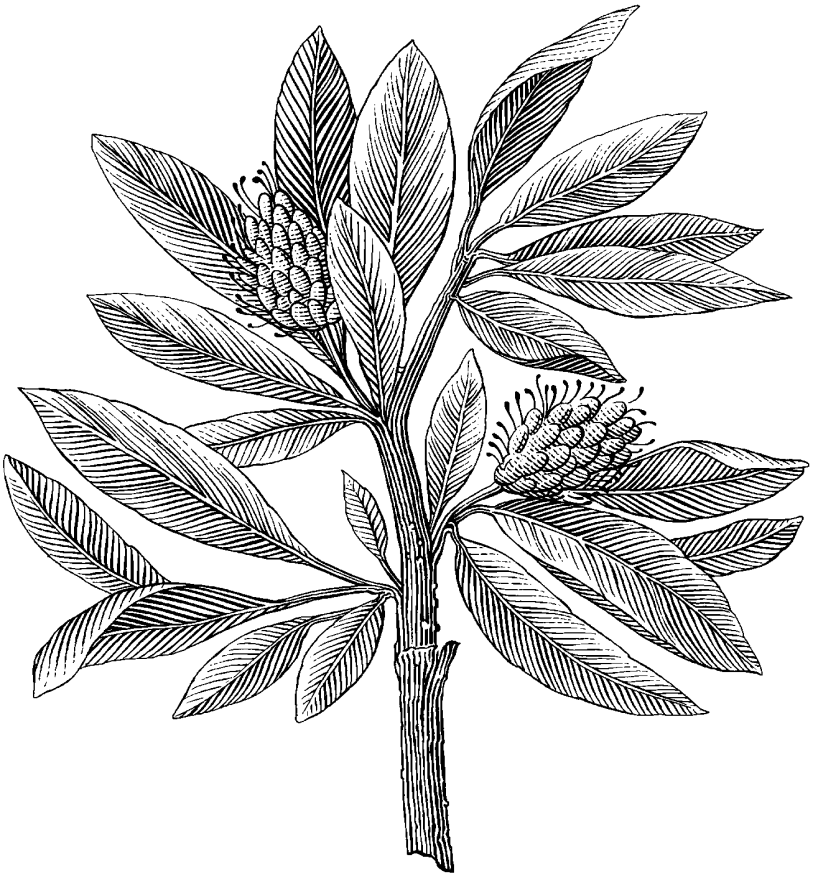
Linnéuniversitetet
Kalmar Växjö

Exam

Performance Engineering

2DV608



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Semester: Spring 2021
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Table of Contents

1 Problem A

This section shows the calculations for each server. It also shows the calculations for the service time of the of the *WinnerPaymentServer*, *Database, BettingServer*, and the utilization for the *WebServer*.

1.1 Calculations

Cells that with '-' signify that the value was not needed for further calculations. Values in red are the ones that were required.

Server	S	X	U
WebServer	0.03	1.5	0.045
WinnerPaymentServer	1	0.375	0.375
PlayerEngagementServer	0.4	-	-
Database	0.06	-	-
BettingServer	0.199	1.049	0.2091

1.2 WebServer

$S_{ws} = 0.03$, $C_{ws} = 648{,}000$, $T = 432{,}000$

$X_{ws} = C_{ws}/T = 648{,}000 / 432{,}000 = 1.5$

$U_{ws} = X_{ws} * S_{ws} = 1.5 * 0.03 = 0.045$

1.3 WinnerPaymentServer

$U_{wps} = 0.375$

$C_{wps} = 648{,}000 * 0.25 = 162{,}000$ (25% of C)

$X_{wps} = C_{wps} / T = 162{,}000 / 432{,}000 = 0.375$

$S_{wps} = U_{wps} / X_{wps} = 0.375 / 0.375 = 1$ (Using Utilization Law)

1.4 Database

$D_{db} = 0.12$, $V_{db} = 2$

$S_{db} = D_{db} / V_{db} = 0.12 / 2 = 0.06$

1.5 BettingServer

$N_{bs} = 0.265$, $R_{bs} = 0.2525$, $U_{bs} = 0.2091$

$X_{bs} = N_{bs} / R_{bs} = 0.265 / 0.2525 = 1.049$ (Using Little's Law)

$S_{bs} = U_{bs} / X_{bs} = 0.2091 / 1.049 = 0.199$ (Using Utilization Law)

Frequency at which users proceed to betting server or finish session:

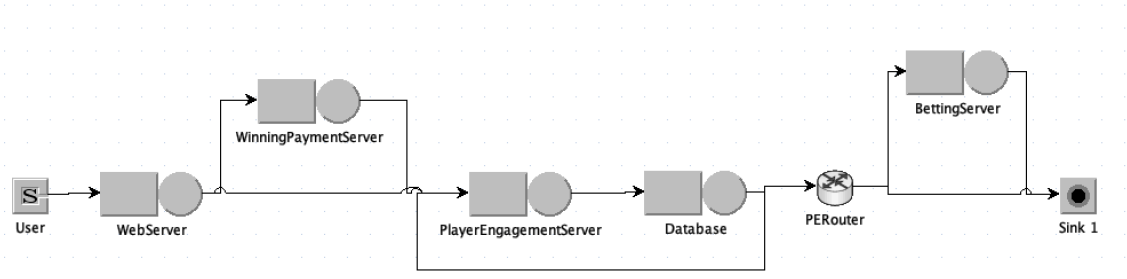
$C_{bs} = X_{bs} * T = 1.049 * 432{,}000 = 453{,}168$

Frequency = $(C_{bs} / C) * 100 = (453{,}168 / 648{,}000) * 100 = 69.99\%$

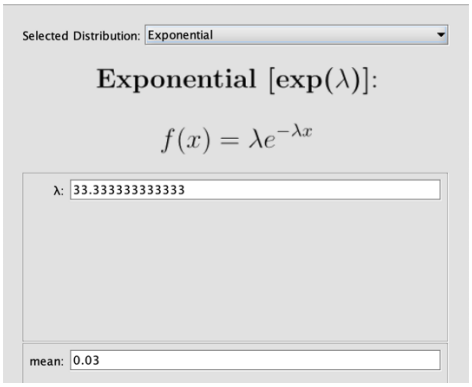
2 Problem B

This section contains screenshots from the JMT Model including the *System Response Time*, *Utilization* and *Throughput* for each server.

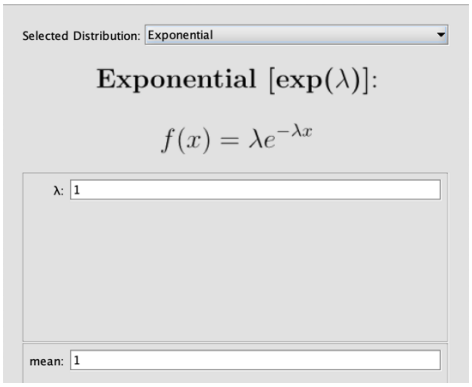
2.1 Model



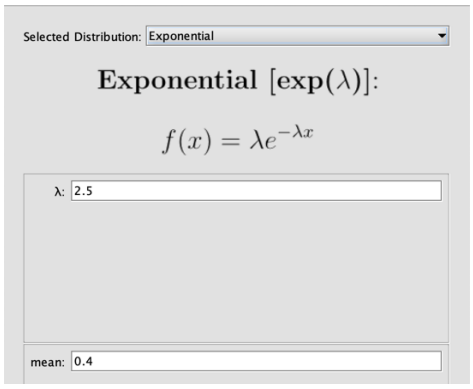
2.2 Service Time



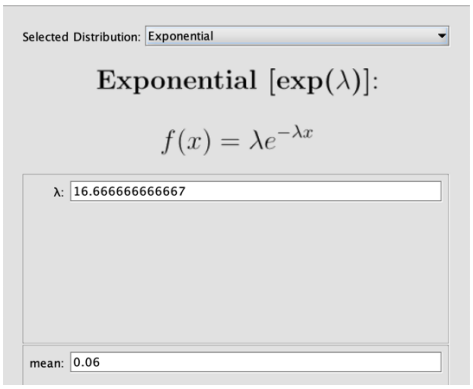
WebServer



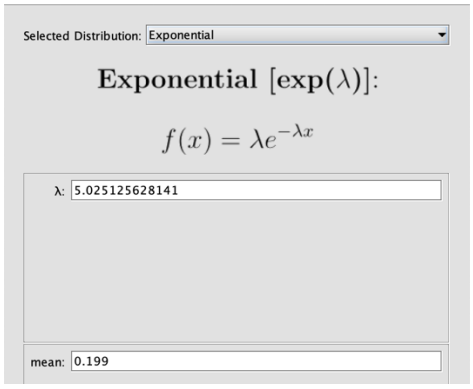
WinningPaymentServer



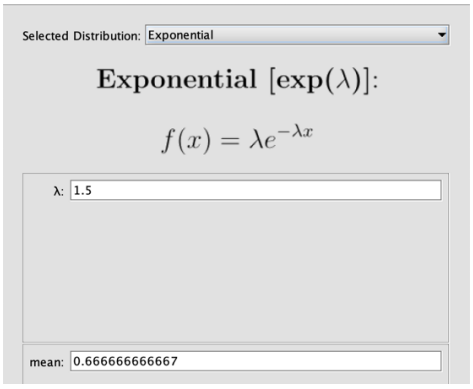
PlayerEngagementServer



Database

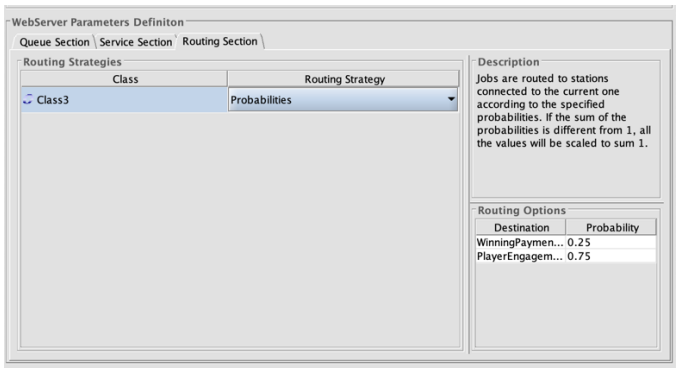


BettingServer

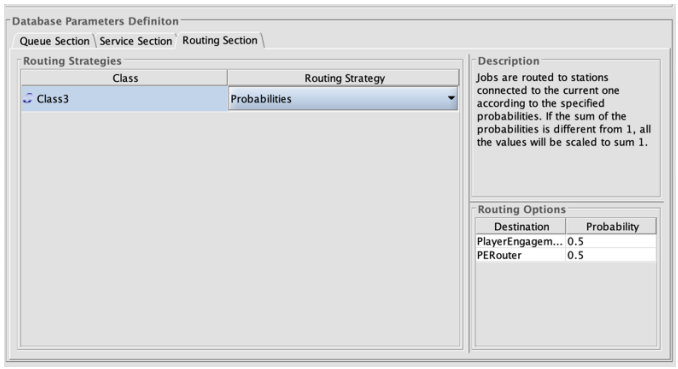


Class arrival rate

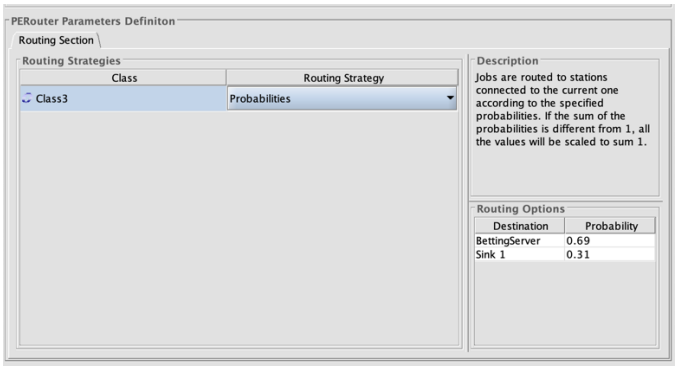
2.3 Routing



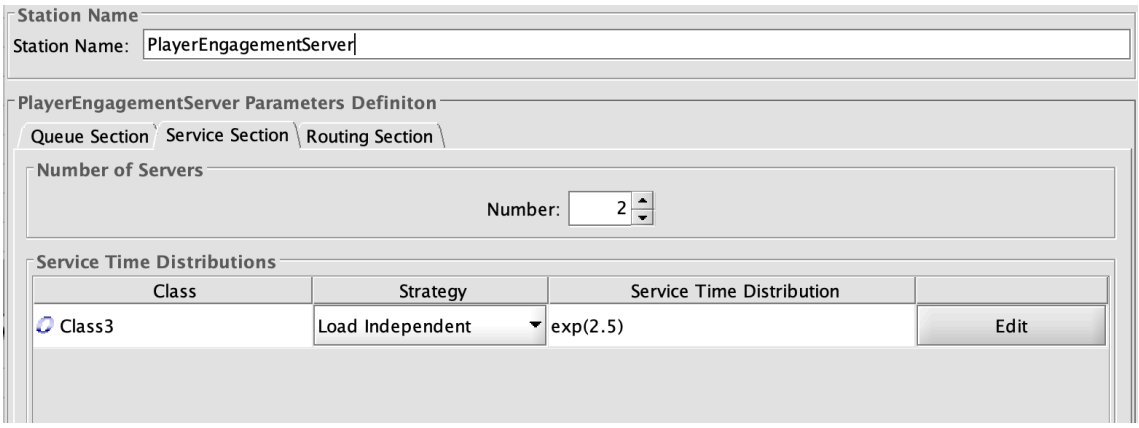
WebServer



Database (Iterating Twice to PlayerEngagementServer)

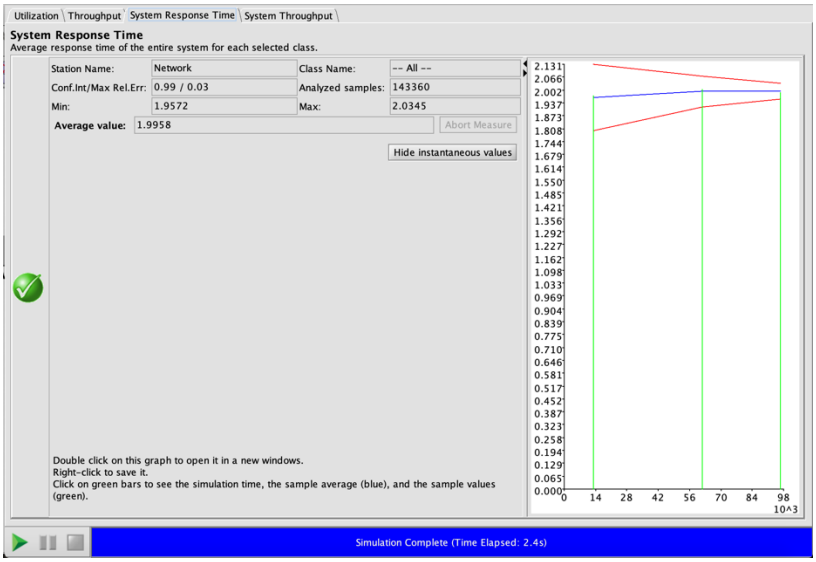


PERouter (From PlayerEngagingServer to BettingServer or finishing)

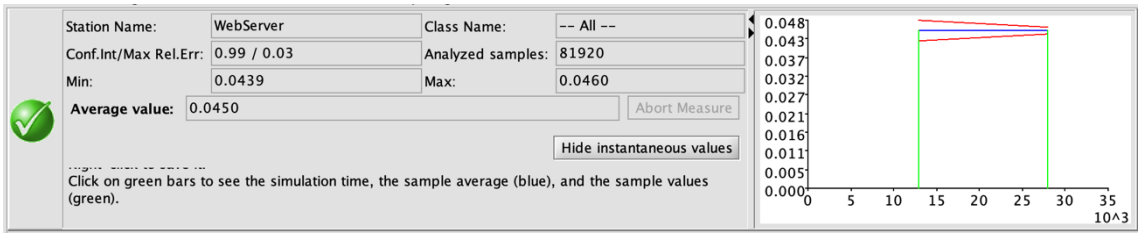


Two servers for PlayerEngagementServer

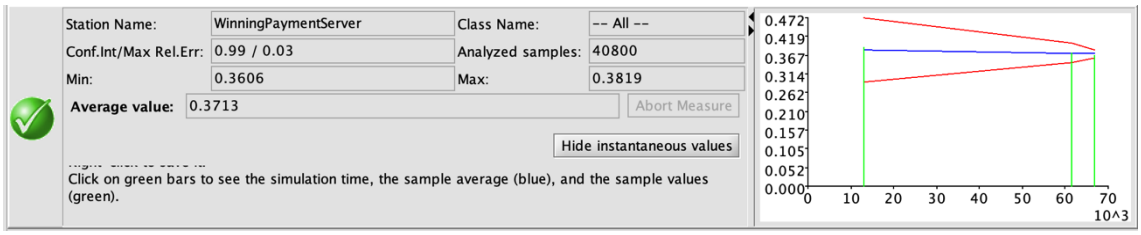
2.4 System Response Time



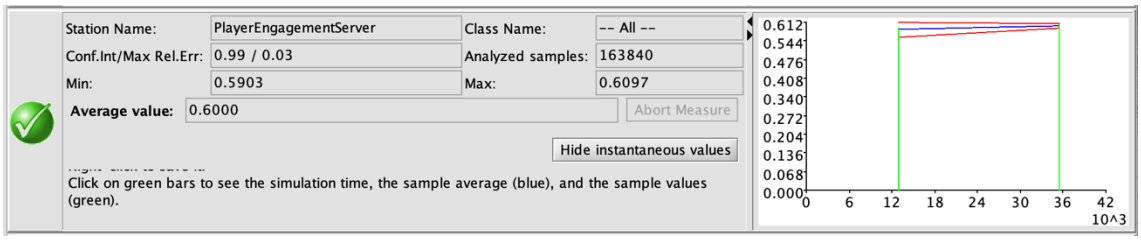
2.5 Utilization



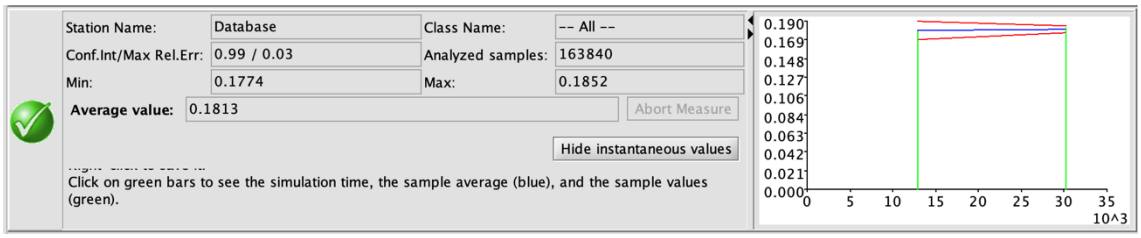
WebServer



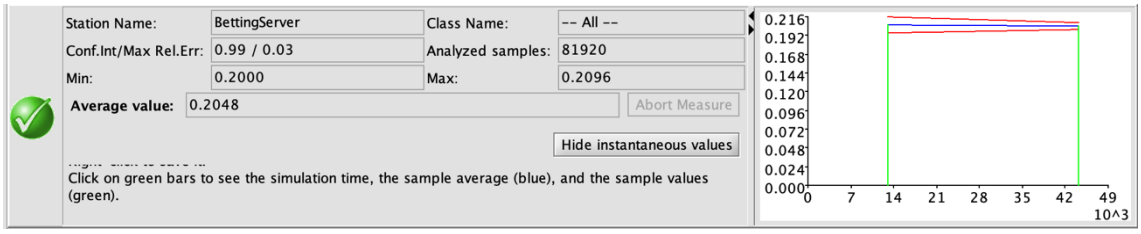
WinningPaymentServer



PlayerEngagementServer

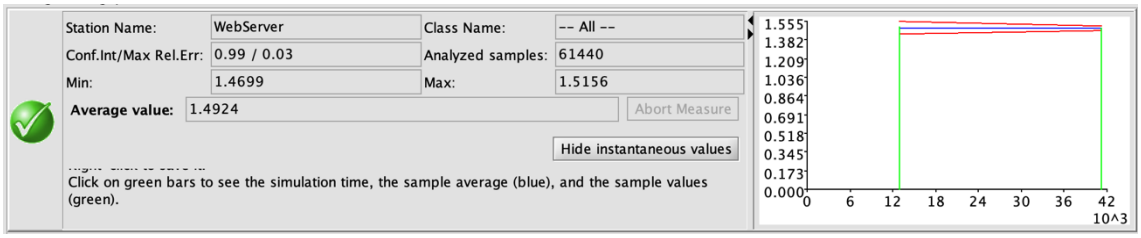


Database

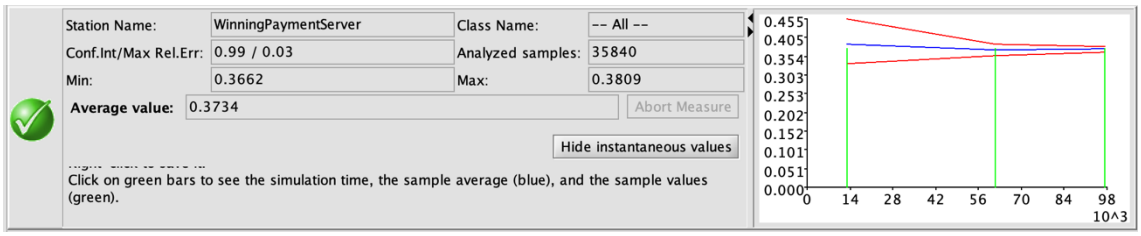


BettingServer

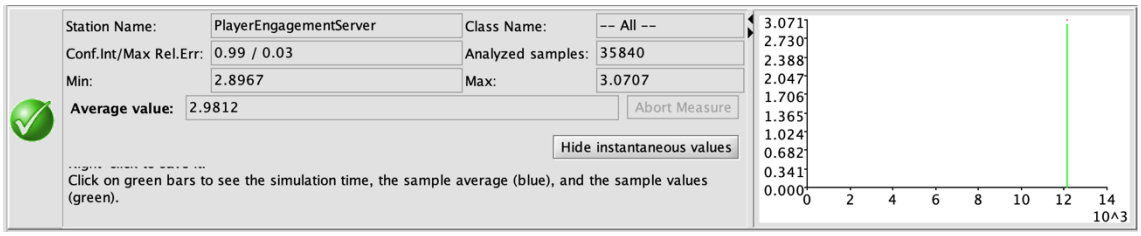
2.6 Throughput



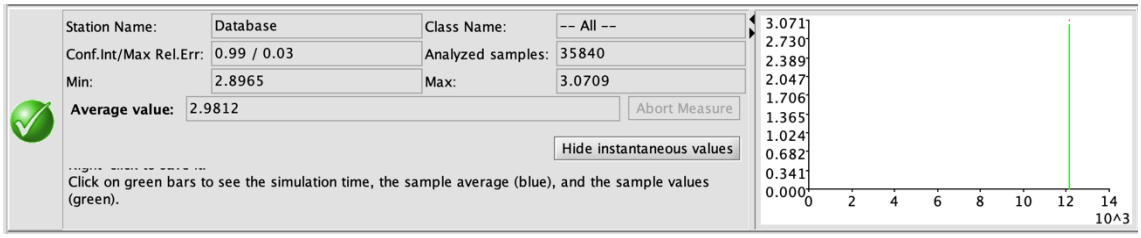
WebServer



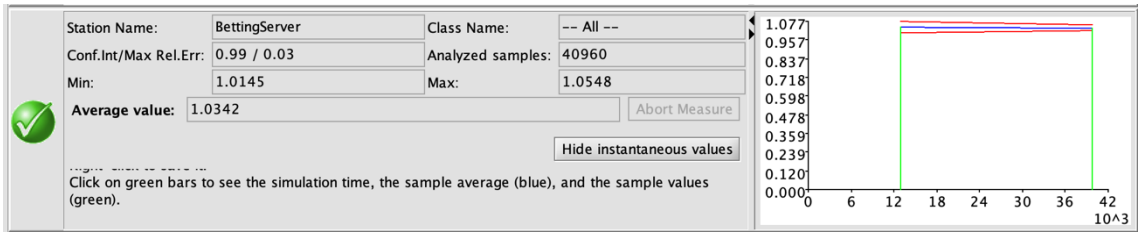
WinningPaymentServer



PlayerEngagementServer



Database



BettingServer

3 Problem C

This section includes the calculations and screenshots of the updated JMT model.

3.1 PlayerEngagementServer Calculations

X = 3 (180 users per minute) , S_{pes} = 0.4 , V_{pes} = 4 , c_{pes} = 2

$X_{pes} = V_{pes} * X = 4 * 3 = 12$

$U_{pes} = (X_{pes} * S_{pes}) / c_{pes} = (12 * 0.4) / 2 = 2.4 = 240\%$

With 2 parallel servers the system saturates. However, using 5 parallel servers (c = 5) prevents saturation as seen below:

$U_{pes} = (X_{pes} * S_{pes}) / c_{pes} = (12 * 0.4) / 5 = 0.96 = 96\%$

3.2 Database Calculations

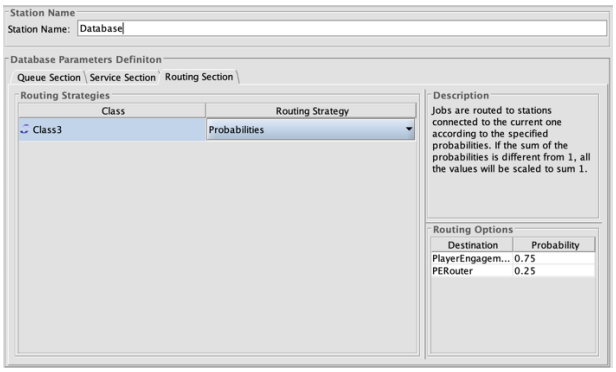
X = 3 , S_{pes} = 0.06 , V_{pes} = 4

$X_{pes} = V_{pes} * X = 4 * 3 = 12$

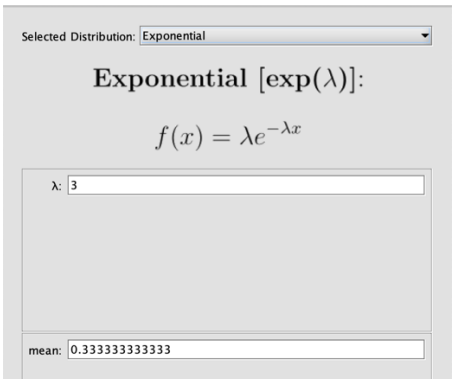
$U_{pes} = X_{pes} * S_{pes} = 12 * 0.06 = 0.72 = 72\%$

Out of the PlayerEngagementServer and the Database, the PlayerEngagementServer will saturate first. For the database no extra parallel servers are needed.

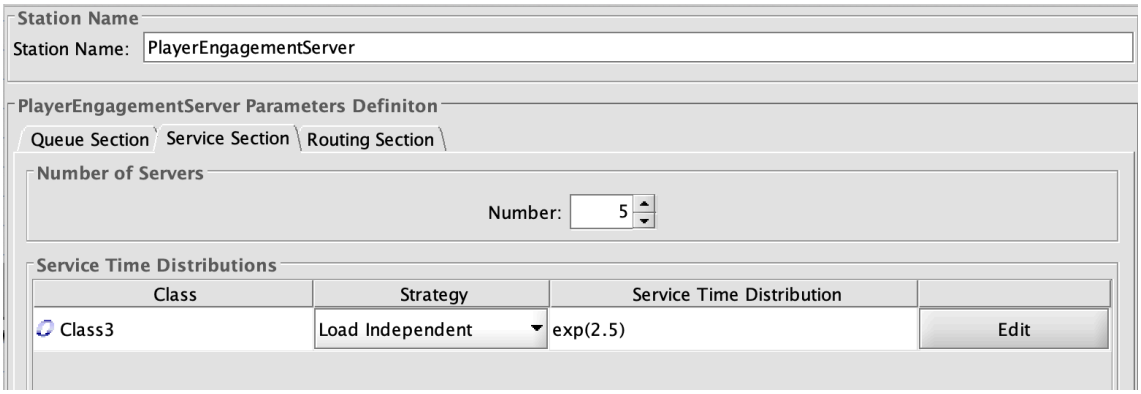
3.3 Updated Iterations and Users per minute and No. of Servers



Iterating four times to PlayerEngagementServer

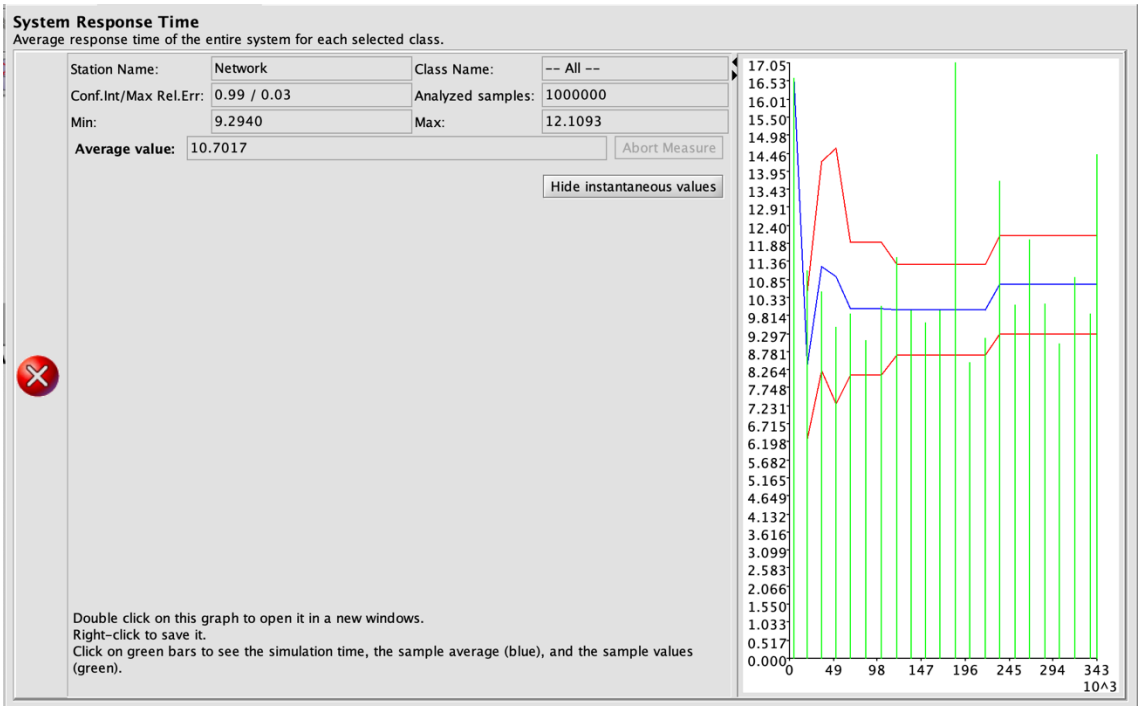


180 users per minute



Three parallel servers for PlayerEngagementServer

3.4 System Response Time



As shown the System Response Time is 10.7. It is also red; this is due to the high variance and the fact that the PlayerEngagementServer and Database are so close to being saturated.