



Software Design Assignment 2

Performance Engineering



Author: Yetnayet Belachew (yb222ce)
supervisor: Mauro Caporuscio
subject: Software Design
Course code: 2DV608
Date: 2022-02-27



A) Running system = 3 days

Time = 3 day = **4320** minutes = 259200 second

Completed (C_k) = **129600**

Throughout (X_k) = $C_k/T = 129600 / 259200 = 0.5$

WebServer

$S_k = 75\text{ms} = 0.075$ second **conver it to second**

Throughout (X_k) = $C_k/T = 129600 / 259200 = 0.5$

$U_k = \text{Throughout } (X_k) * \text{Average service time } (S_k) = 0.5 * 0.075 = 0.0375$

SoftwareSearchEngine

$$C_j = C_x * U_k$$

$$C_j = 129600 * 85\% = 110160$$

Throughout (X_j) = $C_j/T = 110160 / 259200 = 0.425$

$$U_j = 0.085$$

$$S_j = 8.5\% = 0.085 / 0.425 = 0.2 \quad \text{conver it}$$

SoftwareUploadManager the
arrival rate:

$$\lambda_k = C_k/T = 129600 * 0.15 = 19440$$

0.1754 jobs in SoftwareUploadManager , Waiting for service = 0.4677 s , During = 38900 s

Throughout (X_i) = $C_i/T = 0.1754 / 0.4677 \text{ s} = 0.37$ **0.3750267265**

$$U_i = 38900 \text{ s} / 259200 = 0.15$$

$$S_i = 0.15 / 0.37 = 0.40 \quad \text{0.4054054054}$$

$$(C_i) = 0.38900 / 0.4 \text{ s} = 97250$$

Database

$$c = 2$$

$$(C_d) = 129600 / 8 = 1036800$$



Throughout (X_d) = $C_d/T = 1036800 / 259200 = 4$

$S_d = 8 / 2 = 4$

$U_d = (X_d S_d) / c \quad U_d * c / (X_k * 4) = S_d$

$D = U_d * 0.5 \quad \ggg \quad U_d = D * X_d = 1 \quad \gggg \quad U_d * c / 4 = S_d \quad \ggg \quad 1 * 2 / = 0.5$

$S_d = 0.5$

ContributorRewardService

$(C_x) = 19440$

Throughout (X_x) = $\lambda_k / T = 19440 / 259200 = 0.075$

$S_x = 0.5$

$U_x = (X_x * S_x) = 0.0375$

WebServer	<u>SoftwareSearchEngin</u> e	<u>SoftwareUploadManager</u>	<u>Database</u>	<u>ContributorRewardService</u>
$X_k = 0.5$	$X_J = 0.425$	$X_i = 0.37$	$X_d = 4$	$X_x = 0.075$
$S_k = 0.075$	$S_k = 0.2$	$S_i = 0.40$	$S_d = 0.5$	$S_x = 0.5$
$U_k = 0.0375$	$U_k = 0.085$	$U_i = 0.15$	$U_d = 0.15$	$U_x = 0.0375$
$C = 129600$	$C = 110160$	$C_i = 97250$	$C_d = 1036800$	$C_x = 19440$
			$C = 2$	



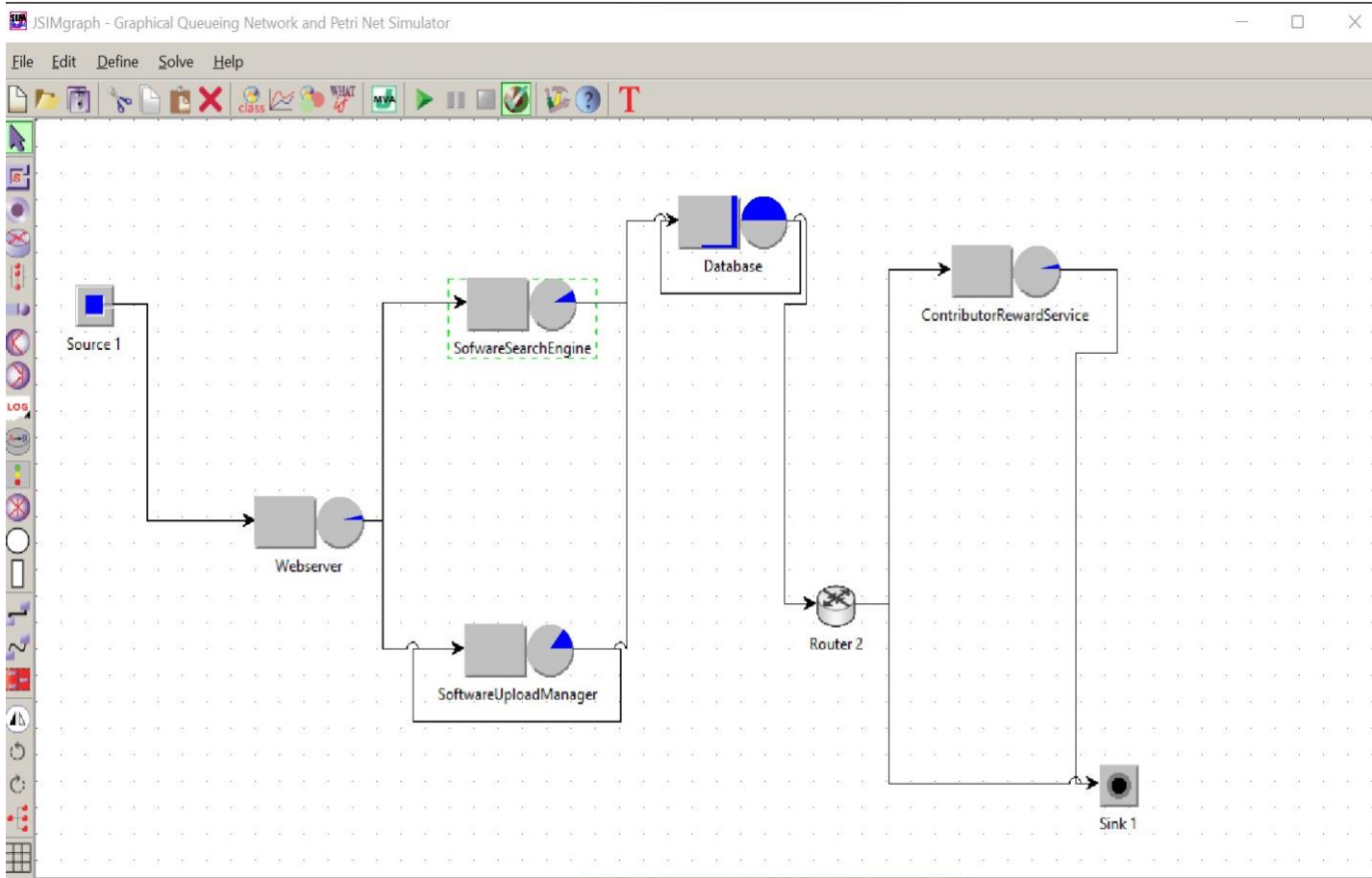
B) Model

Linnæus University

Sweden

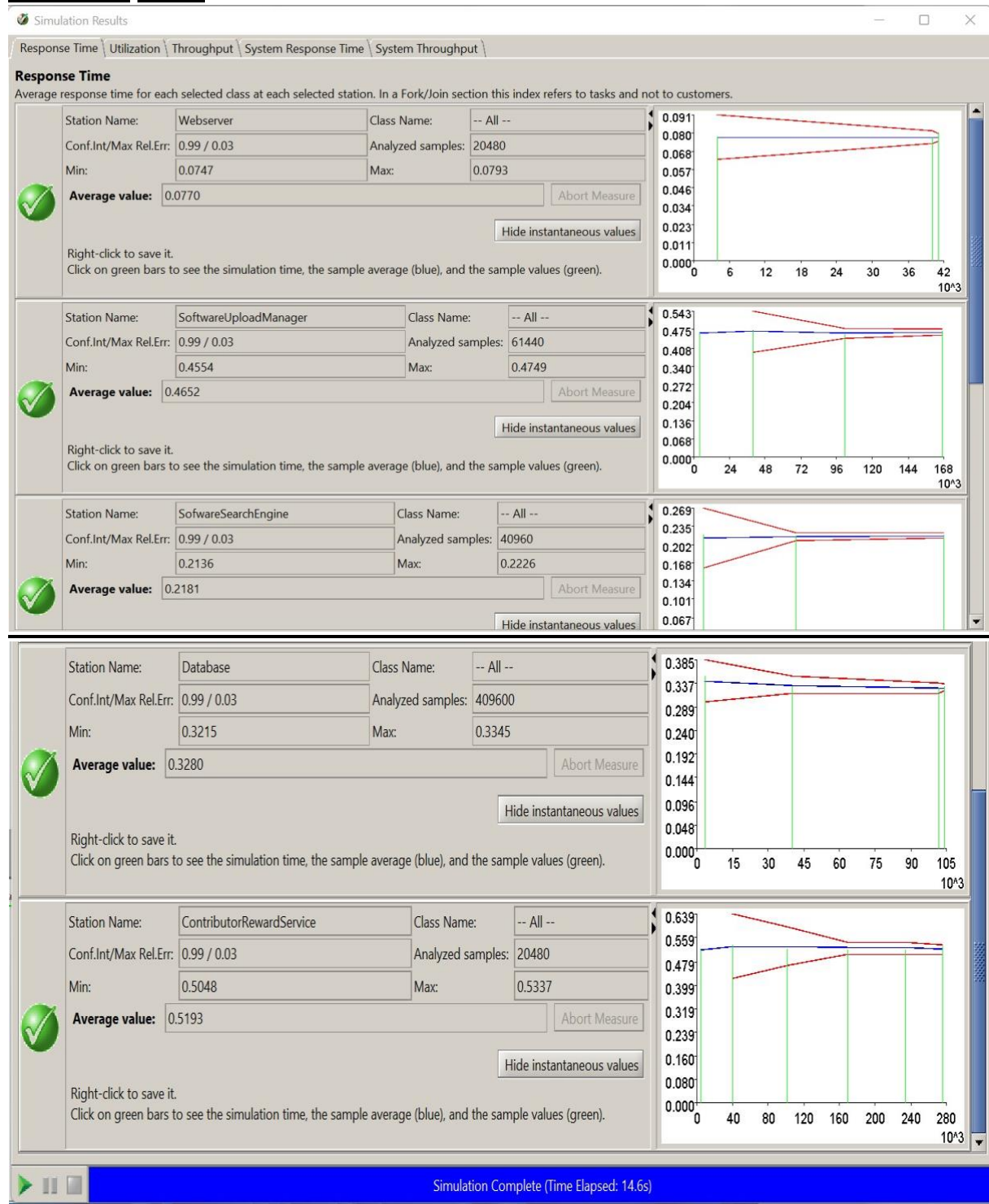
the System using Queueing Networks

(in JMT or your preferred Queueing Network simulation engine).





Response Time





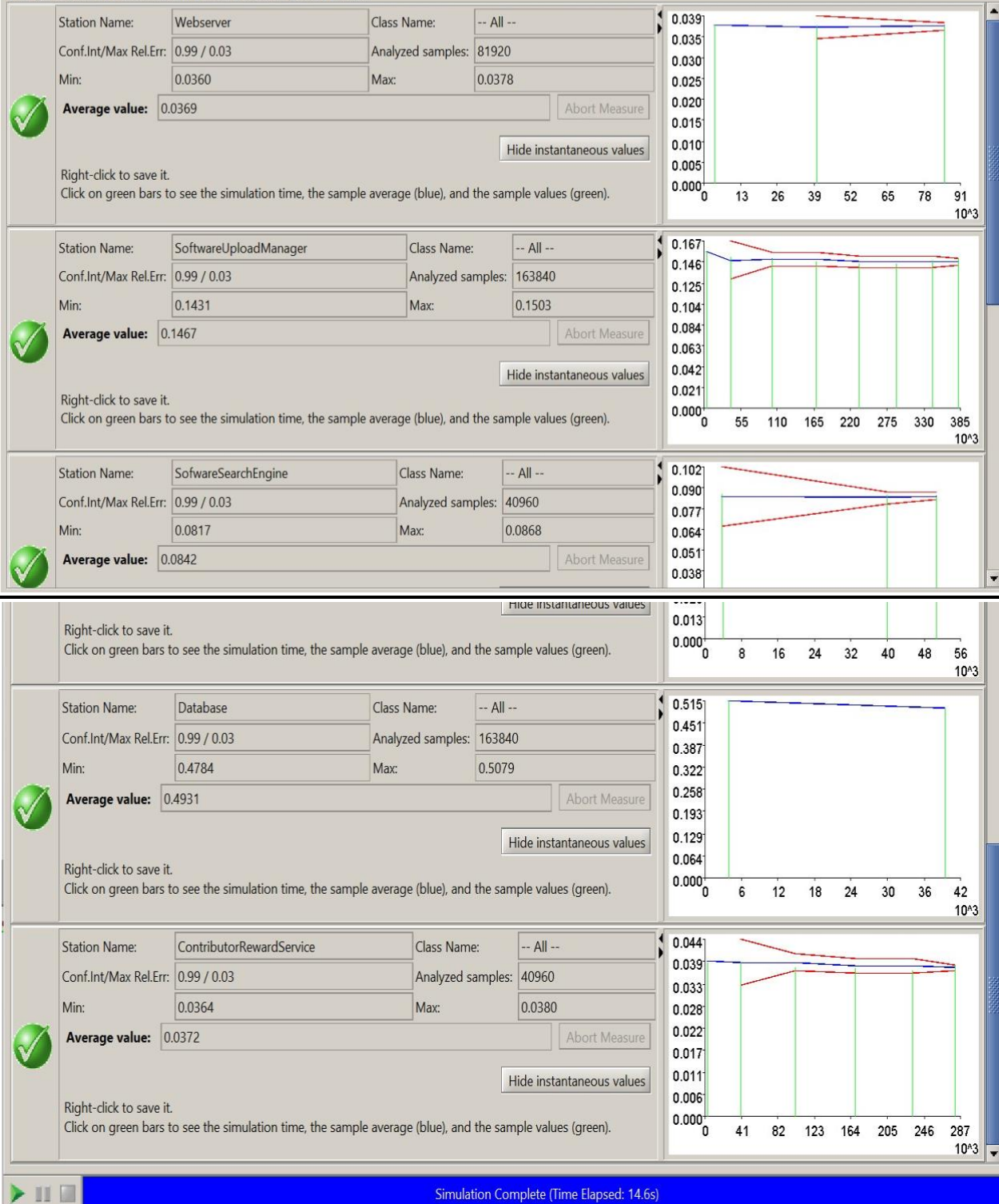
Utilization

Simulation Results

Response Time | Utilization | Throughput | System Response Time | System Throughput

Utilization

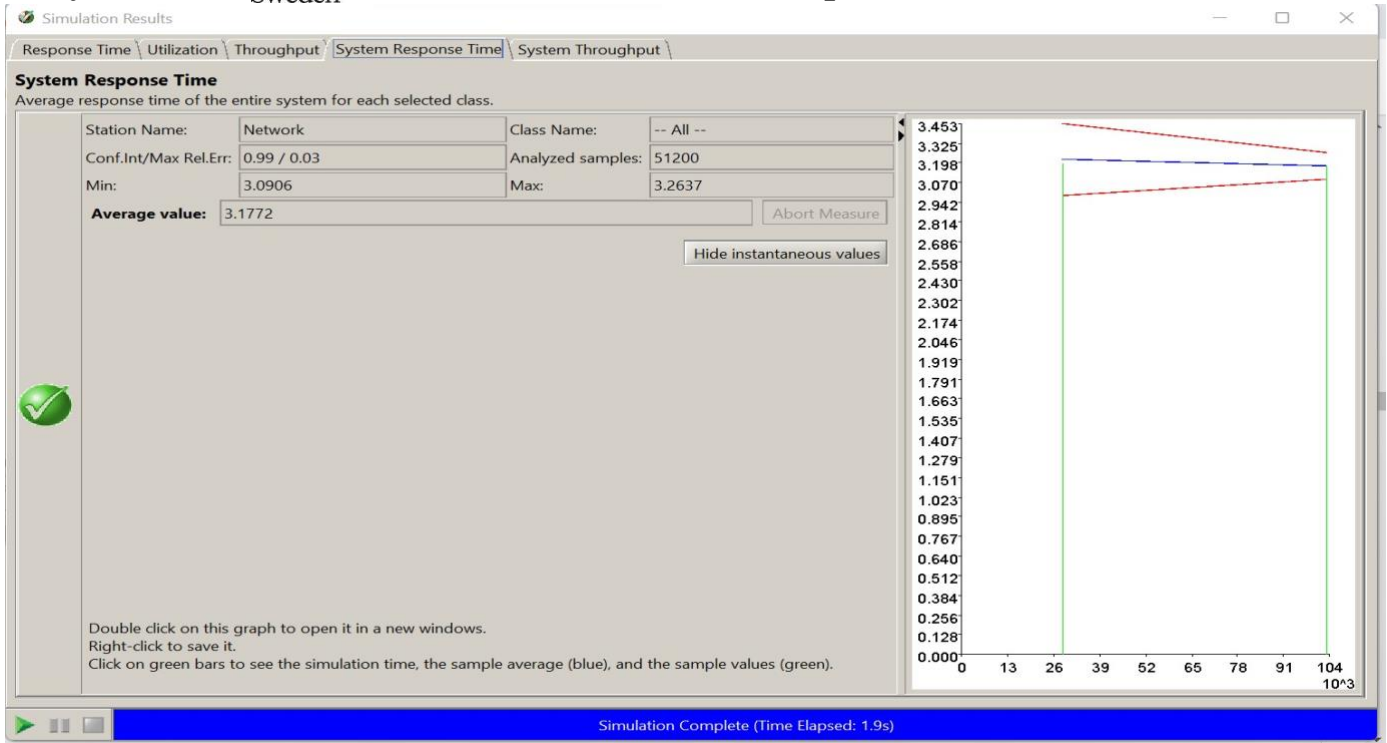
Average utilization for each selected class at each selected station. For multi-server queueing stations this is the average utilization of each server. The utilization of a delay station is the average number of customers in the station (may be greater than 1).



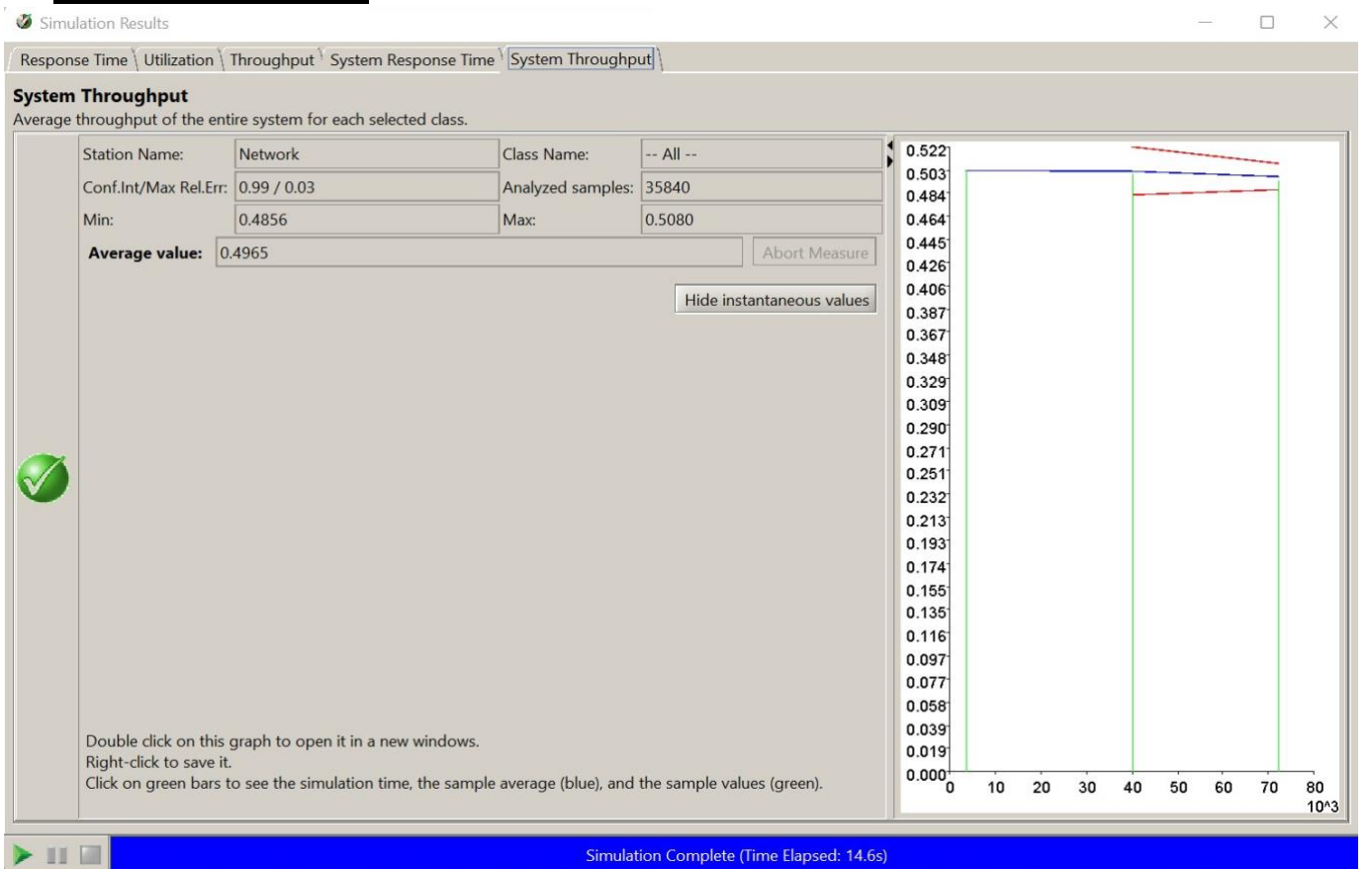


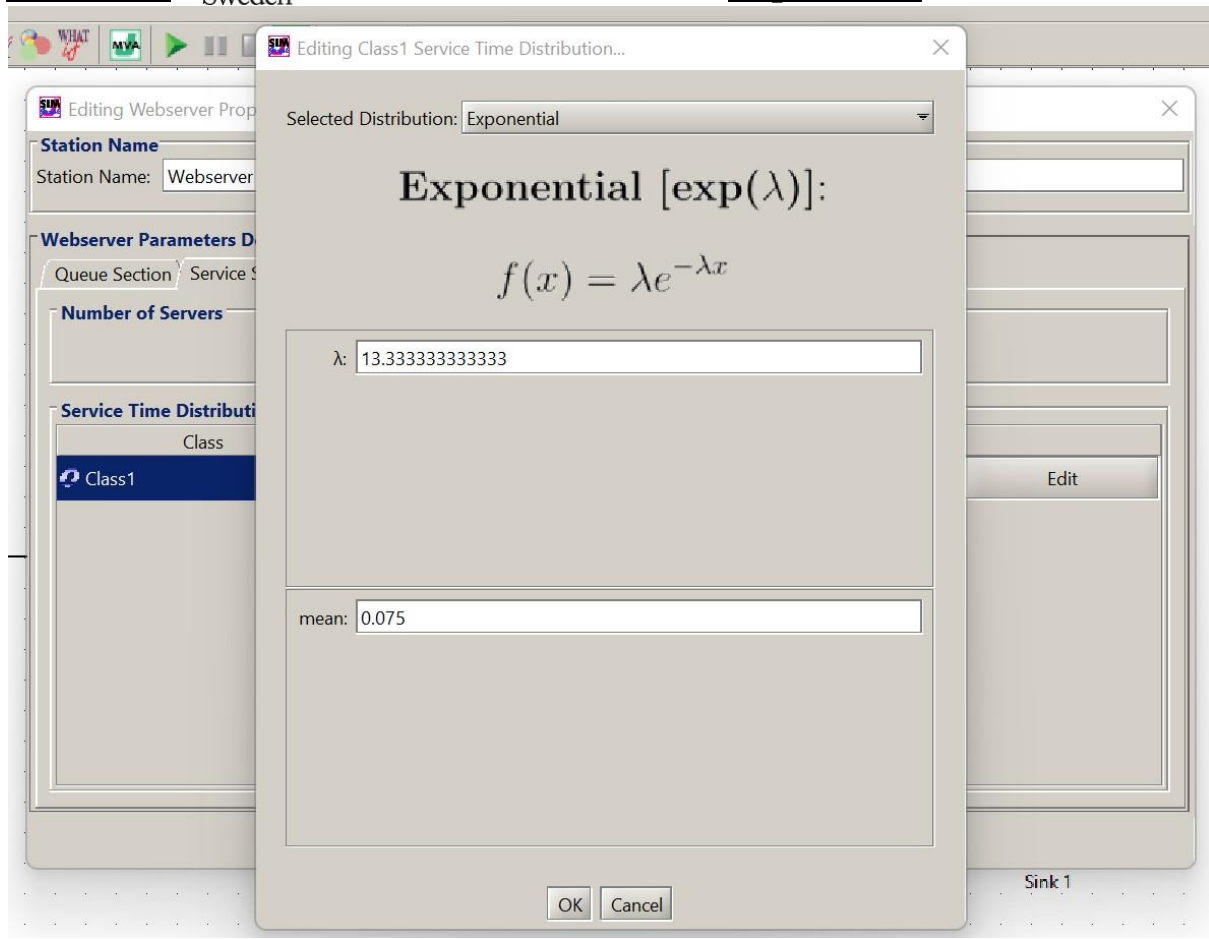
Throughput



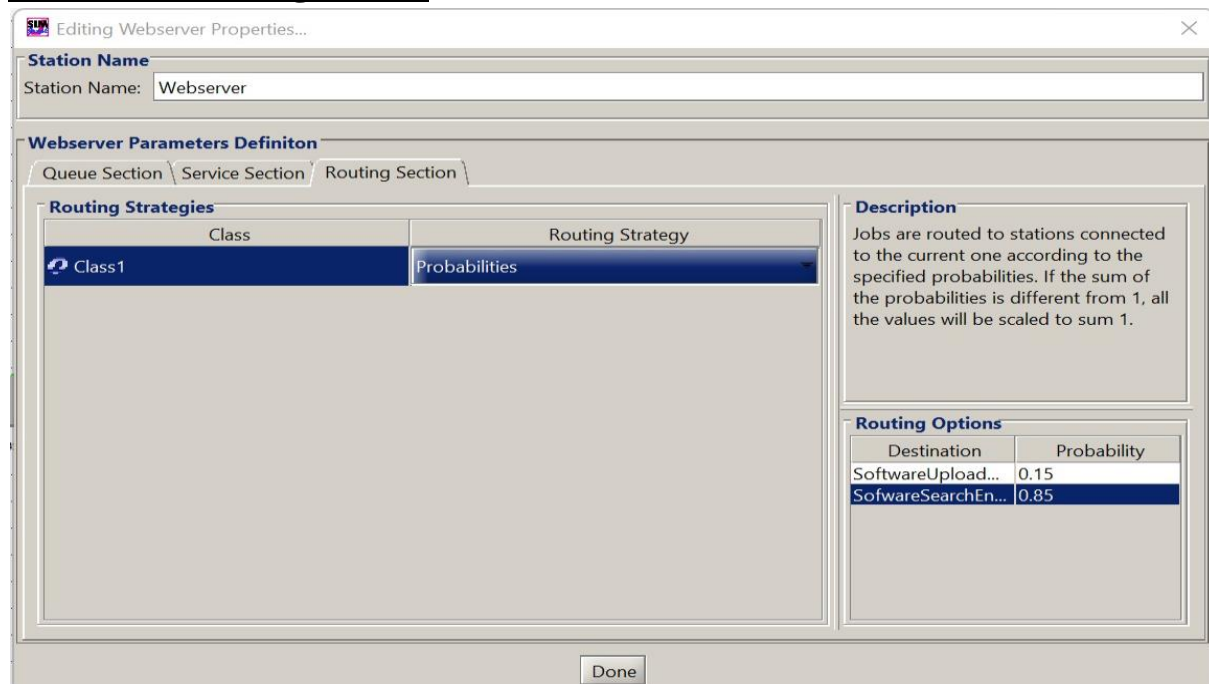


System Throughput





webserver Routing section





Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp(λ)]:

$$f(x) = \lambda e^{-\lambda x}$$

λ : 2.5

mean: 0.4

OK Cancel

SoftwareSearchEngine Exponential

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp(λ)]:

$$f(x) = \lambda e^{-\lambda x}$$

λ : 5

mean: 0.2

OK Cancel



Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp(λ)]:

$$f(x) = \lambda e^{-\lambda x}$$

λ: 4

mean: 0.25

OK Cancel

Editing Database Properties...

Station Name: Database

Database Parameters Definition

Queue Section Service Section

Number of Servers

Service Time Distribution

Class

Class1

Edit

Sink 1

Database Routing

Editing Database Properties...

Station Name: Database

Database Parameters Definition

Queue Section Service Section Routing Section

Routing Strategies

Class	Routing Strategy
Class1	Probabilities

Description

Jobs are routed to stations connected to the current one according to the specified probabilities. If the sum of the probabilities is different from 1, all the values will be scaled to sum 1.

Routing Options

Destination	Probability
Database	0.875
Router 2	0.125

Done



ContributorRewardService Exponential

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp(λ)]:

$$f(x) = \lambda e^{-\lambda x}$$

λ : 2

mean: 0.5

OK Cancel

Station Name: ContributorRewardService

Queue Section: Service S

Number of Servers

Service Time Distribution

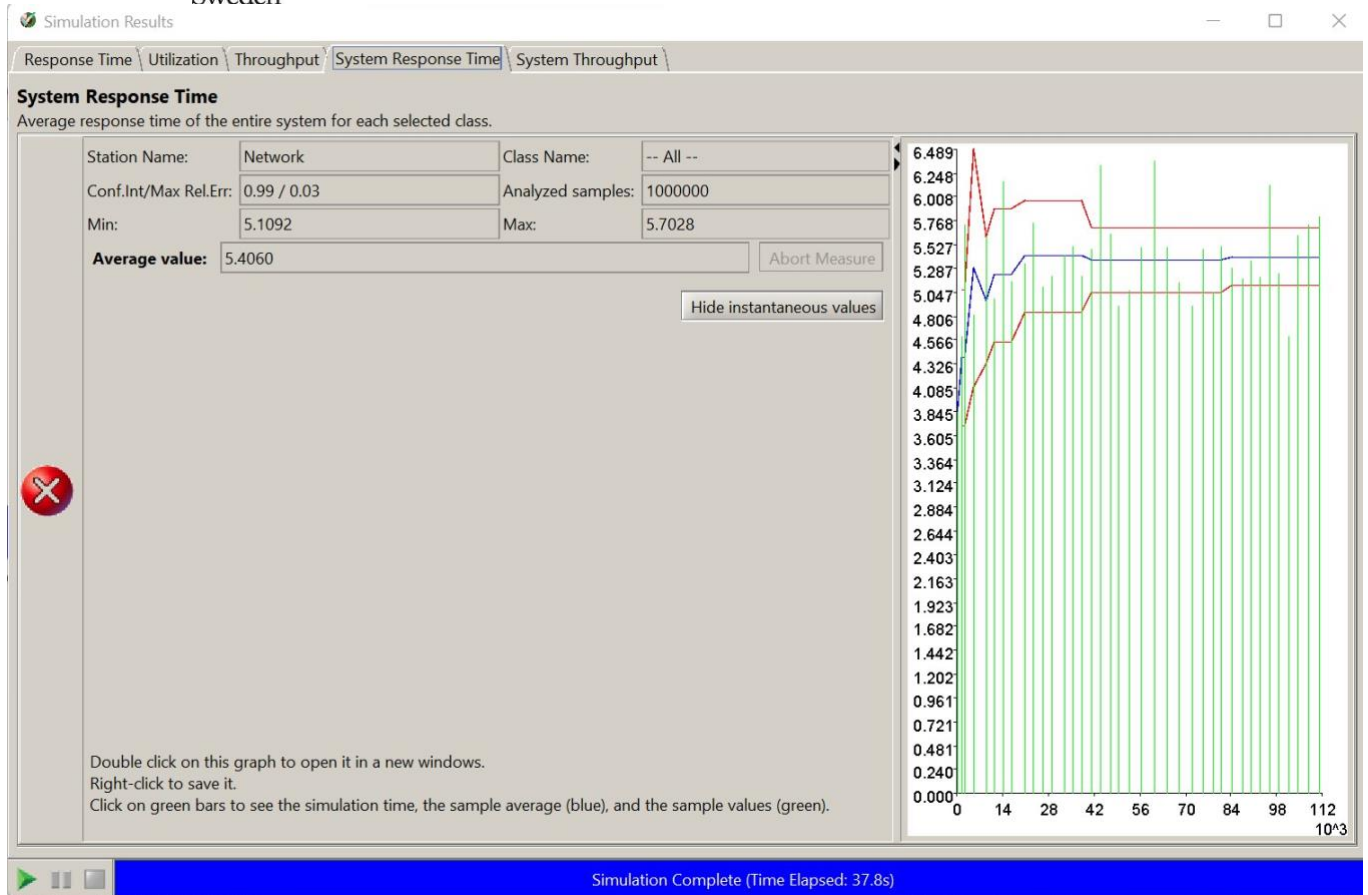
Class

Class1

Edit

Sink 1

C)



$V1 = C2/C = 1$ $D1 = V1 * S1 = 0.075$ $U1 = D1 * X = 0.675$ 1 server $V2 = C2/C = 1749600 / 2332800 = 0.75$
 $D2 = V2 * S2 = 0.15$ $U2 = D2 * X = 1.35$ 2 servers

$V3 = C3/C = 291600 / 2332800 = 1.25$ $D3 = V3 * S2 = 0.5$ $U3 = D3 * X = 4.5$ 5 servers $V4 = C4/C = 8$
 $D4 = V4 * S4 = 2$ $U4 = D4 * X = 18$ 19 servers $V5 = C5/C = 0.35$ $D5 = V5 * S5 = 0.125$ $U5 = D5 * X = 1.125$ 2 servers