



## Assignment

# Performance Engineering



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## Introduction

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

## Calculations

| Server             | S      | X    | U      |
|--------------------|--------|------|--------|
| 1 - Web Server     | 0.2508 | 0.83 | 0.209  |
| 2 - User App S     | 0.1992 | 3    | 0.2988 |
| 3 - User App L     | 0.0996 | 3    | 0.2988 |
| 4 - Admin App S    | 0.3    | 0.16 | 0.05   |
| 5 - Admin App L    | 0.1    | 0.16 | 0.016  |
| 6 - DB             | 0.05   | 2.5  | 0.125  |
| 7 - Security Check | 0.3    | 0.83 | 0.25   |

### Web Server

$$C_1 = 6000 \quad B_1 = 1504.8$$

$$S_1 = \frac{1504.8}{6000} = 0.2508$$

$$X_1 = \frac{6000}{7200} = 0.8\hat{3}$$

$$U_1 = \frac{1504.8}{7200} = 0.209$$

### User App Server

$$C_2 = 21600 \quad U_2 = 0.2988 \quad c = 2$$

$$X_2 = \frac{21600}{7200} = 3$$

$$S_2 = \frac{0.2988}{3} \cdot 2 = 0.1992$$



## User App Log

$$C_3 = 21600 \quad U_3 = 0.2988$$

$$S_3 = \frac{0.2988}{3} = 0.0996$$

$$X_3 = \frac{21600}{7200} = 3$$

## Admin App Server

$$C_4 = 1200 \quad B_4 = 360$$

$$X_4 = \frac{1200}{7200} = 0.1\hat{6}$$

$$S_4 = \frac{0.05}{0.166} = 0.3$$

$$U_4 = \frac{360}{7200} = 0.05$$

## Admin App Log

$$C_5 = 1200 \quad B_5 = 120$$

$$S_5 = \frac{120}{1200} = 0.1$$

$$B_5 = \frac{120}{7200} = 0.01\hat{6}$$

$$X_5 = 0.1\hat{6}$$

## Database

$$B_6 = 900 \quad N_6 = 0.14325 \quad R_6 = 0.0573$$

$$X_6 = \frac{0.14325}{0.0573} = 2.5$$

$$U_6 = \frac{900}{7200} = 0.125$$

$$S_6 = \frac{0.125}{2.5} = 0.05$$

In this case, I made an extra calculation to know the exact number of request that accesses the database.

$$C_6 = \frac{900}{0.05} = 18000$$

Because the total of completed requests by the database is exactly three times the system requests, I will assume that the request iterates three times before leaving the database.



## Security Check

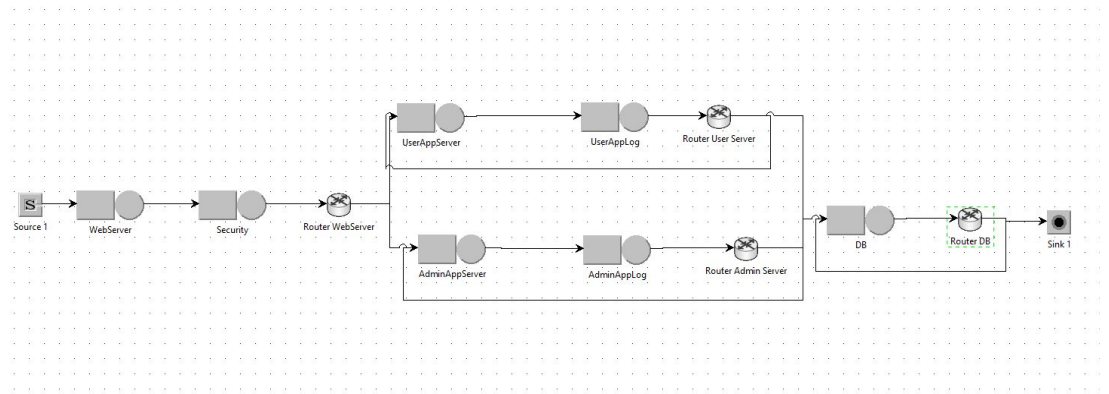
In order to check that the results of JMT were correct, I calculated the throughput and service time of the security check.

$$S_7 = 0.3 \quad C_7 = 6000$$

$$X_7 = \frac{6000}{7200} = 0.83$$

$$U_7 = 0.83 \cdot 0.3 = 0.25$$

## Model



## Service Time

Web Server

Security Check

User App Server

User App Log



## Admin App Server

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

**Exponential [exp( $\lambda$ )]:**

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

$\lambda$ : 1.0333333333333333

mean: 0.3

OK Cancel

## Admin App Log

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

**Exponential [exp( $\lambda$ )]:**

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

$\lambda$ : 10

mean: 0.1

OK Cancel

## Database

Editing Class1 Service Time Distribution...

Selected Distribution: Exponential

**Exponential [exp( $\lambda$ )]:**

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

$\lambda$ : 20

mean: 0.05

OK Cancel

## Class Arrival Rate

Editing Class1 distribution...

Selected Distribution: Exponential

**Exponential [exp( $\lambda$ )]:**

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

$\lambda$ : 0.8333333333333333

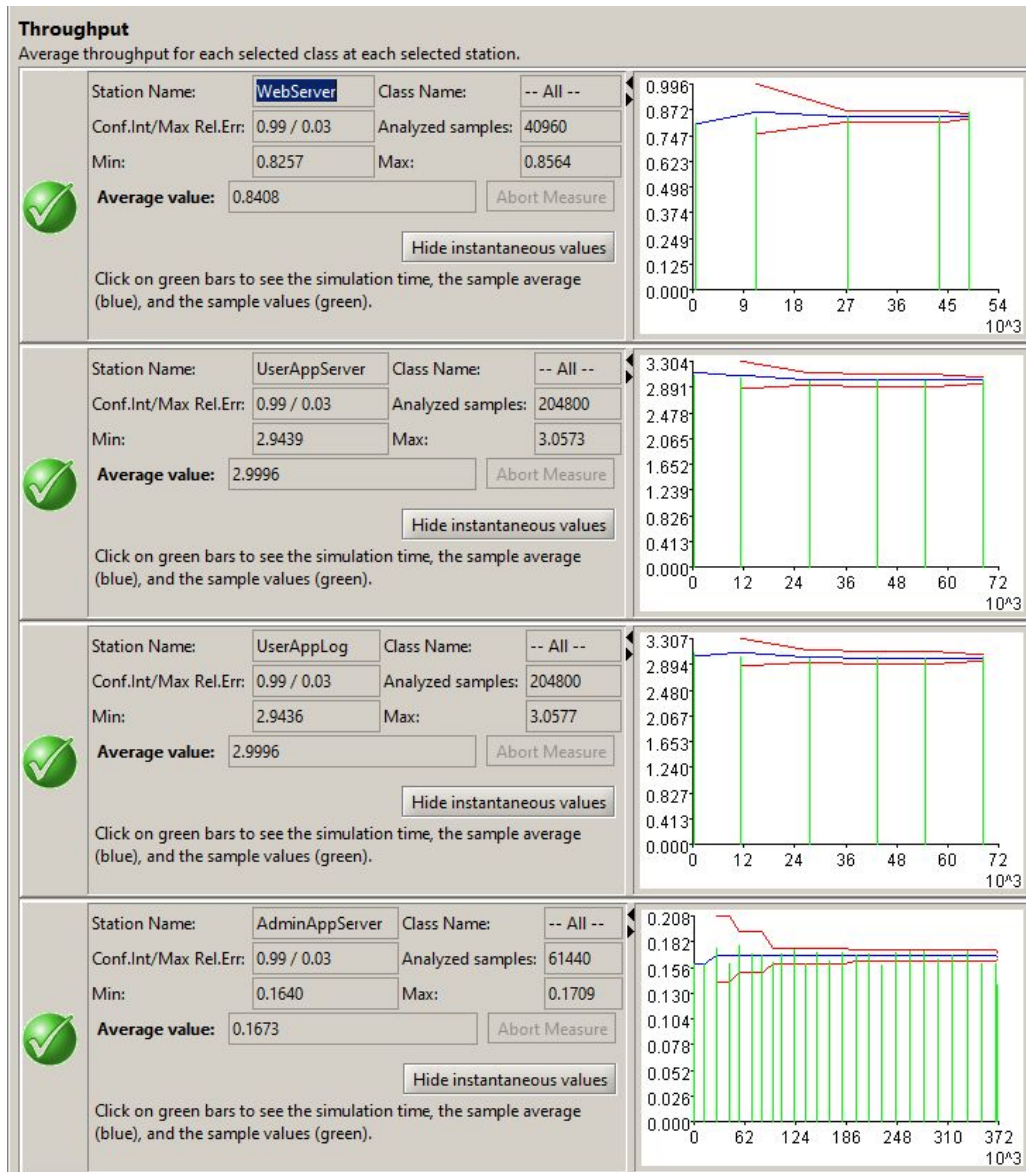
mean: 1.2

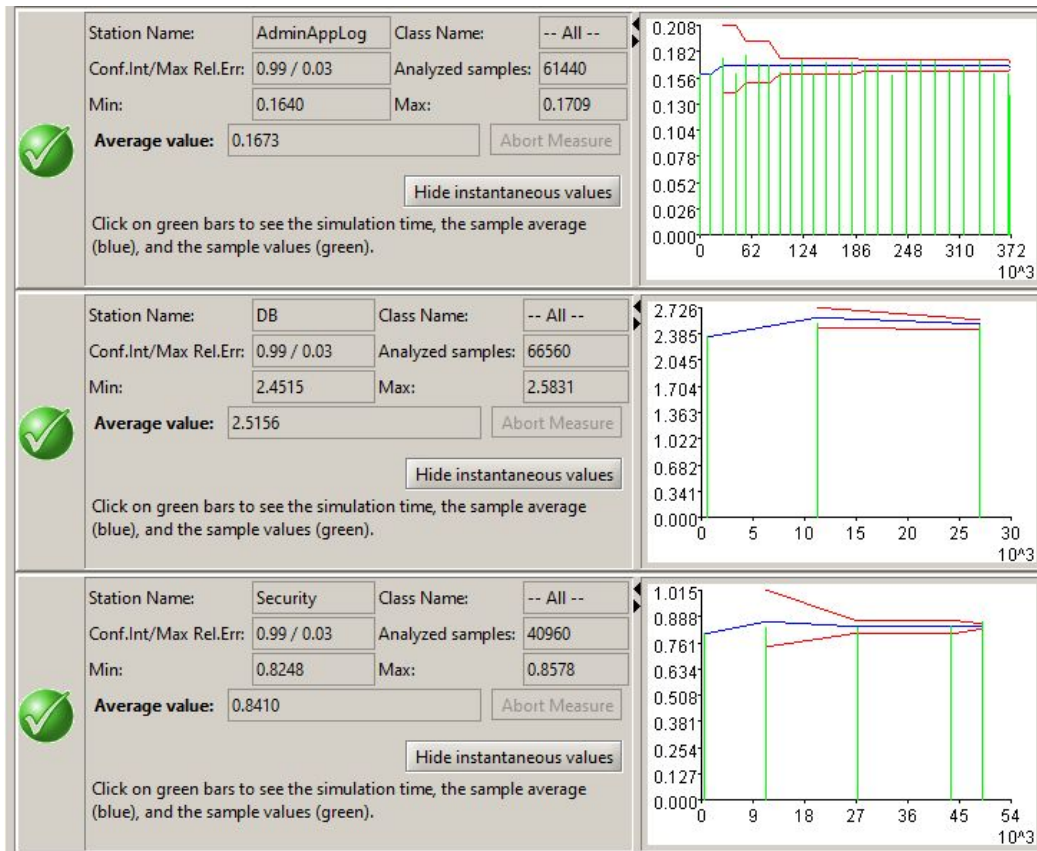
OK Cancel



## Arrival Rate

In this particular place, where all the jobs are completed, the arrival rate is the same that the throughput. All the received requests are the same that all the completed requests. Different tests has been performed and the results are always close enough to the mathematical proof to be accurate.





## Routing

### Web Server router

Editing Router WebServer Properties...

Station Name: Router WebServer

Router WebServer Parameters Definition

Routing Section

| 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.

| Destination    | Probability |
|----------------|-------------|
| UserAppServer  | 0.9         |
| AdminAppServer | 0.1         |

Done

### Users router

Editing Router User Server Properties...

Station Name: Router User Server

Router User Server Parameters Definition

Routing Section

| 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.

| Destination   | Probability |
|---------------|-------------|
| UserAppServer | 0.75        |
| DB            | 0.25        |

Done

### Admin router

Editing Router Admin Server Properties...

Station Name: Router Admin Server

Router Admin Server Parameters Definition

Routing Section

| 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.

| Destination    | Probability |
|----------------|-------------|
| AdminAppServer | 0.3         |
| DB             | 0.3         |

Done

### DB router

Editing Router DB Properties...

Station Name: Router DB

Router DB Parameters Definition

Routing Section

| 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.

| Destination | Probability        |
|-------------|--------------------|
| DB          | 0.6666666666666666 |
| Sink 1      | 0.3333333333333333 |

Done





## Resources

All the servers have only one resource except User App Server.

Editing UserAppServer Properties...

Station Name: UserAppServer

UserAppServer Parameters Definition

Queue Section | Service Section | Routing Section

Number of Servers

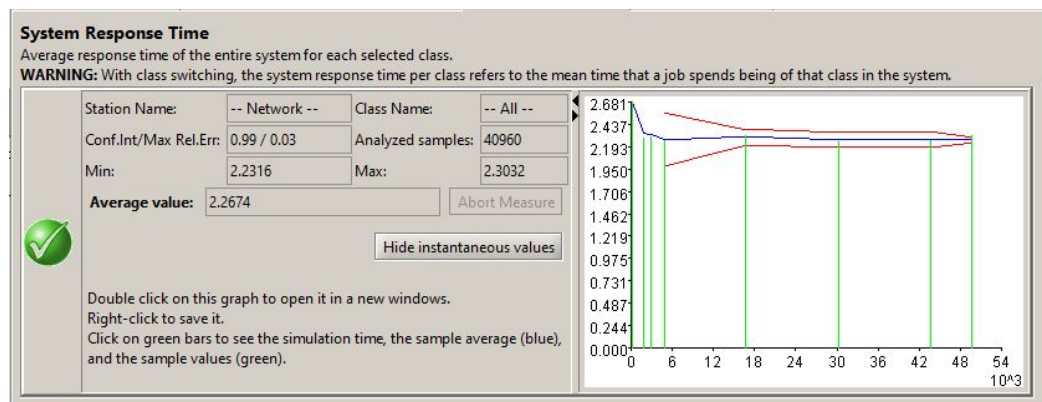
Number: 2

Service Time Distributions

| Class  | Strategy         | Service Time Distribution | Edit |
|--------|------------------|---------------------------|------|
| Class1 | Load Independent | exp(5.02)                 | Edit |

Done

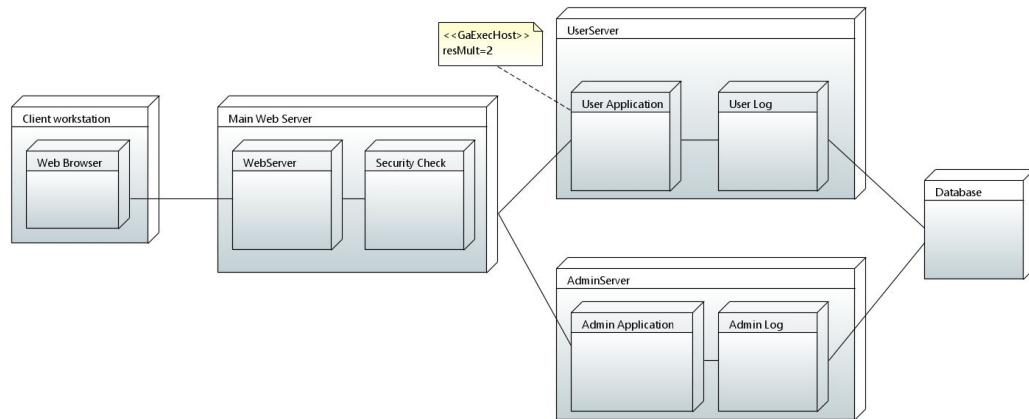
## System Response Time





## UML

### Deployment Diagram



### Activity Diagram

