Evaluation of Microservice Architecture Designs in an IoT-Context

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Introduction

The thesis overview

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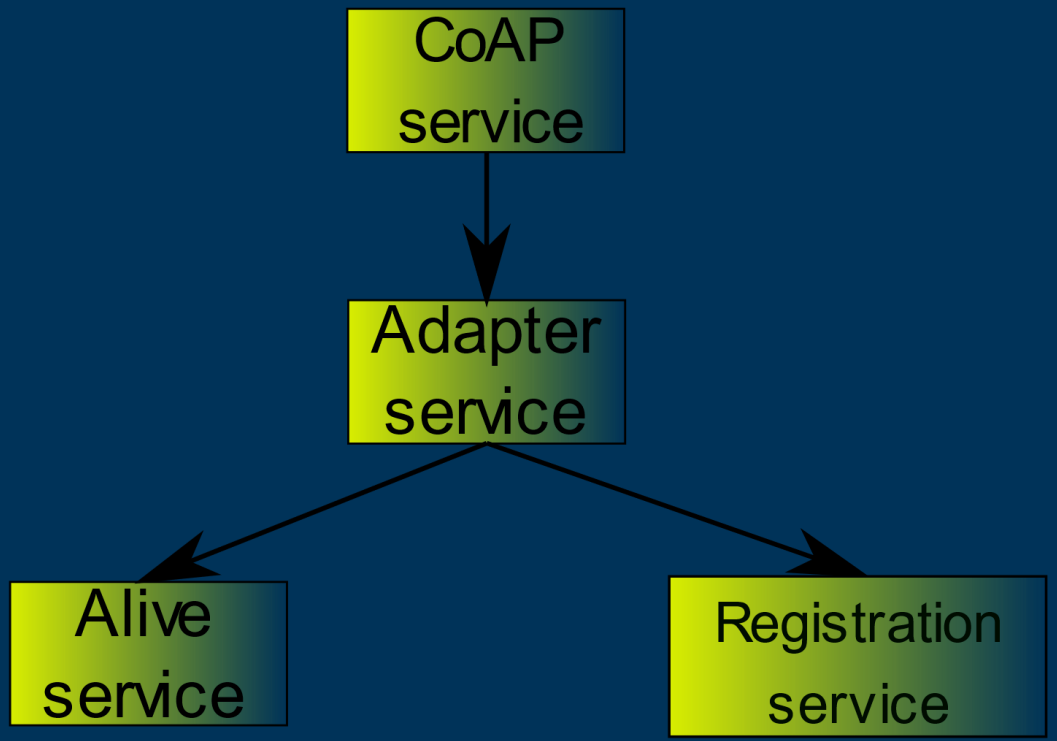
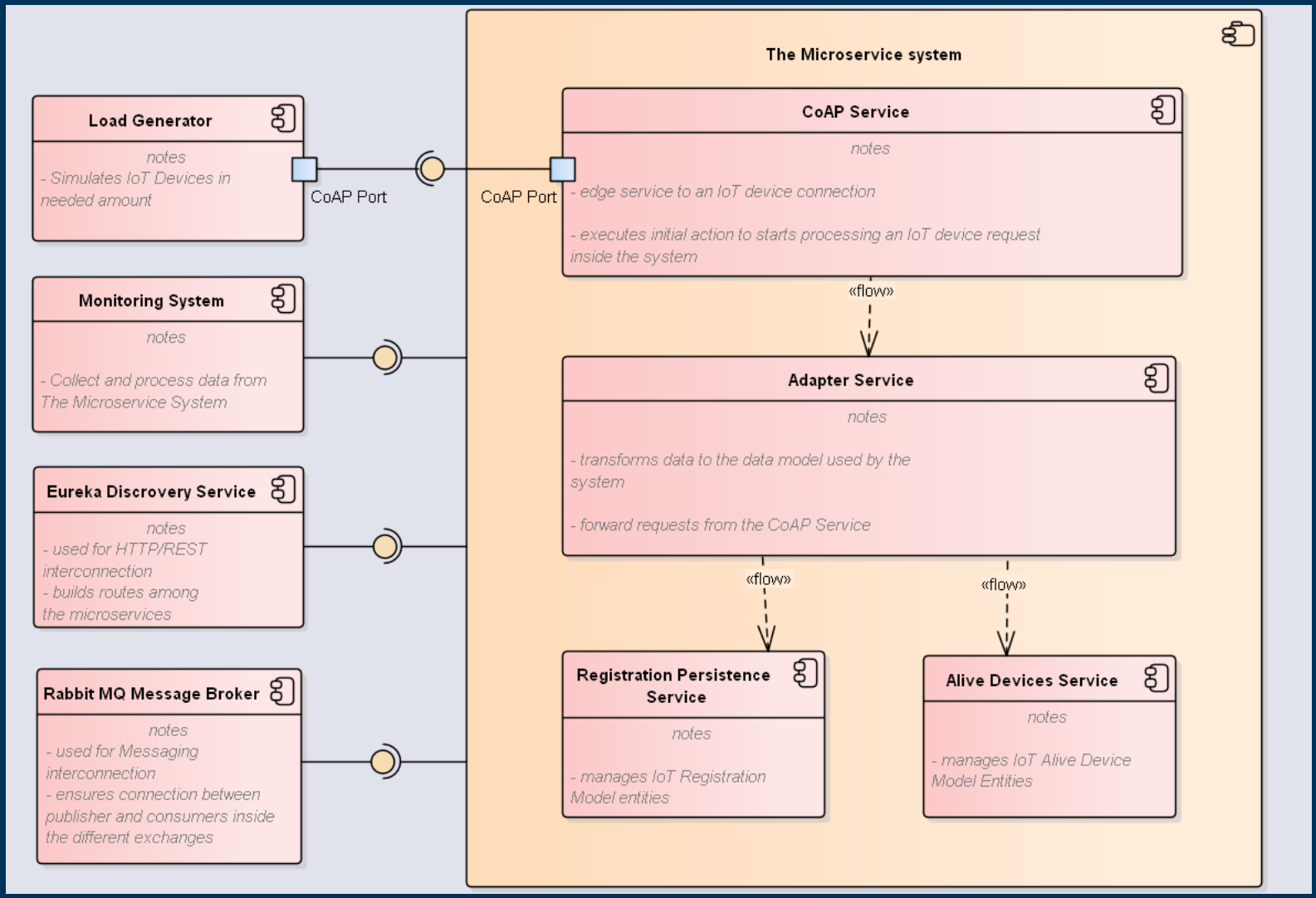
The microservice system

- CoAP s-ce – edge service handling IoT devices request
- Adapter s-ce – transforms CoAP a device data model and forward its request.
- Alive s-ce – provides information about connected devices
- Registration s-ce – responsible for device registration within the system



Component diagram



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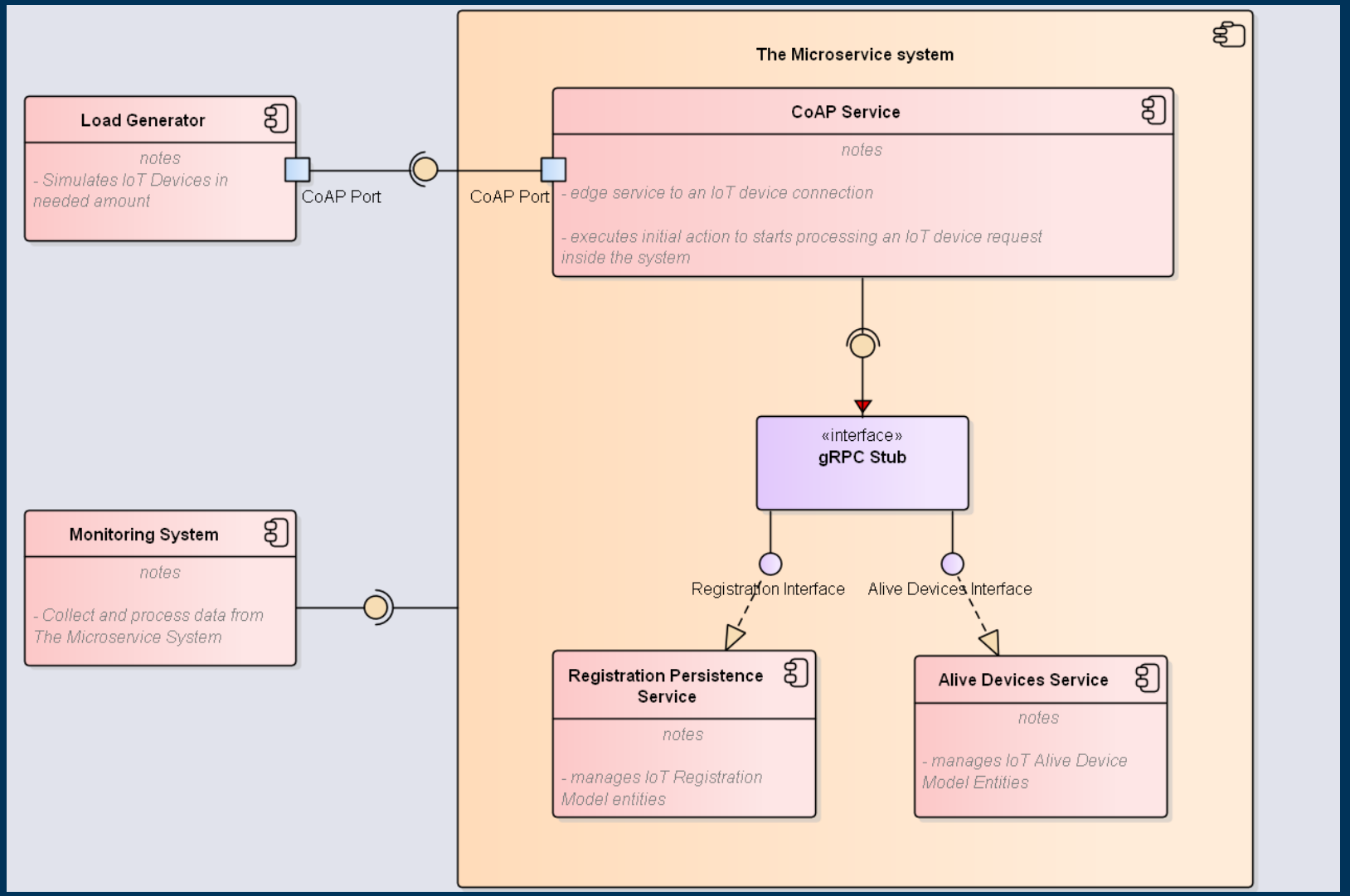
Component diagram (gRPC)



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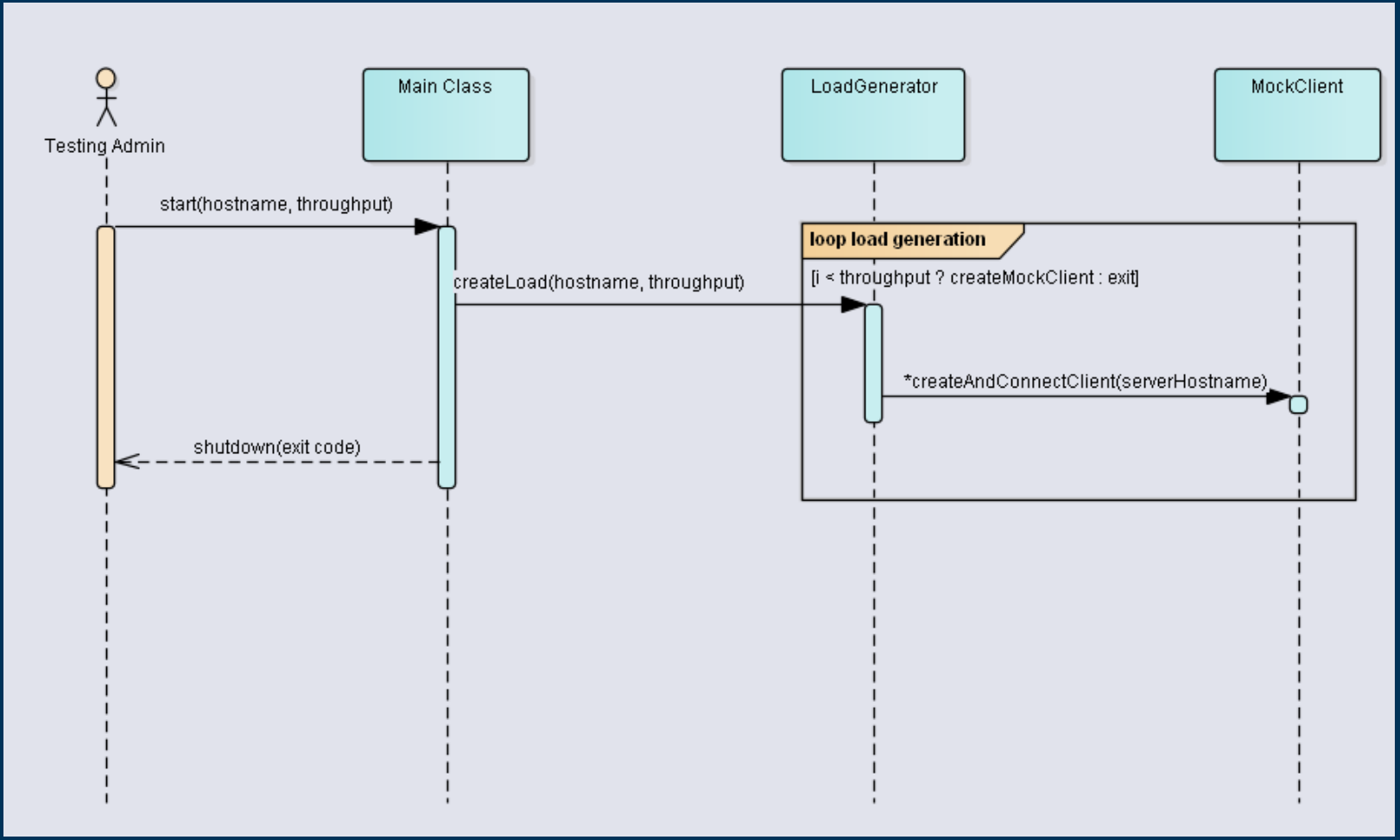
Load generation



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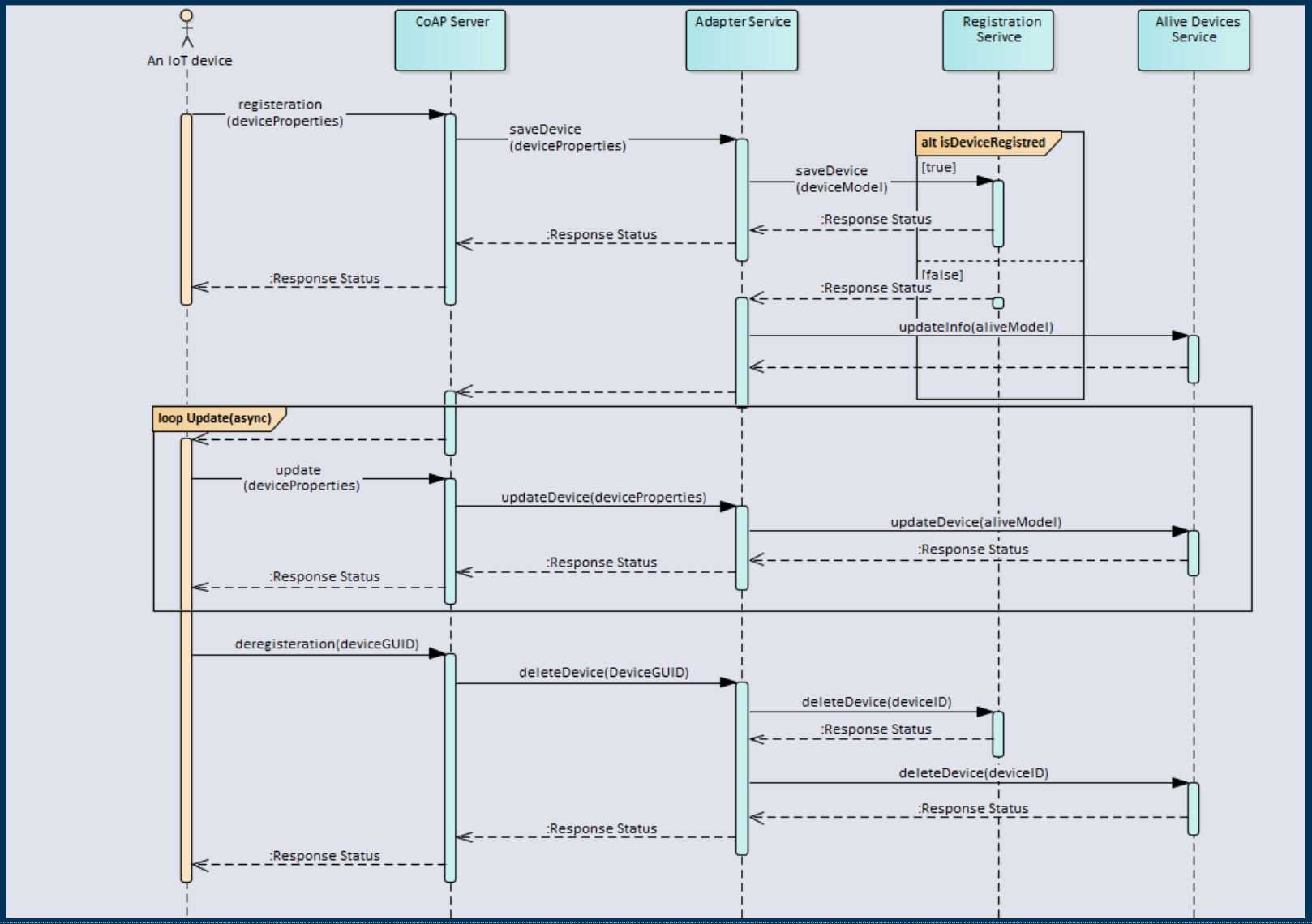
Test scenario



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Requirements

The system requirements

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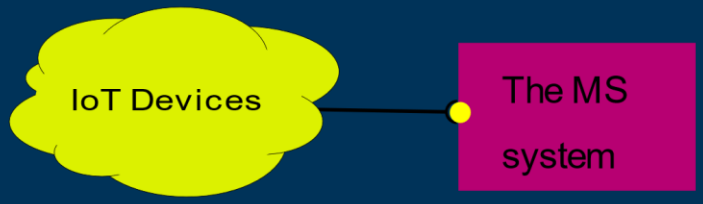
Functional Requirements



Non-functional Requirements

Qualitative

- Testable
- Reproducible
- Deployable

Quantitative

- Response time
- Scalable

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State of the art

Literature overview

Basic articles

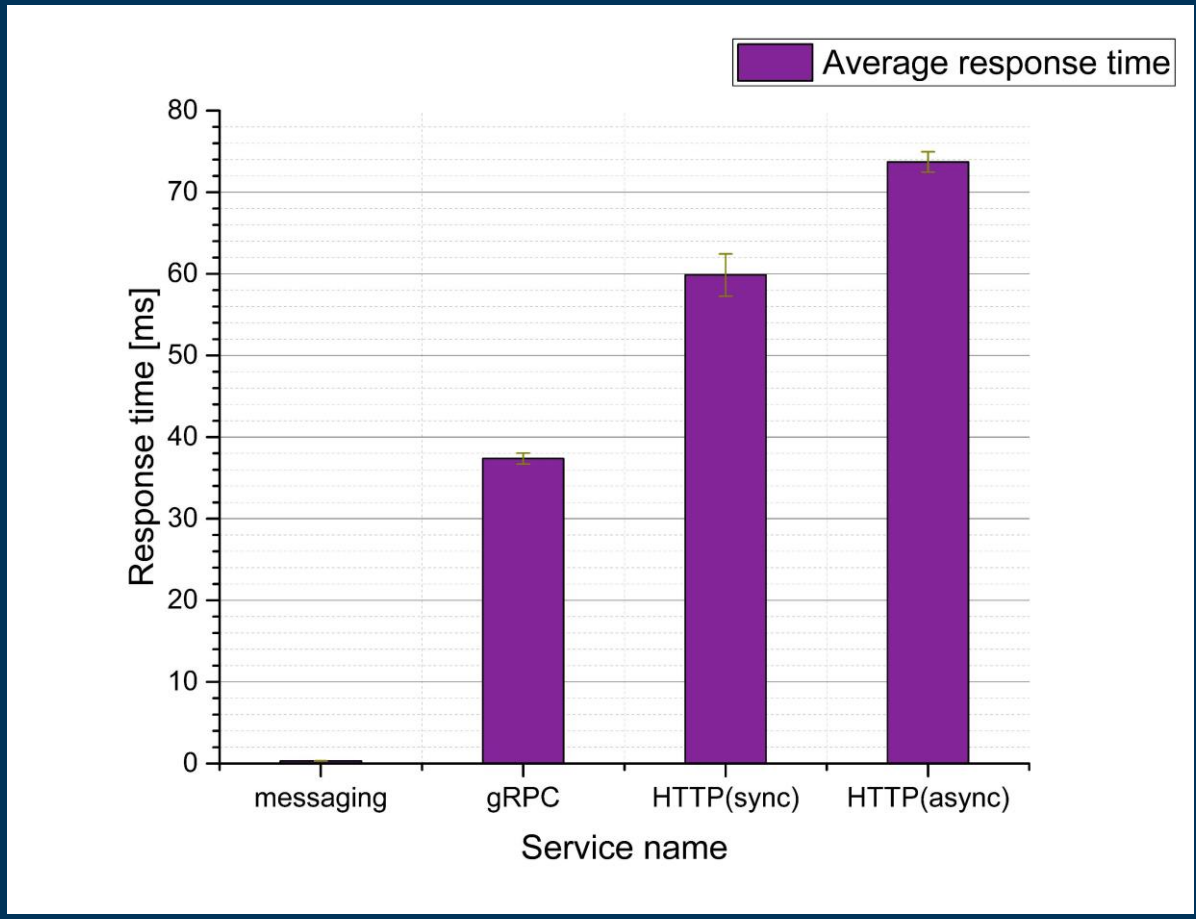
- M. S. Hatem Hamad and R. Abed, “Performance evaluation of restful web services for mobile devices,” *Computer Engineering Department, Islamic University of Gaza, Palestine, International Arab Journal of e-Technology*, 2010.
- P. J. Amaral M. and C. D., “Performance evaluation of microservices architectures using containers.,” *IEEE 14th International Symposium on Network Computing and Applications*, 2015.
- J. F. Kunhua Zhu and Y. Li, *Research the performance testing and performance improvement strategy in web application”, 2nd international Conference on Education Technology and Computer.* 2010.

Results

The Results discussion

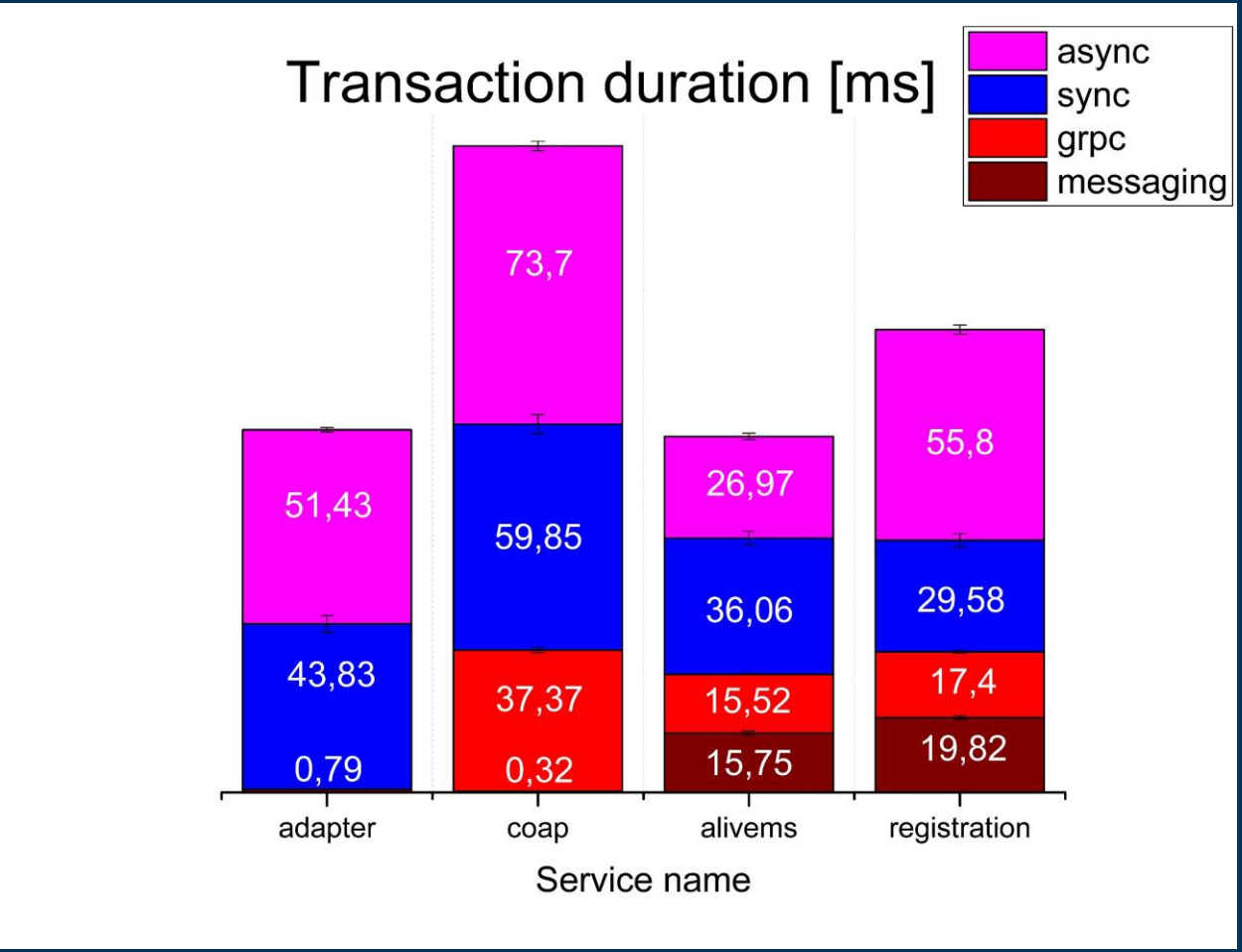
Interconnection comparison

- Messaging provides the lowest response time less than1 millisecond.
- Async. HTTP provides the highest response time, a bit higher 70 milliseconds.



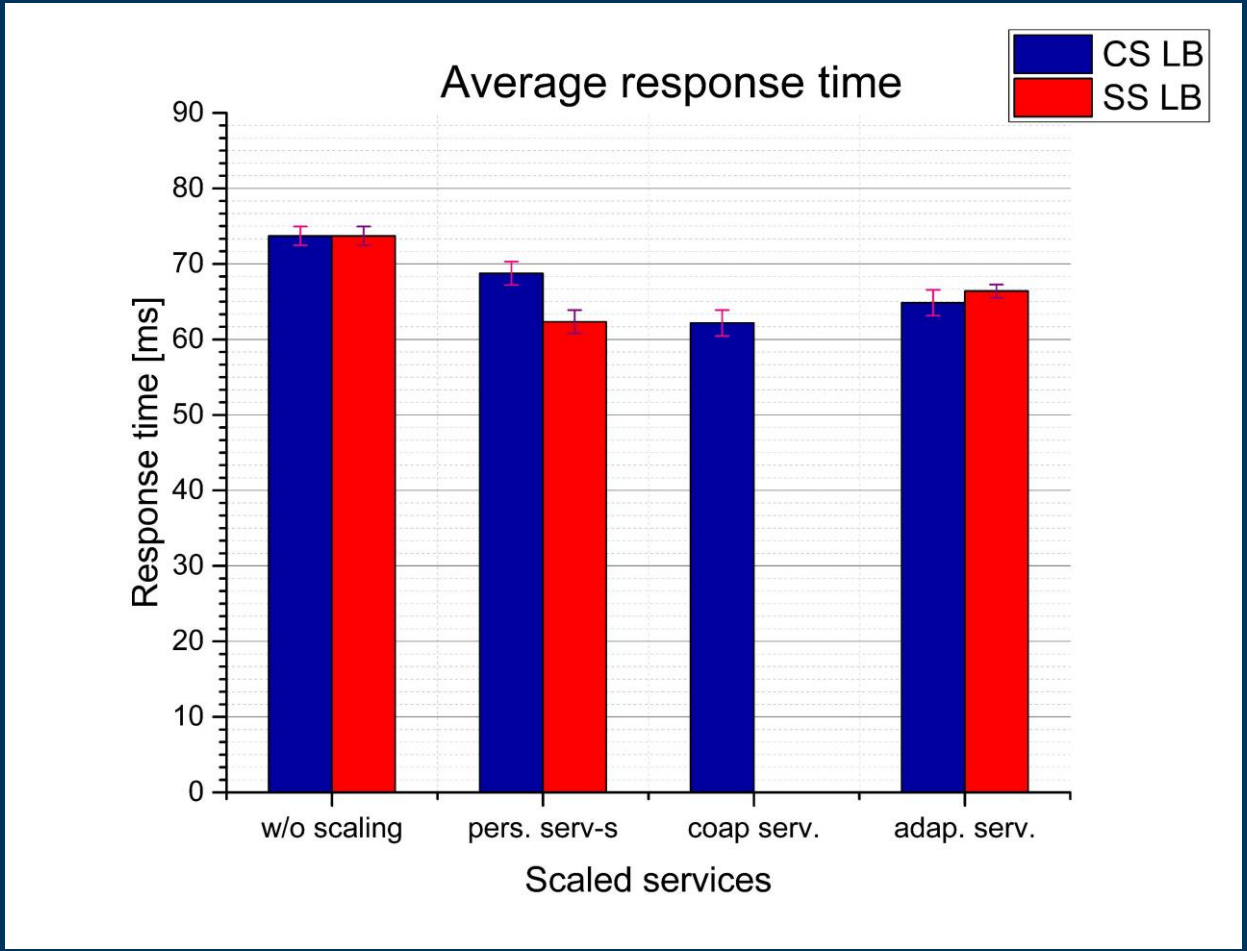
Transaction duration by service

- gRPC interconnection provides lowest transaction duration time of persistence services.
- The messaging one provides the lowest transaction duration time of non-persistence services.



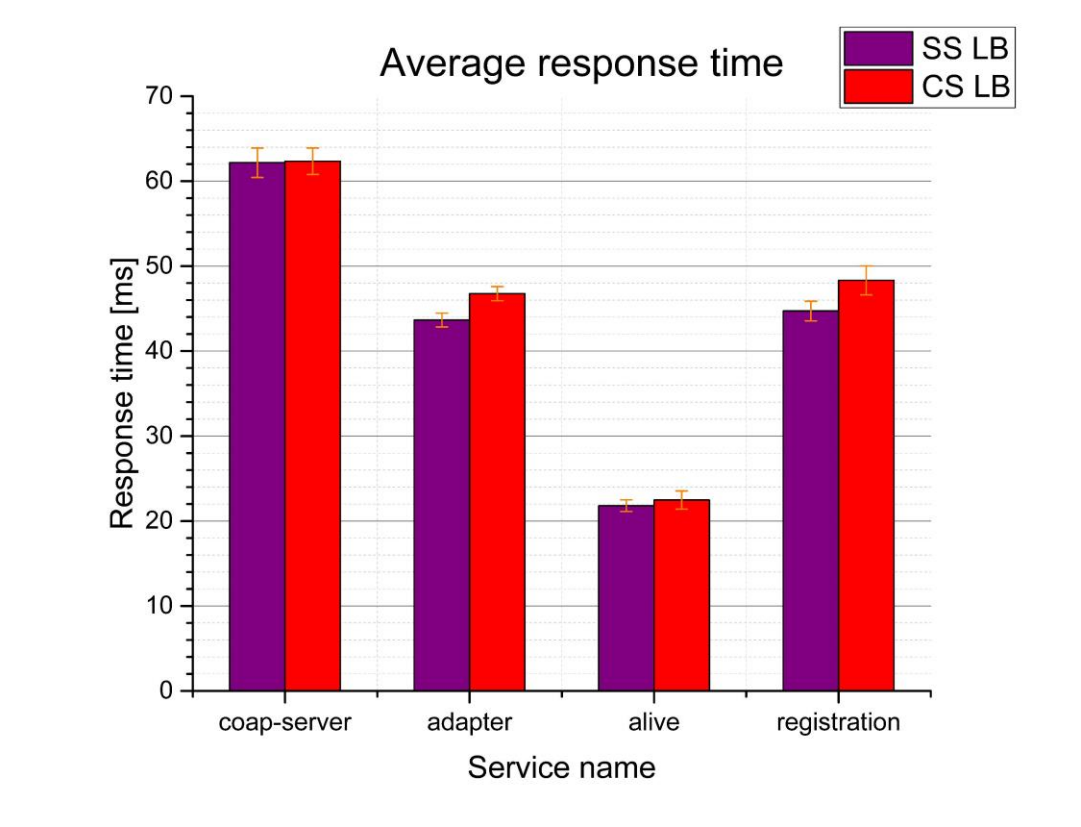
Load balancing strategies comparison

- Client-side LB strategy provides about 10% less the system response time, scaling persistency services.
- Server-side LB strategy improves the system response by almost the same amount but by scaling edge service.



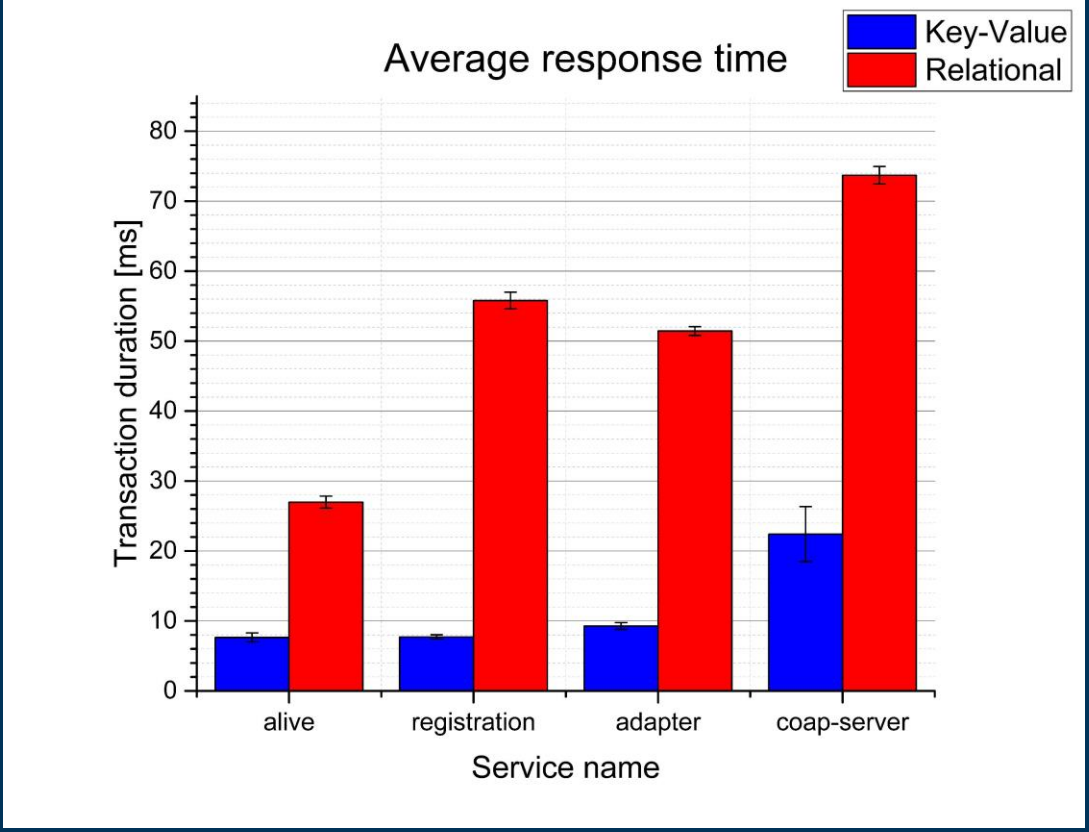
impact of lb on services

- Probably picture with an error.



DBMS comparison

- Key-Value DBMS requires significantly less time to execute database operations.
- Despite a data structure it needs about 8 milliseconds to process an operation.



Conclusion

Summing up the thesis

Conclusion

- The fastest an IoT device request handling can provide a microservice system with messaging middleware interconnection to non-persistency services and gRPC interconnection to persistency services.
- Document-oriented key-value DBMS can ensure the lowest transaction duration of persistency services.
- Load balancing strategy choice depends on where a microservice system has a bottleneck.

Future work

- To test the microservice system with some additional services satisfying more realistic requirements.
- Improve the load generation.
- Survey about how caching might affect the system response time.
- Prove our research on a production made application.

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