# Coverage Measures for Integration Testing of Microservice Systems

Bachelor's/ Master's Thesis or Guided Research

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## Context

Microservices, a widely adopted software architecture style, bring a new way of building flexible and scalable systems [1]. The distributed nature of microservices, coupled with their diverse technology stack, introduces inherent complexities in testing, surpassing those encountered in monolithic systems. However, good tests are crucial for ensuring good quality software. Traditional test adequacy criteria like branch coverage can be used to evaluate tests focusing on implementation details within single services. However, when it comes to the quality of higher-level tests that focus on the interactions between microservices, new adequacy criteria are needed, as traditional approaches are too fine-grained and fail to capture the dependencies across system boundaries.

We consider integration tests as tests that focus on the interaction of multiple microservices - in practice often referred to as gateway integration tests.

## Goal

Previous to this thesis, a first set of coverage criteria for integration tests in microservice systems has been derived, and a small prototype has been developed. This thesis aims to improve the existing prototype by implementing more fine-grained metrics as well as improving the usability of the prototype and the presentation of the metric results.

## Working Plan

1. Implement the calculation of the remaining coverage criteria.
2. Implement a user frontend with a graphical representation of the metric results and configuration options.
3. Evaluate the coverage criteria (for a Bachelor's thesis, this will be rather basic; for a Master's thesis, this needs to be more in-depth).
4. Write the thesis report.

## Deliverables

- Implementation of the coverage measure tool in a high-quality and well-documented form.
- Final thesis written in conformance with TUM guidelines.
- Presentation of the work at the chair after the submission.

## Requirements

For this thesis topic, existing experience with Docker, TestContainers, and microservice development (ideally Springboot microservices with REST APIs) is highly required. Experience with OpenTelemetry might be an advantage. Very good skills in Java are required. This thesis topic is relatively implementation-heavy, so good programming skills are necessary.

## References

[1] Lewis, J., Fowler, M.: Microservices (Mar 2014), https://martinfowler.com/articles/microservices.html