

Report

# Assignment 2

*Performance Engineering*

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## Appendix

## 1. Calculate Service Time

A) Service time

\* Web Server  
 $S_k = \underline{0.075s}$

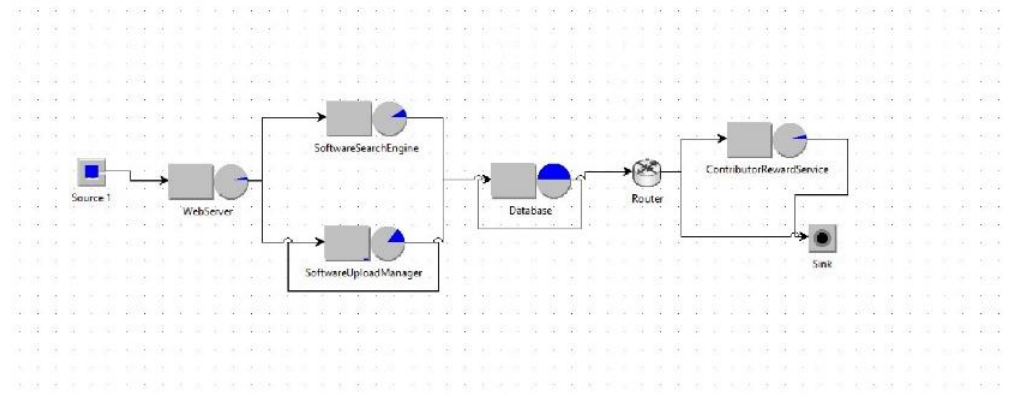
\* Software Search Engine  
 $U_k = 0.085$  ,  $C_k = 881,280$   
 $X_k = \frac{110,160}{259,200} = 0.425$   
 $S_k = \frac{0.085}{0.425} = \underline{0.2}$

\* Software Upload Manager  
 $N_k = 0.1754$  ,  $B_k = 38,900s$  ,  $R_k = 0.4677$   
 $X_k = \frac{0.1754}{0.4677} = 0.3750$   
 $U_k = \frac{38,900}{38,880} = 0.15$   
 $S_k = \frac{U_k}{X_k} = \frac{0.15}{0.375} = \underline{0.4}$

\* Database  
 $C_k = 1,036,800$  ,  $D_k = 2$  ,  $c = 2$  ,  $x = 0.5$   
 $D_k = \frac{U_k}{x} \Rightarrow U_k = \frac{D_k \cdot x}{c} = \frac{2 \times 0.5}{2} = 0.5$   
 $X_k = \frac{C_k}{T} = \frac{1,036,800}{259,200} = 4$   
 $S_k = \frac{U_k}{X_k} = \frac{0.5}{4} \cdot 2 = \underline{0.25}$

\* Average number of iterations for Software Upload Manager  
 $C_k = \frac{B_k}{S_k} = \frac{38,900}{0.4} = 97,250$   
 $15\% \text{ of } C = 19440$  So,  $\frac{97,250}{19,440} = \underline{5.0025}$  - We assume there are 5 iterations

## 2. Model



## 2.1. Service Time

### WebServer

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp( $\lambda$ ):]

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

$\lambda$ : 13.333333333333333

mean: 0.075

OK Cancel

### SoftwareUploadManager

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp( $\lambda$ ):]

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

$\lambda$ : 2.5

mean: 0.4

OK Cancel

### SoftwareSearchEngine

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp( $\lambda$ ):]

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

$\lambda$ : 5

mean: 0.2

OK Cancel

### Database

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp( $\lambda$ ):]

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

$\lambda$ : 4

mean: 0.25

OK Cancel

### ContributorRewardService

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

Exponential [exp( $\lambda$ ):]

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

$\lambda$ : 2

mean: 0.5

OK Cancel

## 2.2. Routing Probabilities

### Web Server

The 'Editing WebServer Properties...' dialog box is shown with the 'Routing Section' selected. The 'Station Name' is 'WebServer'. The 'Routing Strategies' table has one entry: 'Class1' with a probability of 1.0. The 'Routing Options' table has two entries: 'Destination' 'SoftwareUploadMgr' with probability 0.8, and 'Destination' 'Database' with probability 0.2.

Class	Routing Strategy	Probability
Class1		1.0

Destination	Probability
SoftwareUploadMgr	0.8
Database	0.2

### SoftwareUploadManager

The 'Editing SoftwareUploadManager Properties...' dialog box is shown with the 'Routing Section' selected. The 'Station Name' is 'SoftwareUploadManager'. The 'Routing Strategies' table has one entry: 'Class1' with a probability of 1.0. The 'Routing Options' table has two entries: 'Destination' 'SoftwareUploadMgr' with probability 0.8, and 'Destination' 'Database' with probability 0.2.

Class	Routing Strategy	Probability
Class1		1.0

Destination	Probability
SoftwareUploadMgr	0.8
Database	0.2

### Database

The 'Editing Database Properties...' dialog box is shown with the 'Routing Section' selected. The 'Station Name' is 'Database'. The 'Routing Strategies' table has one entry: 'Class1' with a probability of 1.0. The 'Routing Options' table has two entries: 'Destination' 'Database' with probability 0.8, and 'Destination' 'Router' with probability 0.2.

Class	Routing Strategy	Probability
Class1		1.0

Destination	Probability
Database	0.8
Router	0.2

### Router

The 'Editing Router Properties...' dialog box is shown with the 'Routing Section' selected. The 'Station Name' is 'Router'. The 'Routing Strategies' table has one entry: 'Class1' with a probability of 1.0. The 'Routing Options' table has two entries: 'Destination' 'Router' with probability 0.8, and 'Destination' 'Sink' with probability 0.2.

Class	Routing Strategy	Probability
Class1		1.0

Destination	Probability
Router	0.8
Sink	0.2

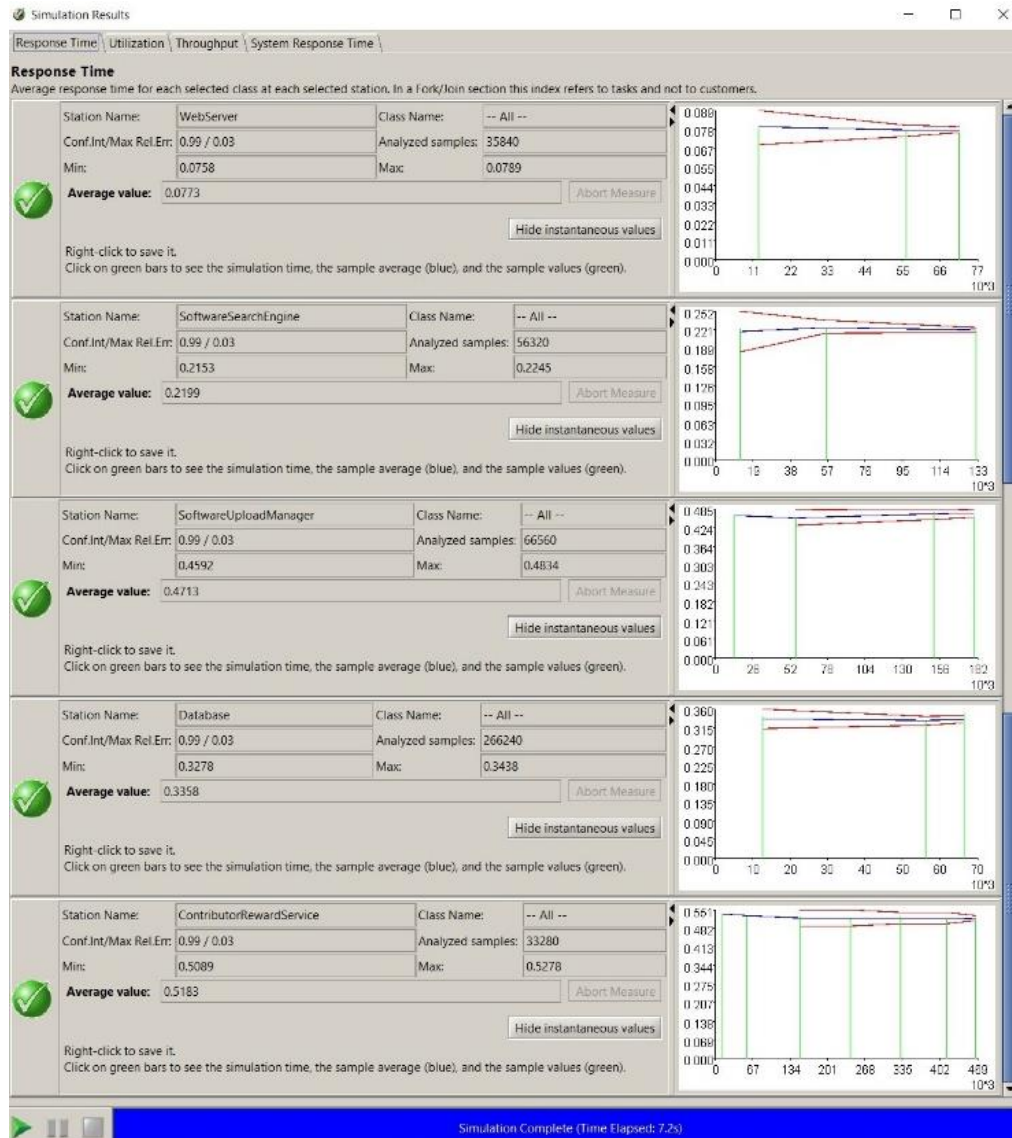
## 2.3. Resources

### Database

The 'Editing Database Properties...' dialog box is shown with the 'Service Section' selected. The 'Station Name' is 'Database'. The 'Number of Servers' is 2. The 'Service Time Distributions' table has one entry: 'Class1' with a 'Load Independent' strategy and an 'exp(4)' service time distribution.

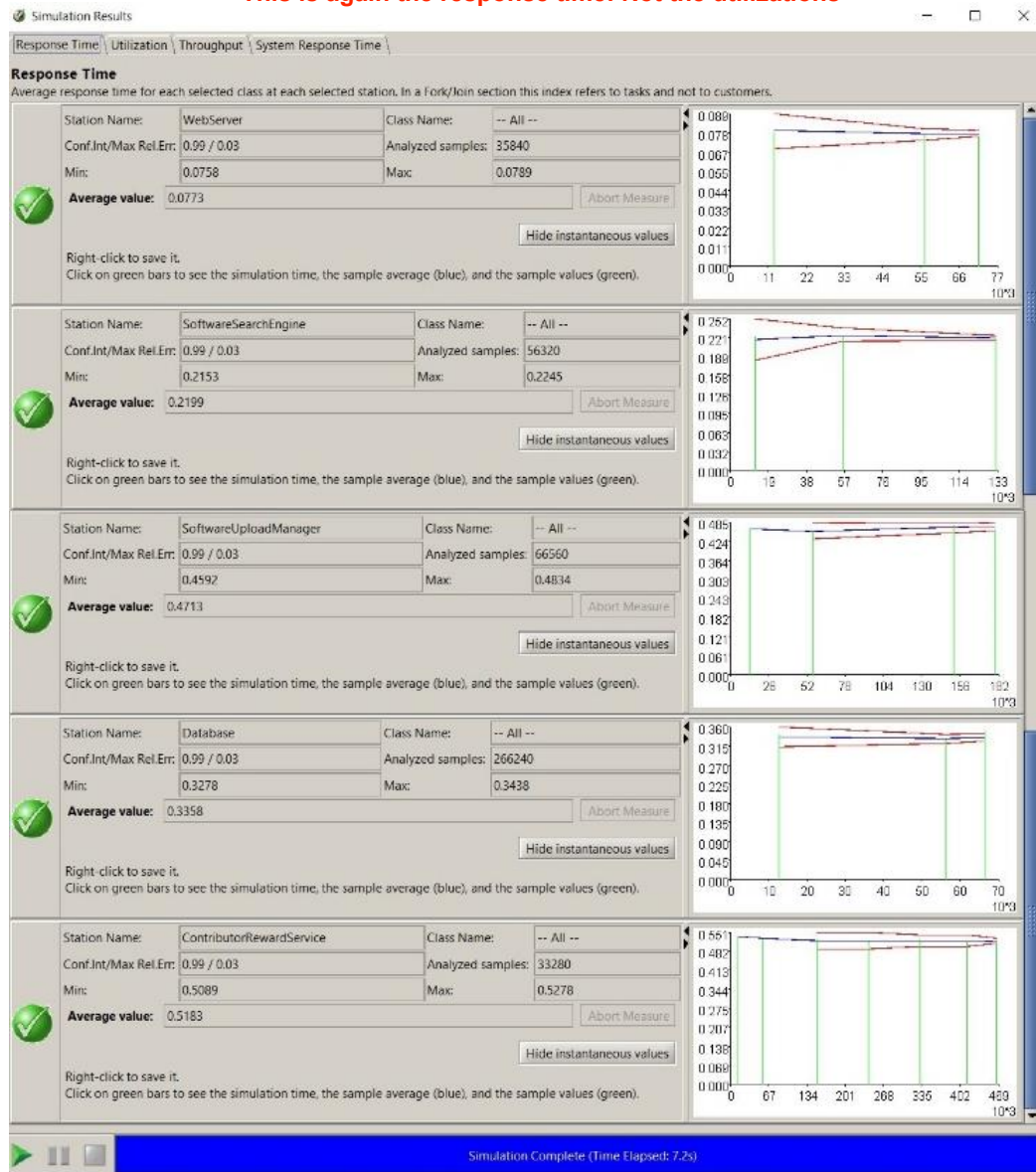
Class	Strategy	Service Time Distribution
Class1	Load Independent	exp(4)

## 2.4. Response Time



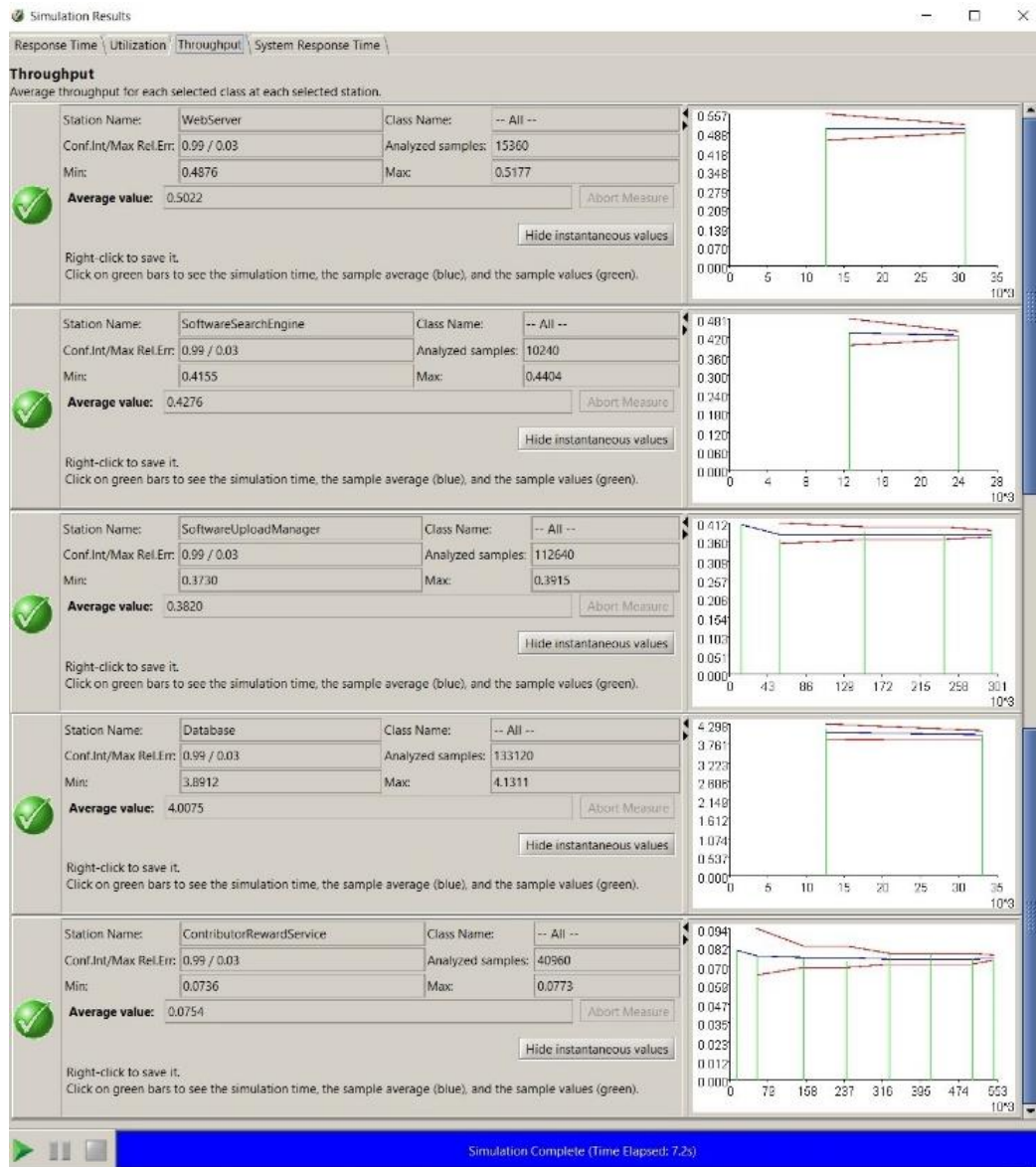
## 2.5. Utilization

This is again the response time! Not the utilizations

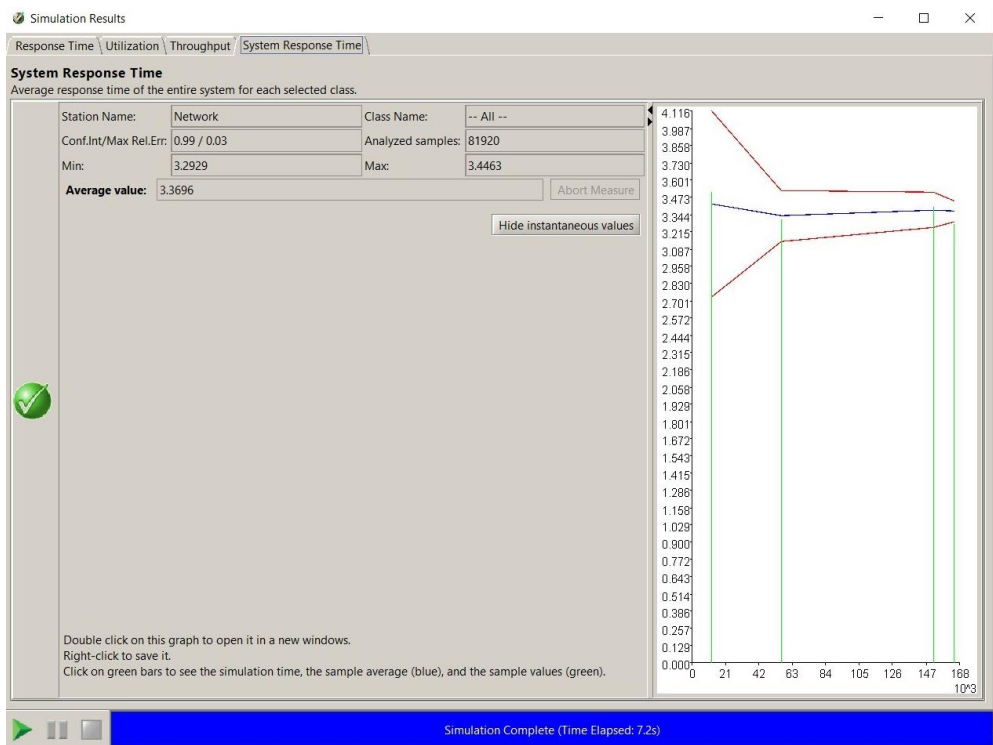




## 2.6. Throughput



## 2.7. System Response Time



### 3. Increasing Resources

Right

C) Resources

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New workload  $129600 \times 18 = 2332800$

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\* Web Server

$S_r = 0.075$ ,  $C_r = 2332800$

$X_r = \frac{2332800}{259200} = 9$

$U_r = 9 \times 0.075 = 0.675$

• Not saturated so,  $c = 1$  Almost 70%

---

\* Software Search Engine

$S_r = 0.2$

$C_r = 2332800 \times 0.75 = 1749600$

$X_r = \frac{1749600}{259200} = 6.75$

$U_r = 0.2 \times 6.75 = 1.35$

• Saturated so,  $\frac{1.35}{2} = 0.675$  Almost 70%

$c = 2$

---

\* Software Upload Manager

$S_r = 0.4$

$A_r = 0.25 \times 2332800 = 583200$

5 iterations so,  $C_r = 5 \times 583200 = 2916000$

$X_r = \frac{2916000}{259200} = 11.25$

$U_r = 0.4 \times 11.25 = 4.5$

• Saturated so,  $\frac{4.5}{5} = 0.9$  90%

$c = 5$

---

\* Database

$S_r = 0.25$ ,  $A_r = 2332800$

$C_r = 8 \times 2332800 = 18662400$

$X_r = \frac{18662400}{259200} = 72$

$U_r = 0.25 \times 72 = 18$

• Saturated so, 1 resource = 18 (utilisation)

$\frac{18}{19} = 0.947$  90%

$c = 19$

---

\* Contributor Reward Service

$S_r = 0.5$

$A_r = 2332800 \times 0.25 = 583200$

1 iteration so,  $C_r = 583200 \times 1 = 583200$

$X_r = \frac{583200}{259200} = 2.25$

$U_r = 0.5 \times 2.25 = 1.125$

• Saturated so,  $\frac{1.125}{2} = 0.5625$  Almost 60%

$c = 2$

CamScanner

### 3.1. System Response Time

