MULTIPROGRAMMED SERVER

Performance Evaluation of Computer System and Networks

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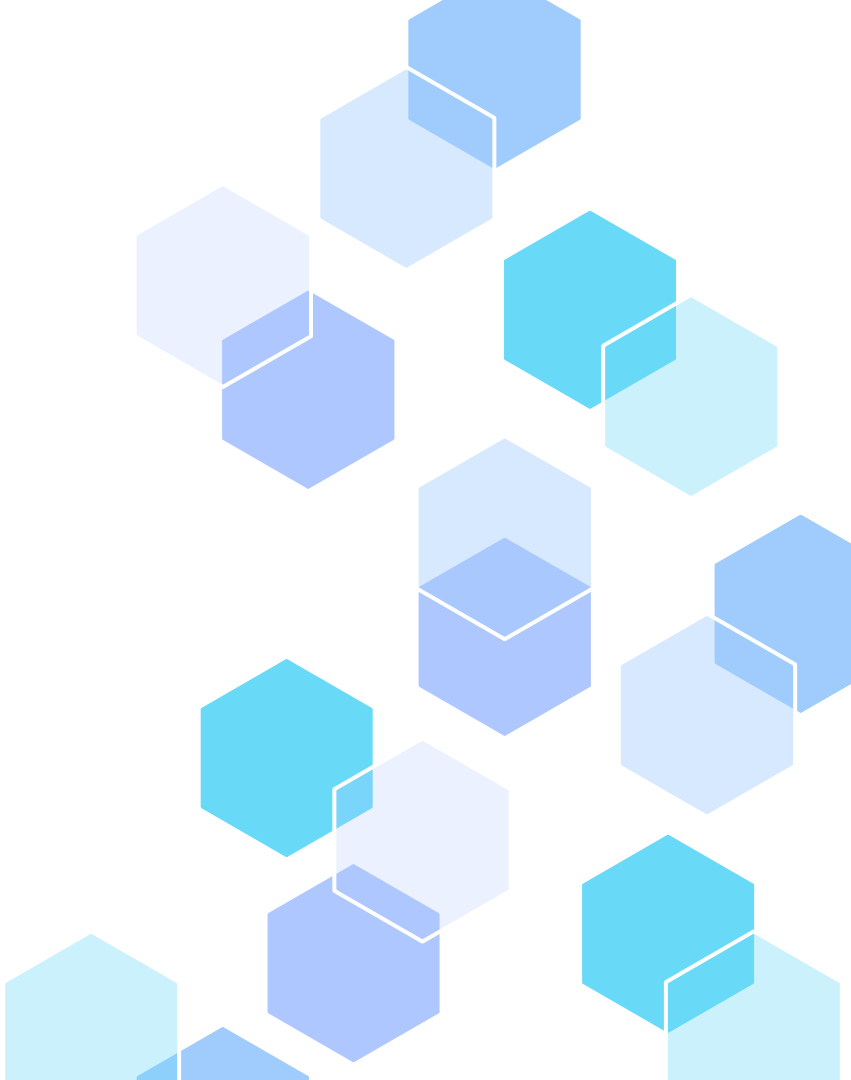
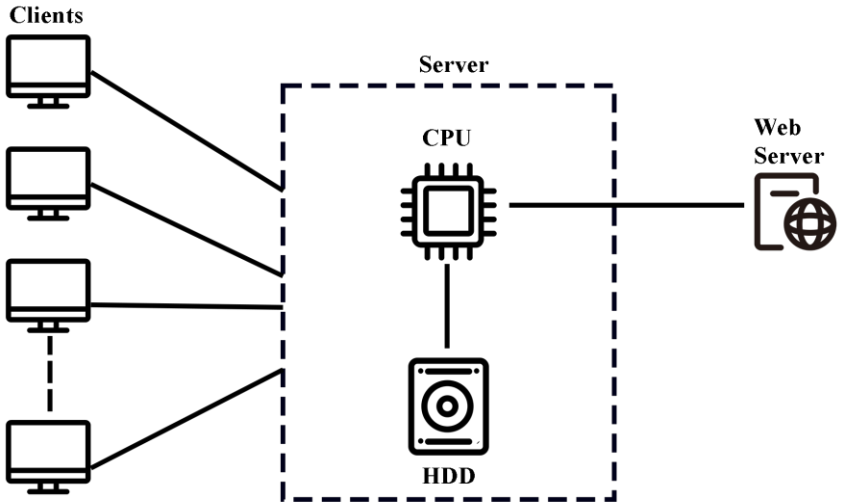
Table of contents

01
Overview



Overview



Objectives:

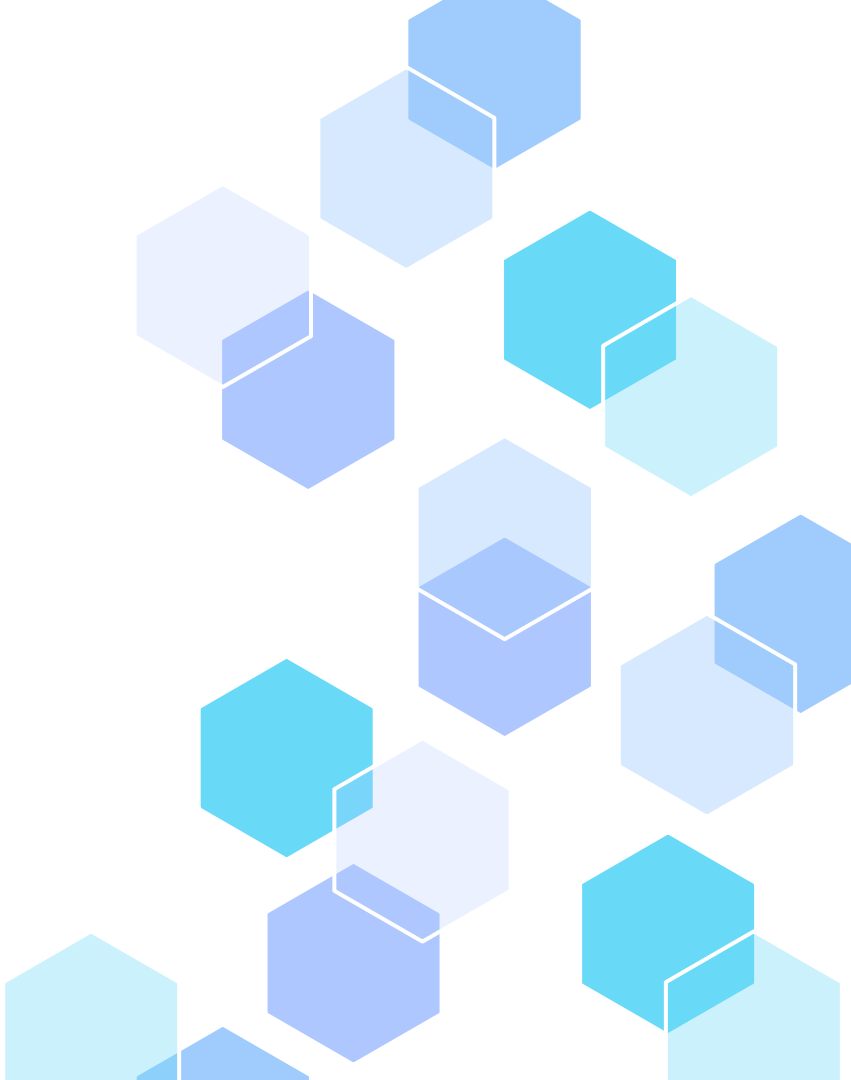
- ❑ Throughput
- ❑ Utilization

Key performance indexes:

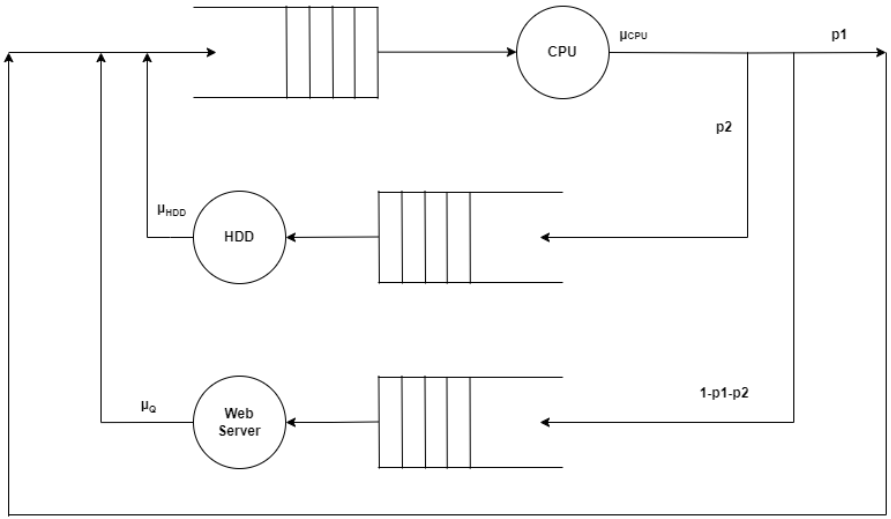
- Throughput: the number of completed transactions per unit of time.
- Utilization: the time percentage during which each node is busy.

02

Model



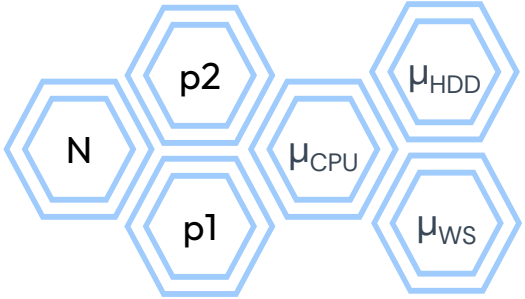
Model



Assumptions

- Finite number of clients = number of jobs within the system.
- Infinite queue size
- Service centers: exponential distributed service time with a different rate and FIFO order processing.

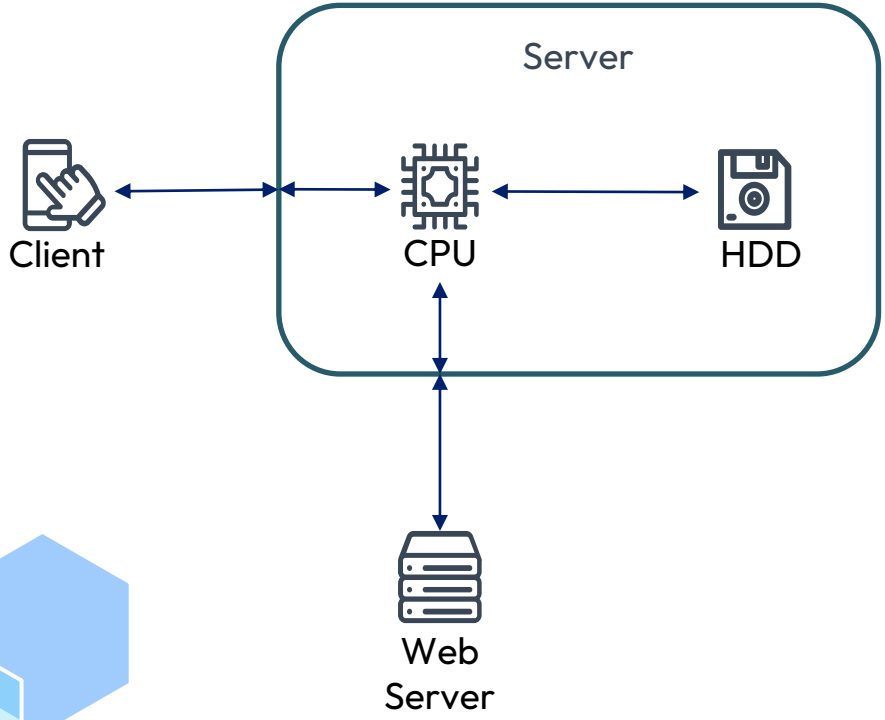
Factors

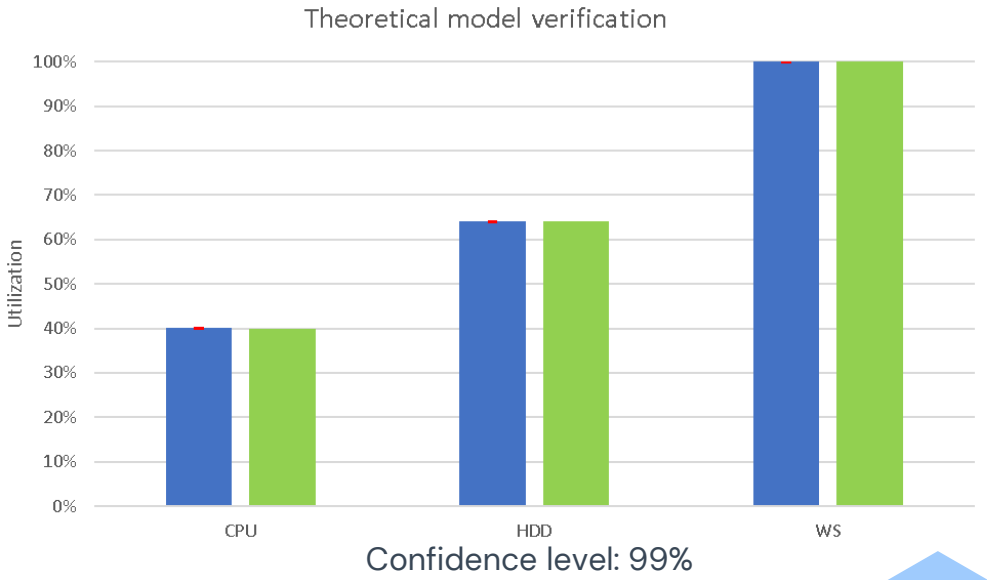


03

Implementation

Omnet++ Model





- **Empirical utilization**
- **Theoretical utilization**

Verification

Continuity Test

- **Second Config**

  p1 = 0.35 μ_{CPU} = 1000

  p2 = 0.41 μ_{HDD} = 250

  μ_{WS} = 75

  Number of clients = 40

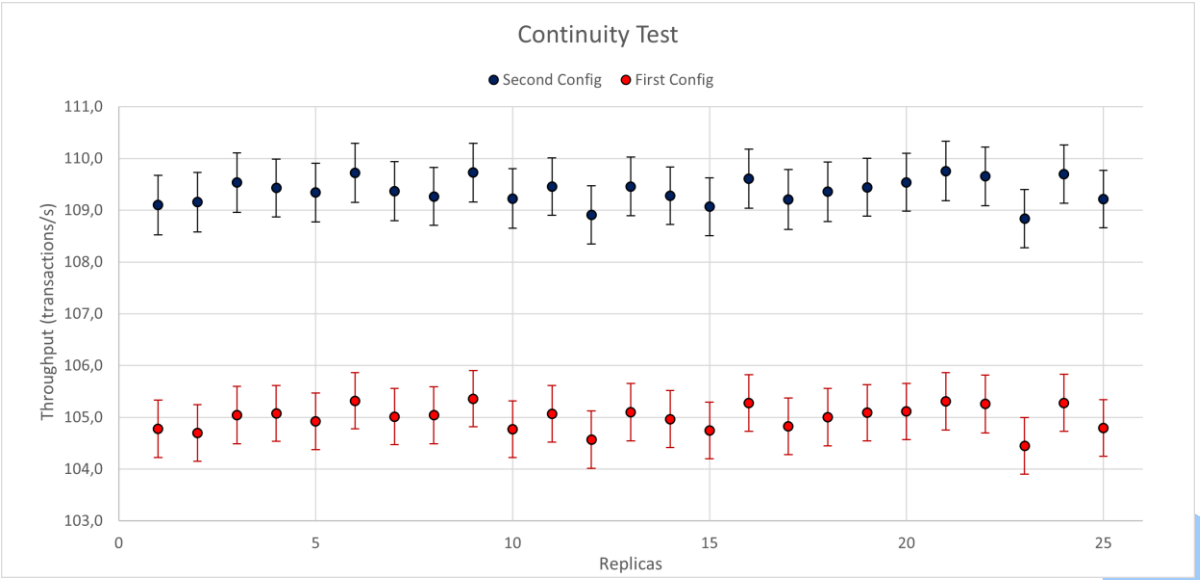
- **First Config**

  p1 = 0.35 μ_{CPU} = 1000

  p2 = 0.40 μ_{HDD} = 250

  μ_{WS} = 75

  Number of clients = 40



Confidence level: 95%

Verification

Consistency Test

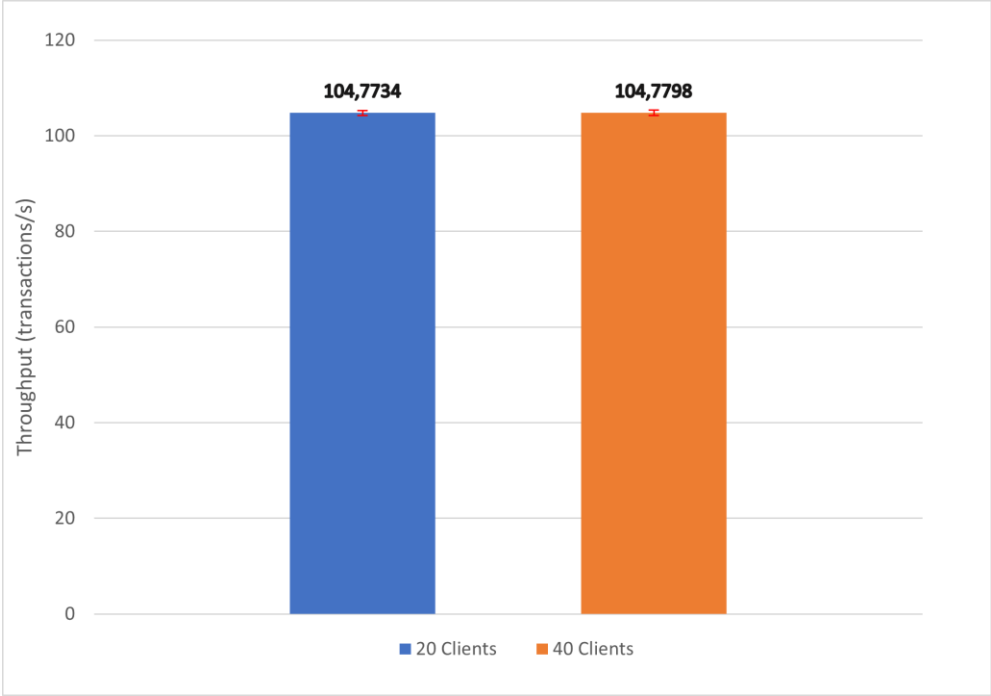
- **Common Values**

  p1 = 0.35 $\quad \mu_{CPU} = 1000$

  p2 = 0.40 $\quad \mu_{HDD} = 250$

  $\mu_{WS} = 75$

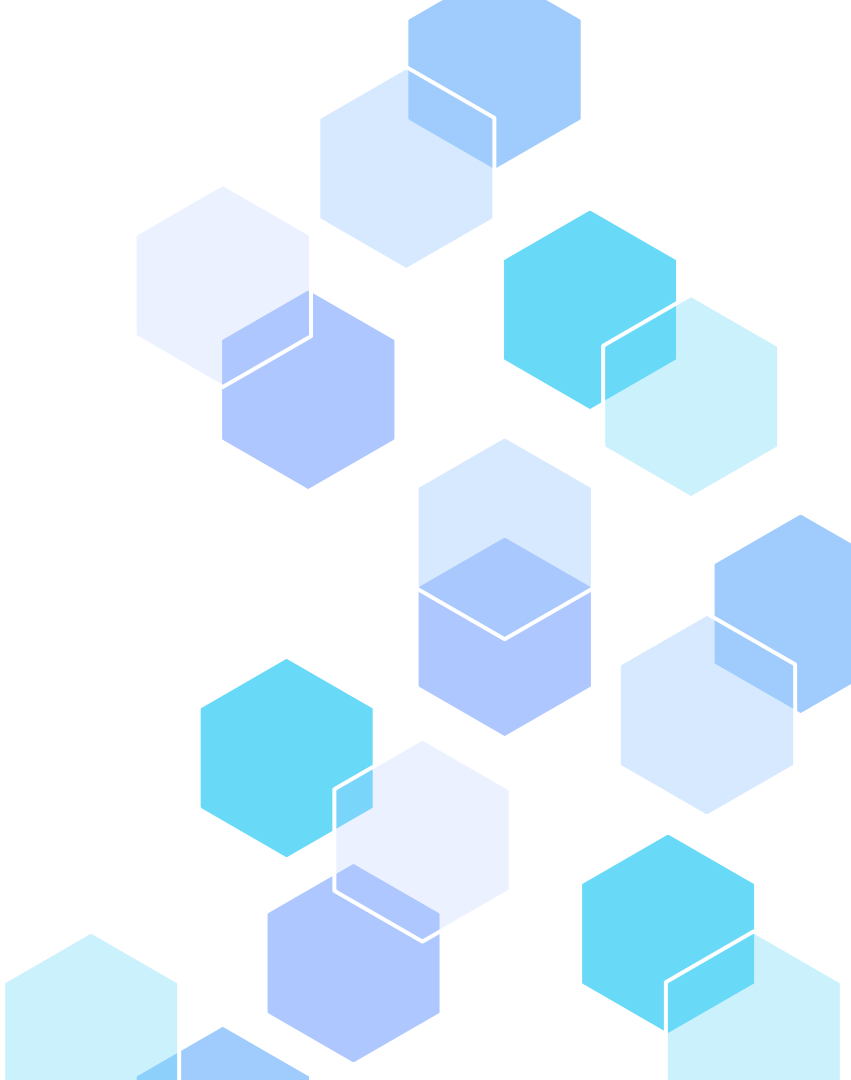
- **20 Clients**
- **40 Clients**



Confidence level: 95%

04

Data Analysis



Calibration

Warm-up evaluation

Repetitions

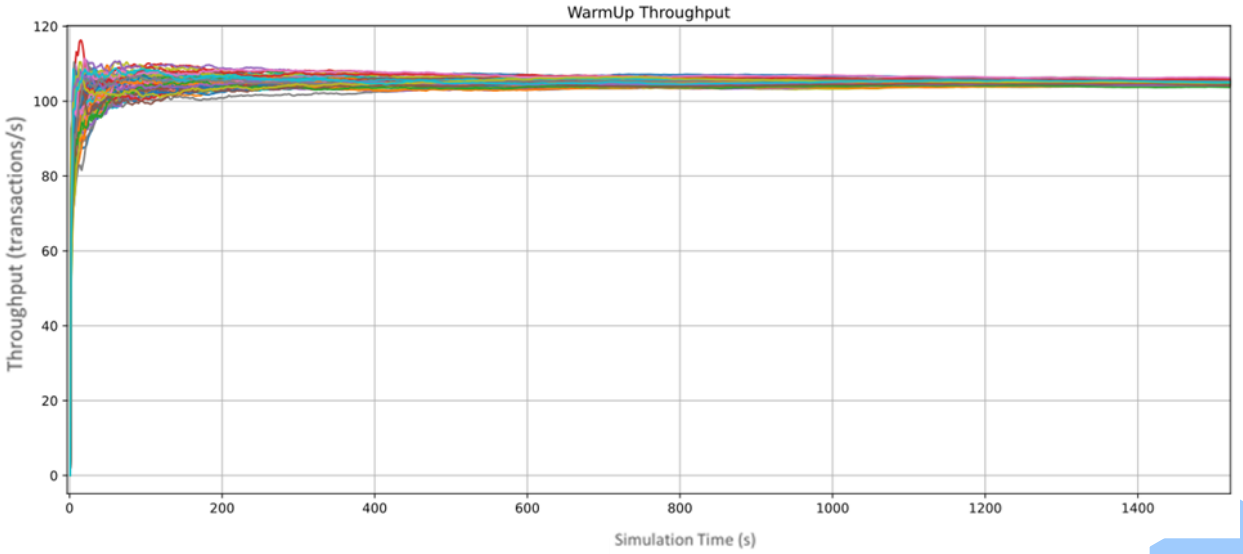
The experiment was based on 100 repetitions

Gathered data

All data were analyzed with time average function

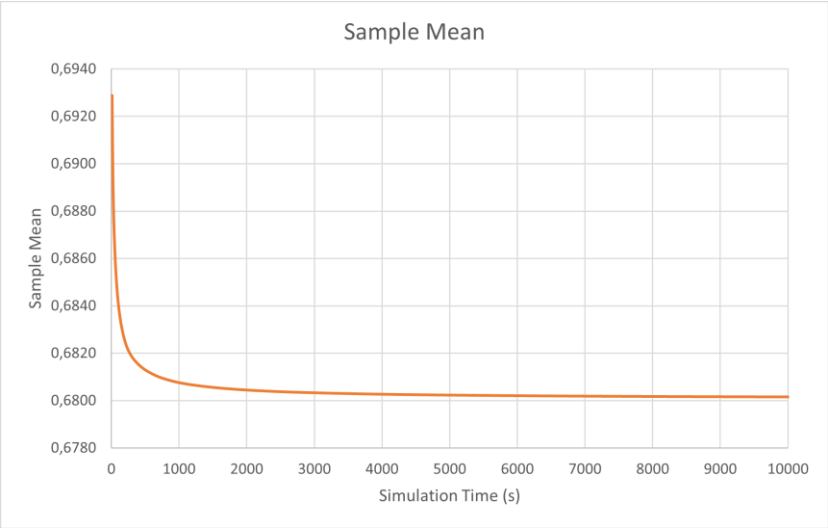
Final Value

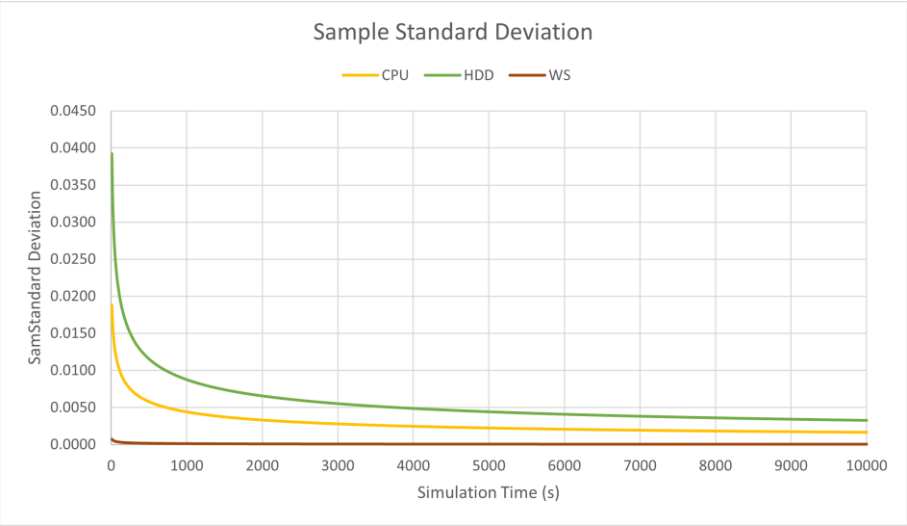
500s warm-up period



Calibration

Simulation Time





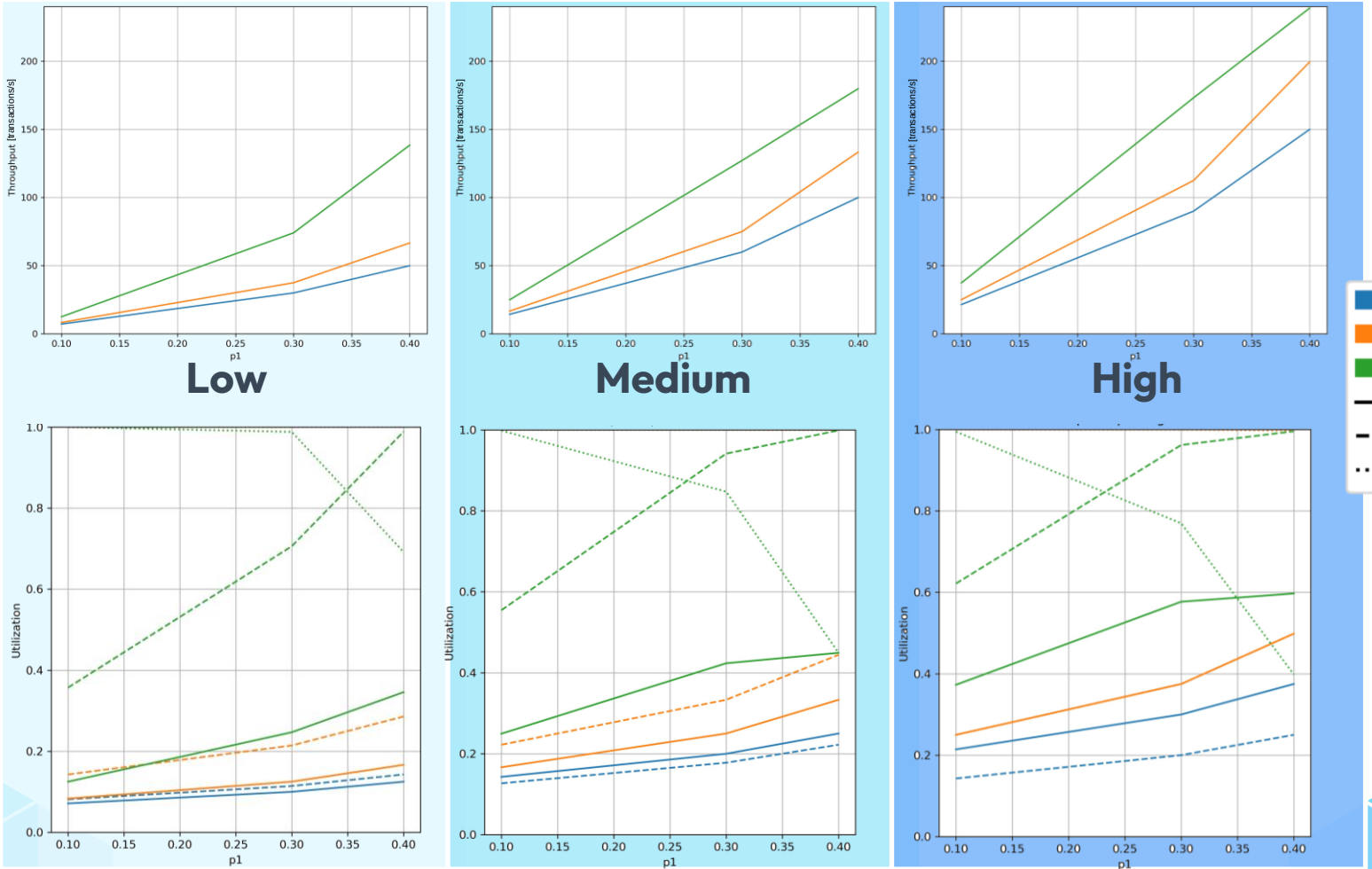
Repetitions
500 repetitions

Gathered Data
Sample mean & Sample Standard Deviation

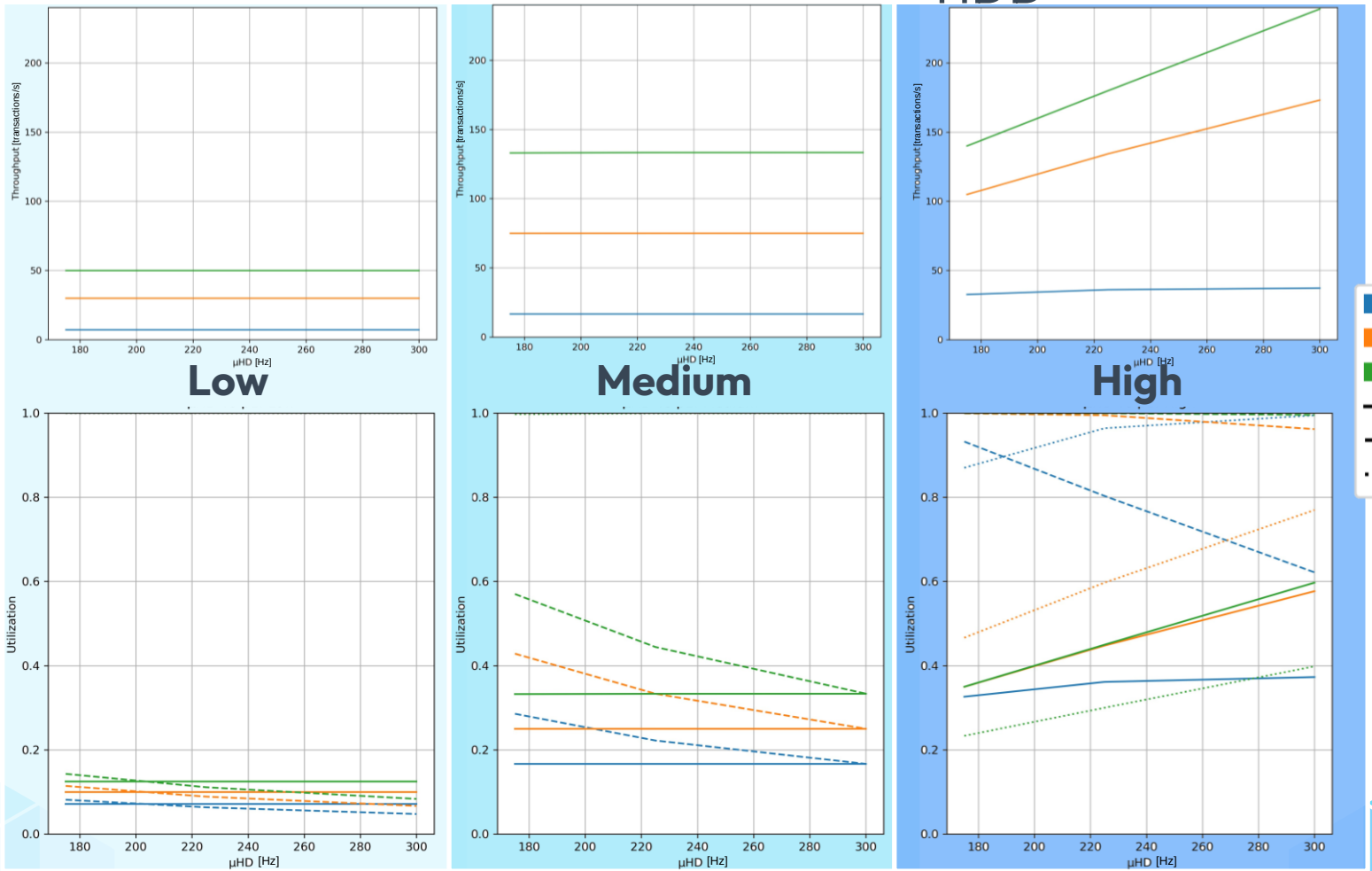
Theoretical Verification
The sample mean converges to $\frac{E[active]}{E[active]+E[idle]}$

Final Value
4000s simulation time

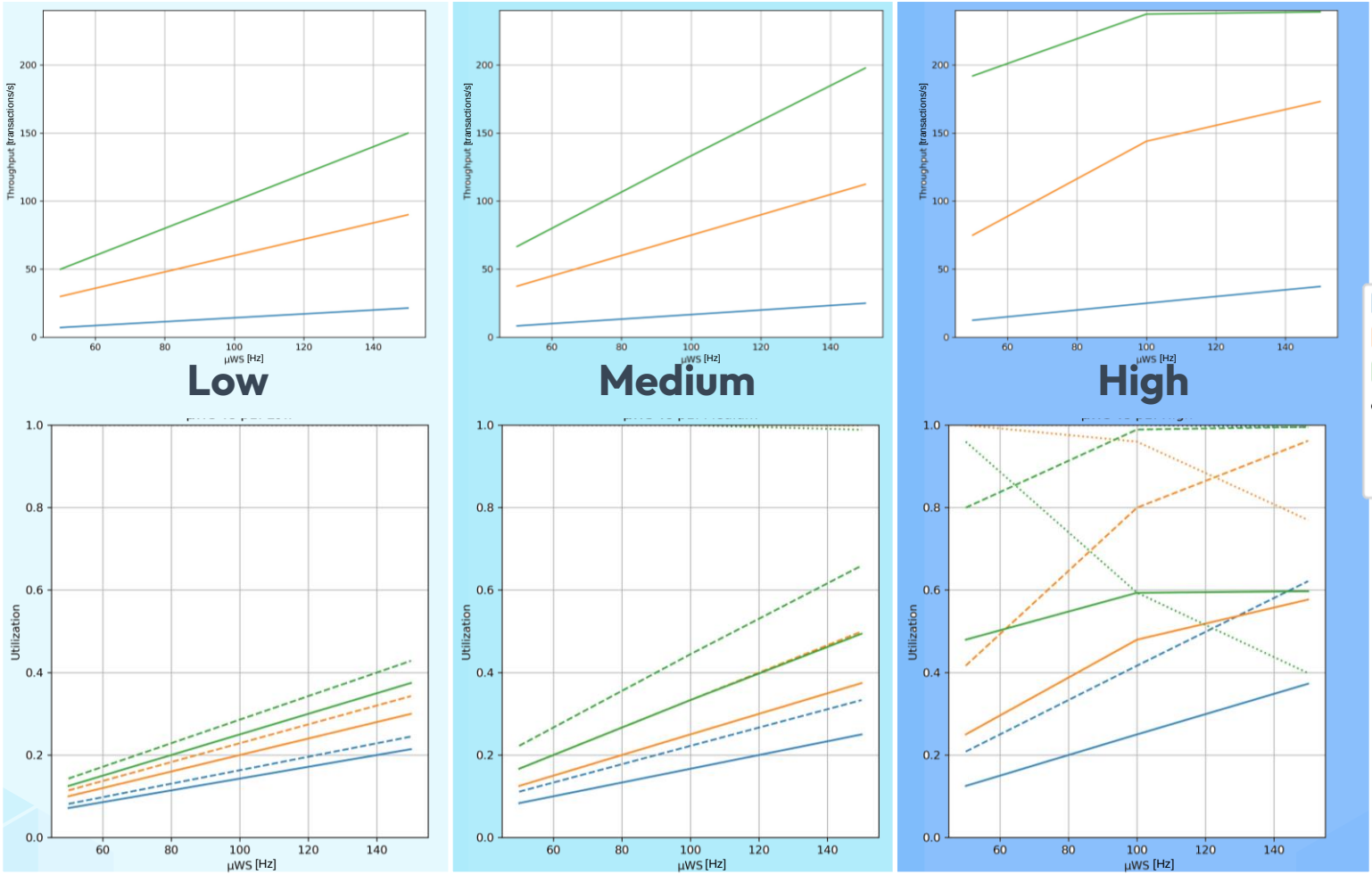
Simulation Scenarios: p1 vs p2



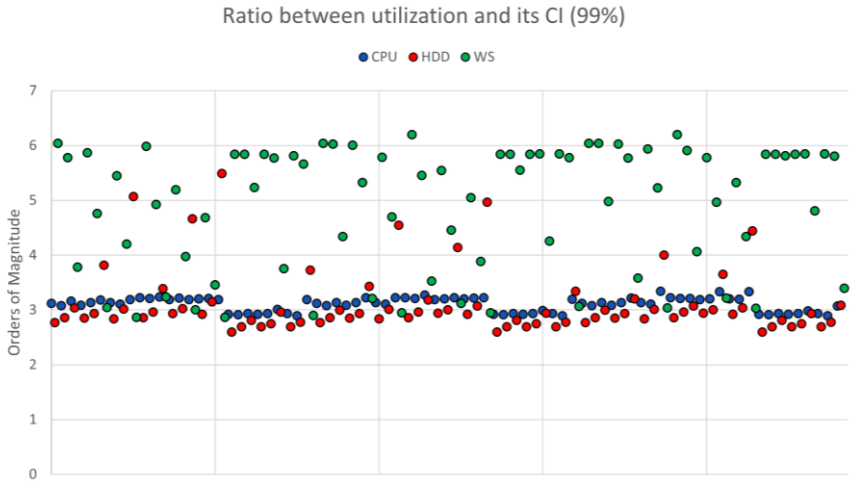
Simulation Scenarios: μ_{HDD} and p1

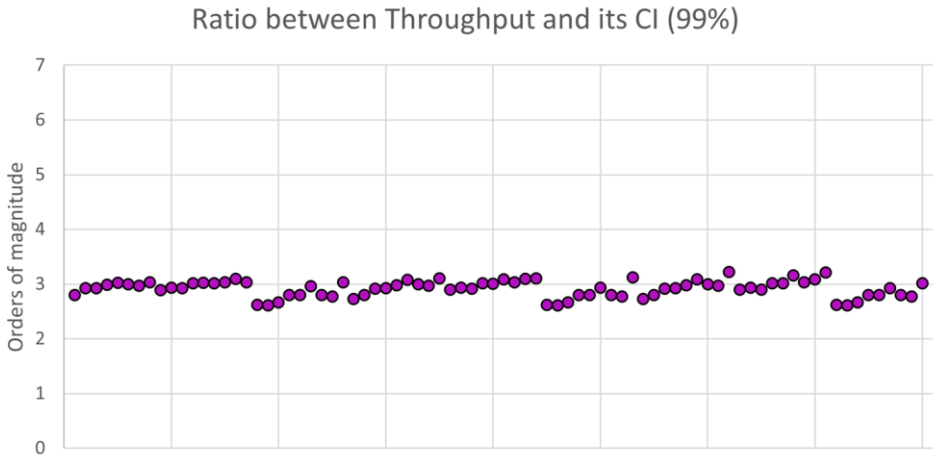


Simulation Scenarios: μ_{WS} and p1



Confidence Interval





We have omitted the representation of confidence intervals due to their negligible size.

Web Server **CPU** **HDD** **Server**

05
Conclusions

Conclusions

First Scenario

Situation

- Vast amount of local computations.
- Minimal interaction with Web Servers.

In the model

p2 is expected to be high due
to the significant load on the local server.

Solution

Increase μHDD to improve the throughput of the system.

Second Scenario

Situation

- Minimal local processing.
- Relies on cloud-based computations.

In the model

p2 is likely to be low due to the high volume of requests to the remote web-server.

Solution

Increase the μWS to boost the throughput of the system.

Thanks!

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