Comparison of Tools for Software Architecture Extraction of Asynchronous Microservice Systems

Jonas Frey

Institute of Information Security and Dependability (KASTEL)
Advisor: M.Sc. Snigdha Singh

English abstract.

Keywords

1 Introduction

This chapter will provide a motivation of why a systematic literature review about tools for architecture extraction of asynchronous systems is necessary.

In chapter 2, we will provide some foundation knowledge. In chapter 3, we will talk about the design and goal of this literature review and the selection of the papers. In chapter 4, we will present the results and compare them using five different aspects. We will discuss these results in chapter 5 and talk about related work in chapter 6, before drawing conclusions in chapter 7.

2 Foundation

This chapter will provide some foundation knowledge for the rest of the paper.

2.1 Microservice Architecture

This section explains the general concepts of a microservice architecture. [Dra+17]

2.2 Asynchronous Communication

This section will explain the basics of asynchronous communication.

2.3 Message-based Communication

This section will explain what message-based communication is in particular.

2.4 Software Architecture Extraction (SAR)

This section will explain Software Architecture Extraction (SAR) in general.

2.5 Palladio Component Model (PCM)

This section provides foundation knowledge of the Palladio Component Model (PCM). [BKR09]

3 Study Design

This chapter will explain the design of the systematic literature review and how it was executed.

3.1 Study Aim

This section explains the goal of the paper, namely to compare different tools for SAR for asynchronous communication-based systems.

3.2 Research Questions

This section presents the research questions we will answer in the following sections.

The research questions are:

- **RQ1**. What are the tools available for extraction of asynchronous architecture?
- **RQ2**. To what extend do the tools support software architecture extraction?

3.3 Selecting the Papers

This section explains how the papers were selected, including the keywords used to search for papers and the selection criteria (inclusion/exclusion).

Asynchronous Papers found:

1. ARCHI4MOM [SWK22], [SKK21]
2. MiSAR [AAE18]
3. — [BHK11]
4. MYCROLYZE [Kle+18] (only supports asynchronous HTTP communication)

5. — [MW18] (only supports asynchronous HTTP communication)
6. — [Nte+21] (only supports asynchronous HTTP communication)

4 Results

This chapter will answer the research questions formulated in 3.2 and analyze the papers selected in 3.3. This chapter will also feature a table comparing the papers in different aspects:

1. **Input** (e.g. source code, artifacts, logs, ...)
2. **Output** (e.g. PCM, UML, ...)
3. **Approach** (how the tools extract the architecture)
4. **End user** (who the result is intended for)
5. **Evaluation metric** (how were the results evaluated, e.g. precision/recall or comparison)

5 Discussion

This chapter will discuss the results of the previous chapter.

6 Related Work

This chapter presents other papers which are similar to my work. For example [DP09], which compares different SAR approaches to formulate a state-of-the-art approach or [GIM13], which compares different SAR tools. We will also talk about the fact that [Gra+17] and [Lan+16] could be extended to support asynchronous communication in the future.

7 Conclusion

In this chapter, we will recap the findings that we made and finish the paper with concluding remarks.

References

[AAE18] Nuha Alshuqayran, Nour Ali, and Roger Evans. "Towards Micro Service Architecture Recovery: An Empirical Study". In: 2018. DOI: 10.1109/ICSA.2018.00014.

[BHK11] Fabian Brosig, Nikolaus Huber, and Samuel Kounev. "Automated extraction of architecture-level performance models of distributed component-based systems". In: IEEE, Nov. 2011, pp. 183–192. ISBN: 978-1-4577-1639-3. DOI: 10.1109/ASE.2011.6100052.

[BKR09] Steffen Becker, Heiko Koziolek, and Ralf Reussner. "The Palladio Component Model for Model-driven Performance Prediction". In: *Journal of Systems and Software* 82 (2009), pp. 3–22. DOI: 10.1016/j.jss.2008.03.066. URL: http://dx.doi.org/10.1016/j.jss.2008.03.066.

[DP09] S. Ducasse and D. Pollet. "Software Architecture Reconstruction: A Process-Oriented Taxonomy". In: *IEEE Transactions on Software Engineering* 35 (4 July 2009), pp. 573–591. ISSN: 0098-5589. DOI: 10.1109/TSE.2009.19.

[Dra+17] Nicola Dragoni et al. *Microservices: Yesterday, Today, and Tomorrow*. 2017. DOI: 10.1007/978-3-319-67425-4_12.

[GIM13] Joshua Garcia, Igor Ivkovic, and Nenad Medvidovic. "A comparative analysis of software architecture recovery techniques". In: *2013 28th IEEE/ACM International Conference on Automated Software Engineering (ASE)*. IEEE. 2013, pp. 486–496.

[Gra+17] Giona Granchelli et al. "Towards recovering the software architecture of microservice-based systems". In: 2017. DOI: 10.1109/ICSAW.2017.48.

[Kle+18] Martin Kleehaus et al. "MICROLYZE: A framework for recovering the software architecture in microservice-based environments". In: vol. 317. 2018. DOI: 10.1007/978-3-319-92901-9_14.

[Lan+16] Michael Langhammer et al. "Automated extraction of rich software models from limited system information". In: 2016. DOI: 10.1109/WICSA.2016.35.

[MW18] Benjamin Mayer and Rainer Weinreich. "An Approach to Extract the Architecture of Microservice-Based Software Systems". In: 2018. DOI: 10.1109/SOSE.2018.00012.

[Nte+21] Evangelos Ntentos et al. "Detector-based component model abstraction for microservice-based systems". In: *Computing* 103 (11 2021). ISSN: 14365057. DOI: 10.1007/s00607-021-01002-z.

[SKK21] Snigdha Singh, Yves Richard Kirschner, and Anne Koziolek. "Towards extraction of message-based communication in mixed-technology architectures for performance model". In: 2021. DOI: 10.1145/3447545.3451201.

[SWK22] Snigdha Singh, Dominik Werle, and Anne Koziolek. "ARCHI4MOM: Using Tracing Information to Extract the Architecture of Microservice-Based Systems from Message-Oriented Middleware". In: *European Conference on Software Architecture* (2022).