# Advanced Systems Lab (Fall'16) – Third Milestone

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**Grading**

| **Section** | **Points** |
|---|---|
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | |
| Total | |

# Contents



# Notes on writing the report

The report does not need to be extensive but it must be concise, complete, and correct. Conciseness is important in terms of content and explanations, focusing on what has been done and explanations of the results. A long report is not necessarily a better report, especially if there are aspects that remain unexplained. Completeness implies that the report should give a comprehensive idea of what has been done by mentioning all key aspects of the modeling and analysis effort. Limited analysis because of flaws in the system or lack of experimental data from Milestones 1 or 2 are not valid arguments for an incomplete report. If bugs or lack of data prevent you from doing a correct analysis, the system must be debugged and new data collected. In case the system has been modified, include a short description of the changes as an appendix.

Remember that this is a report about modeling and analyzing the system you have designed and built, using the experimental data you have collected. There is no unique way to do the report and you may choose to focus on different aspects of the system as long as you deliver a complete analysis of its behavior. Keep in mind that, *for all queuing models in the report*, you need to explain how the the parameters of the model were determined and from which experiments the data comes from (adding a reference to the exact graph, table, etc. from the previous milestones). You have to find all system metrics that can be derived using the corresponding formulas and then match to the experimental results, explaining the similarities and differences in quantitative and qualitative terms. The calculations and the numbers you derive might need to be explained with references to the logs and sources in the previous reports. Make sure to mark these references, as well as the ones pointing to experimental results clearly. *Missing parts of the above requirements might lead to significant loss of points in each section.*

The report should be organized in sections as explained in the next pages, and each section should address at least the questions mentioned for each point. You might be called for a meeting

in person to clarify aspects of the report or the system and to make a short presentation of the work done. By submitting the report, you confirm that you have done the work on your own, the data used comes from experiments your have done, you have written the report on your own, and you have not copied neither text nor data from other sources.

The milestone is worth 200 points.

# 1 System as One Unit

## 1.1 Guidelines

Length: 1-2 pages

Build an M/M/1 model of your entire system based on the stability trace that you had to run for the first milestone. Explain the characteristics and behavior of the model built, and compare it with the experimental data (collected both outside and inside the middleware). Analyze the modeled and real-life behavior of the system (explain the similarities, the differences, and map them to aspects of the design or the experiments). Make sure to follow the model-related guidelines described in the Notes!

## 1.2 Model

TODO: describe the model I was using, and how I found the parameters. also describe problems

book: "Unless explicitly specified, the queues are defined as having infinite buffer capacity, infinite population size, and an FCFS service discipline."

book: "For example, the number of jobs in a queue with a single server and individual arrivals (not bulk arrivals) can be represented as a birth-death process" =¿ we have birth-death process!

book about M/M/1 queues: "It is assumed that the interarrival times and the service times are exponentially distributed and there is only one server. There are no buffer or population size limitations and the service discipline is FCFS."

problems: assumption that arrival rate is i.i.d doesn't hold (closed system =¿ memaslap sends new request as soon as it receives response)

## 1.3 Data

TODO: mention where data came from (new trace from MS2)

## 1.4 Comparison of model and experiments

took service rate to be max of throughput and arrival rate as mean of throughput

TODO: Table of predicted vs actual numbers about the system

Once I have parameters, calculate:

- mean number of jobs in system and queue, using Little's law (Ch30.2)
- distribution of number of jobs in system and queue

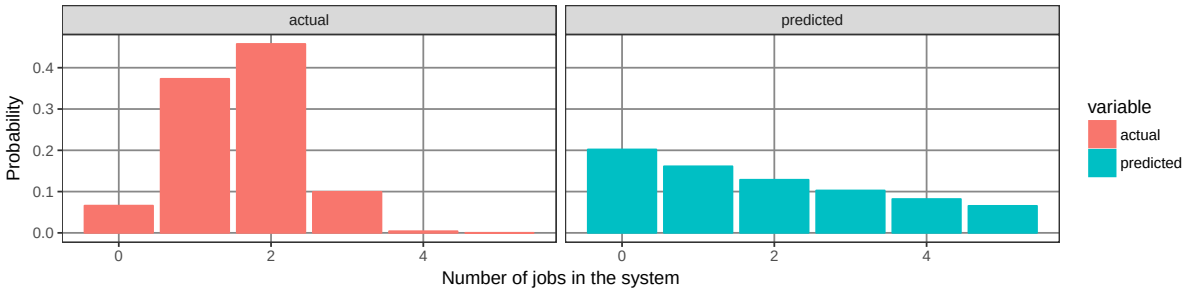



Figure 1: TODO:

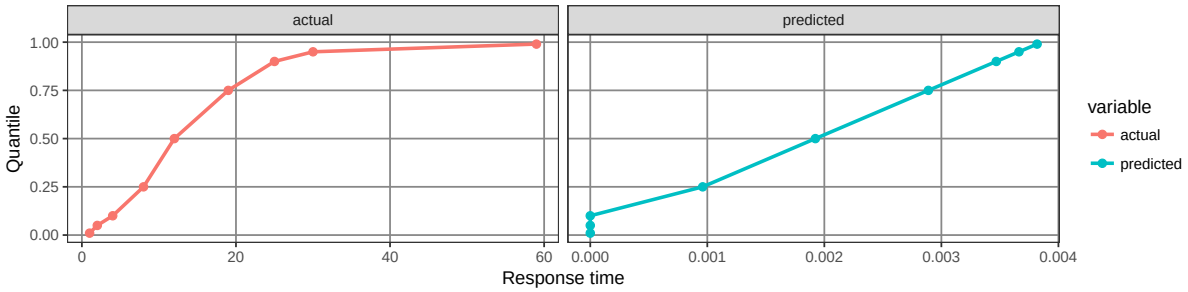



Figure 2: TODO: note x scale huge difference

# 2 Analysis of System Based on Scalability Data

## 2.1 Guidelines

Length: 1-4 pages

Starting from the different configurations that you used in the second milestone, build M/M/m queuing models of the system as a whole. Detail the characteristics of these series of models and compare them with experimental data. The goal is the analysis of the model and the real scalability of the system (explain the similarities, the differences, and map them to aspects of the design or the experiments). Make sure to follow the model-related guidelines described in the Notes!

## 2.2 Model

TODO: describe the model I was using, and how I found the parameters

bad model because I map requests to servers uniformly. M/M/m assumes that each server takes a request when it finishes with the previous one, but that is not true in my case.

## 2.3 Data

mention where data came from (new trace from MS2)

## 2.4 Comparison of model and experiments

# 3 System as Network of Queues

## 3.1 Guidelines

Length: 1-3 pages

Based on the outcome of the different modeling efforts from the previous sections, build a comprehensive network of queues model for the whole system. Compare it with experimental data and use the methods discussed in the lecture and the book to provide an in-depth analysis of the behavior. This includes the identification and analysis of bottlenecks in your system. Make sure to follow the model-related guidelines described in the Notes!

# 4 Factorial Experiment

## 4.1 Guidelines

Length: 1-3 pages

Design a $2^k$ factorial experiment and follow the best practices outlined in the book and in the lecture to analyze the results. You are free to choose the parameters for the experiment and in case you have already collected data in the second milestone that can be used as source for this experiment, you can reuse it. Otherwise, in case you need to run new experiments anyway, we recommend exploring the impact of request size on the middleware together with an other parameter.

# 5 Interactive Law Verification

## 5.1 Guidelines

Length: 1-2 pages

Check the validity of all experiments from one of the three sections in your Milestone 2 report using the interactive law (choose a section in which your system has at least 9 different configurations). Analyze the results and explain them in detail.

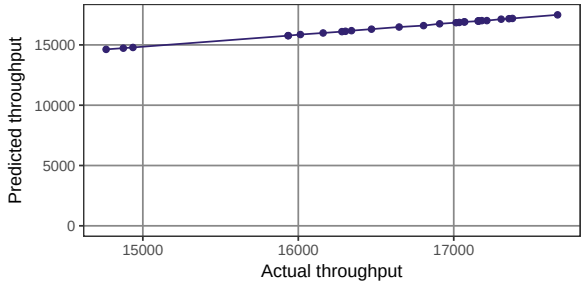
## 5.2 convenience subsection

which experiment I chose, did I remove beginning and end, ...

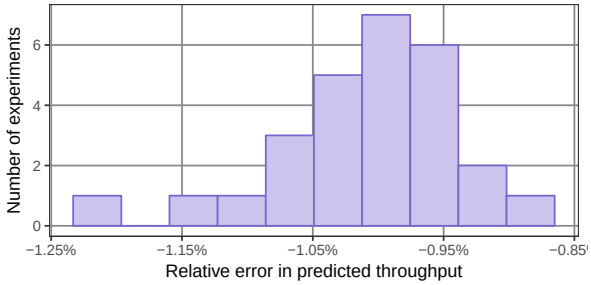
mention mean error

TODO: also show graphs as function of parameters (like in ms2 exp2)?

TODO: why do I predict lower throughput? because total cycle time is higher than it should for given throughput – but why? since measuring is done by memaslap, probably the problem lies on that side




(a) TODO:




(b) TODO: . note scale

# Appendix A: Template appendix