Router Web Server

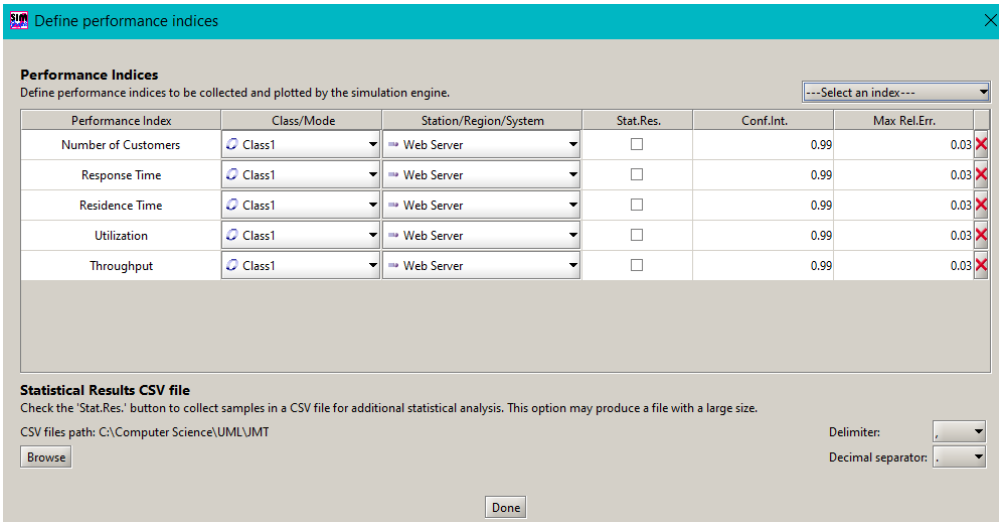


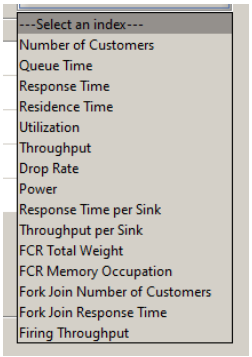
3.3 Resources

Only PlayerEngagementServer has 2 servers working in parallel.

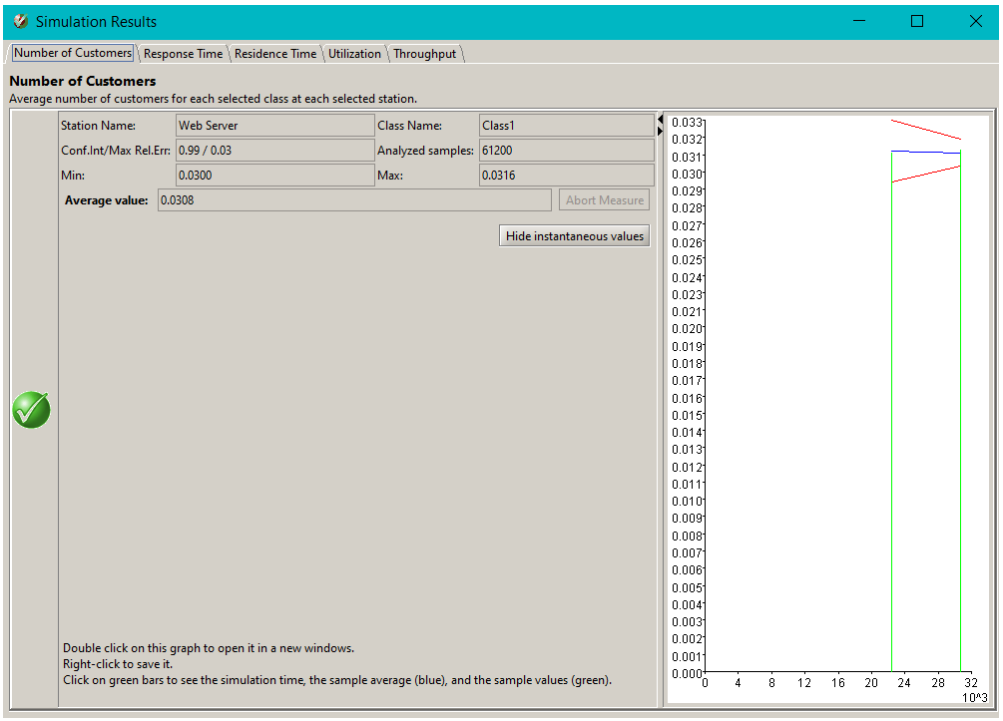


There is no System Response Time to choose in Performance Indices in this version.

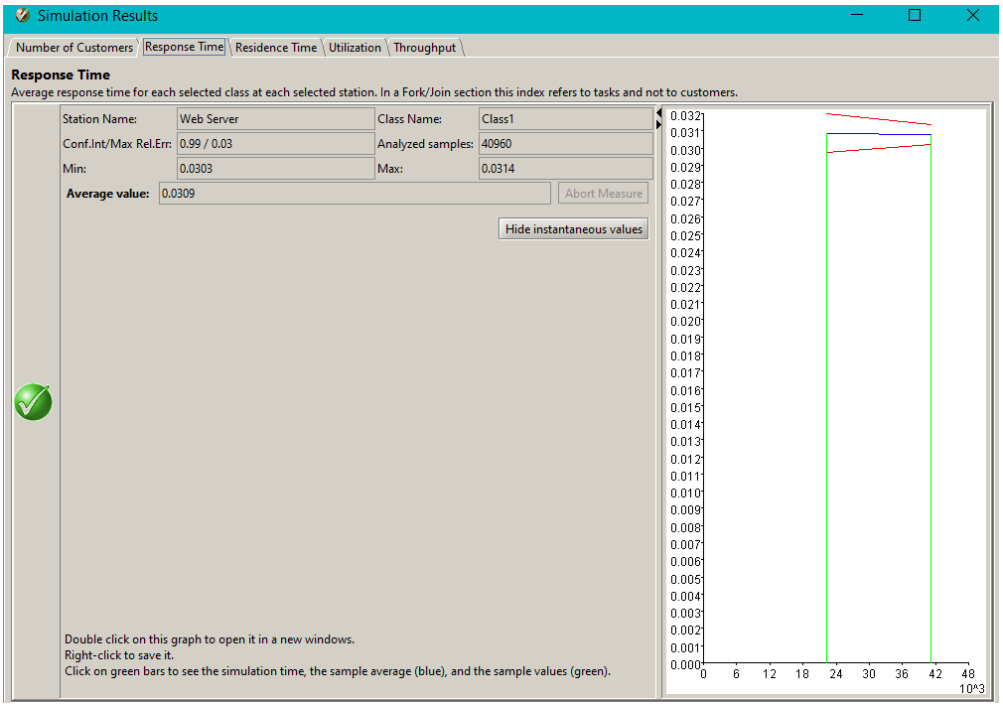




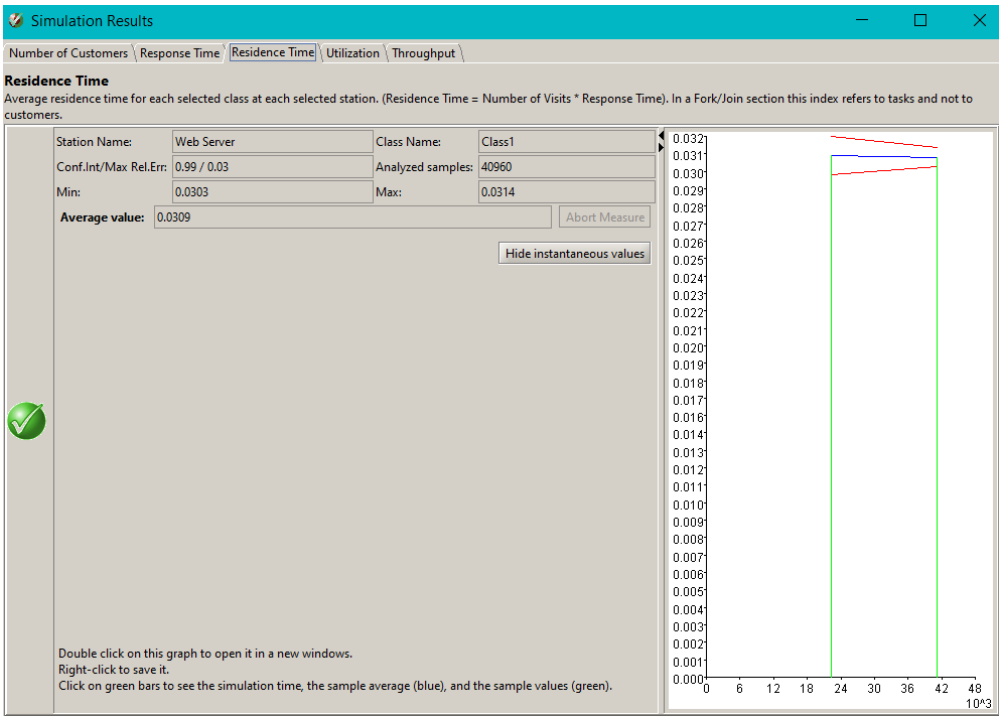
3.4 Number of Customers



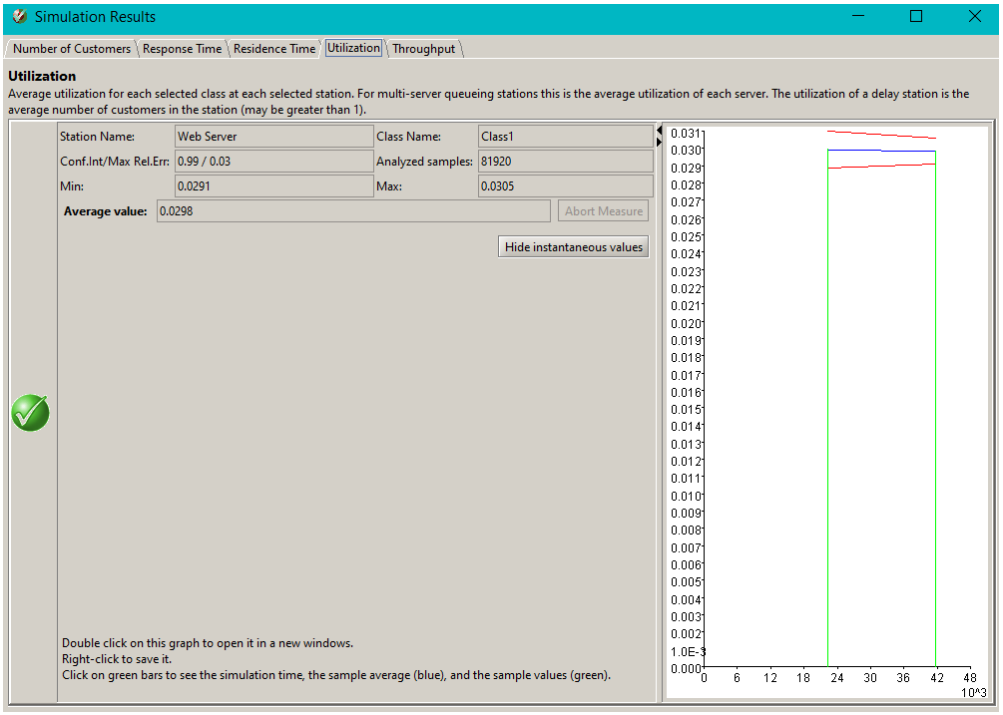
3.5 Response Time



3.6 Residence Time



3.7 Utilization



3.8 Throughput