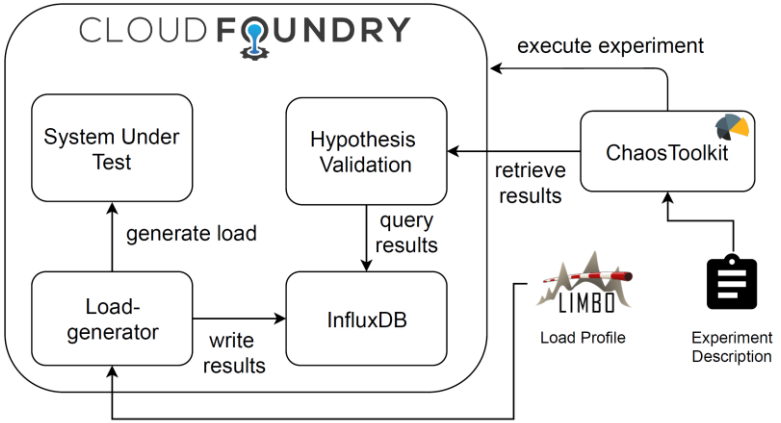
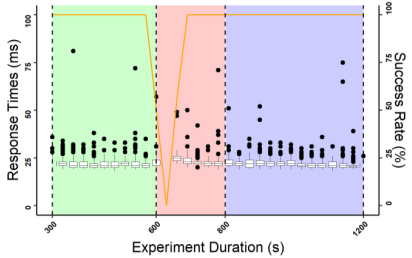
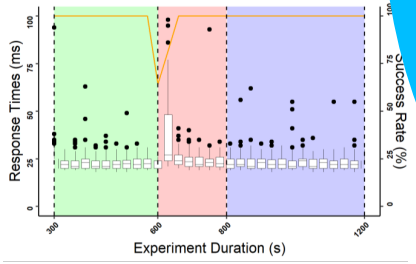
University of Stuttgart
Software Quality and Architecture Group







Scenario-based Resilience Evaluation and Improvement of Microservice Architectures: A Case Study

11th Symposium on Software Performance, 13.11.2020

André van Hoorn
Dominik Kesim
Joakim von Kistowski
Lion Wagner
Mir Alireza Hakamian
Sebastian Frank

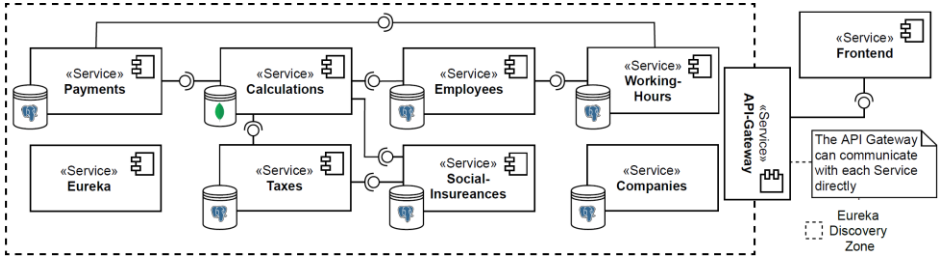
SQA Software Quality and Architecture Group

DATEV

Motivation

migration to microservice architecture

How can we evaluate resilience requirements to suggest architecture improvements?



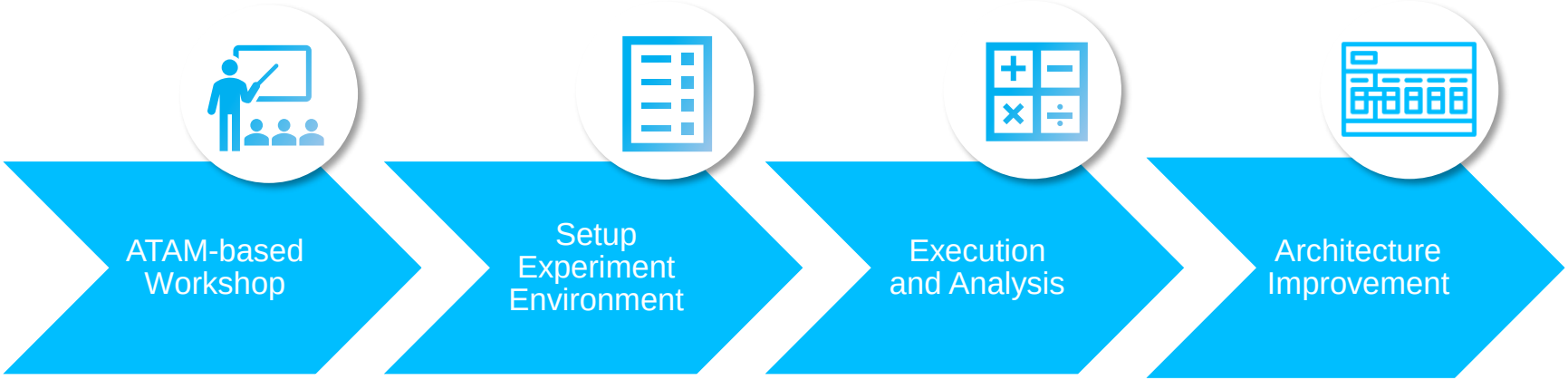
Goal

Explore the application and adoption of the ATAM for
resilience requirements elicitation and resilience testing
by using chaos experimentation for architecture assessment and improvement

Research Question:

How to leverage ATAM to elicit resilience requirements
to quantitatively evaluate resilience through
resilience experiments and suggest architectural improvements?

Research Process



ATAM-based Workshop

Session 1:
Architecture

Component & Use Case Diagrams

Session 2:
Hazard Analysis

Fault Tree

Session 3:
Scenarios

Post-It Notes

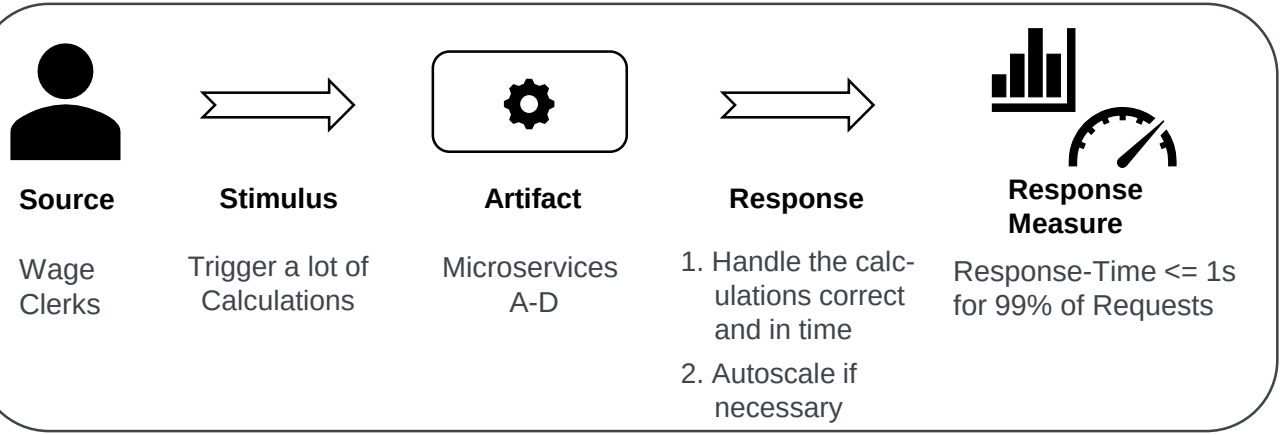
12
Resilience Scenarios

Participants

2x Architects
1x Quality Assurance
1x Product Owner

Software Scenarios — Example

Scenario

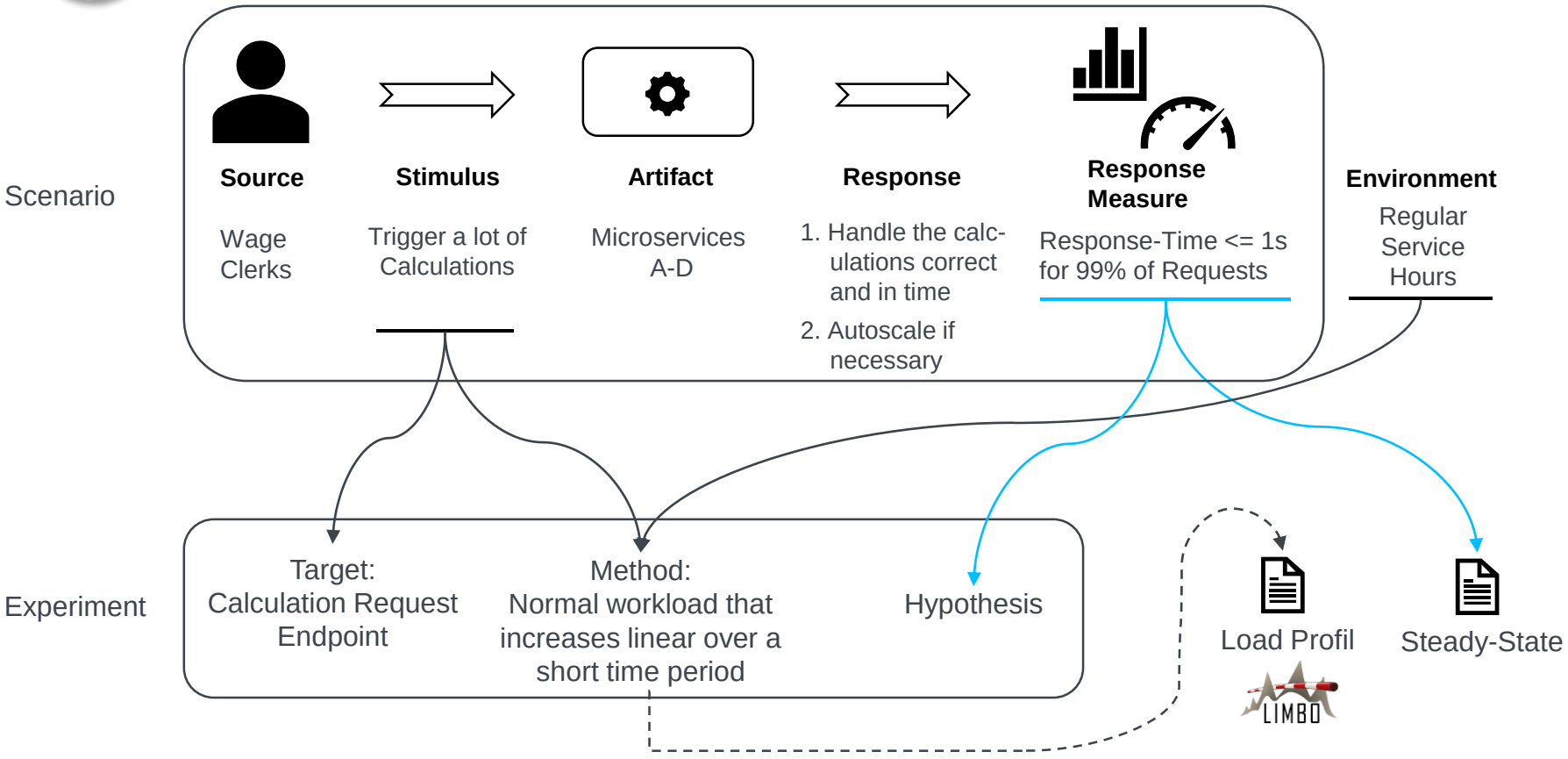


Source	Stimulus	Artifact	Response	Response Measure
Wage Clerks	Trigger a lot of Calculations	Microservices A-D	1. Handle the calc-ulations correct and in time 2. Autoscale if necessary	Response-Time <= 1s for 99% of Requests

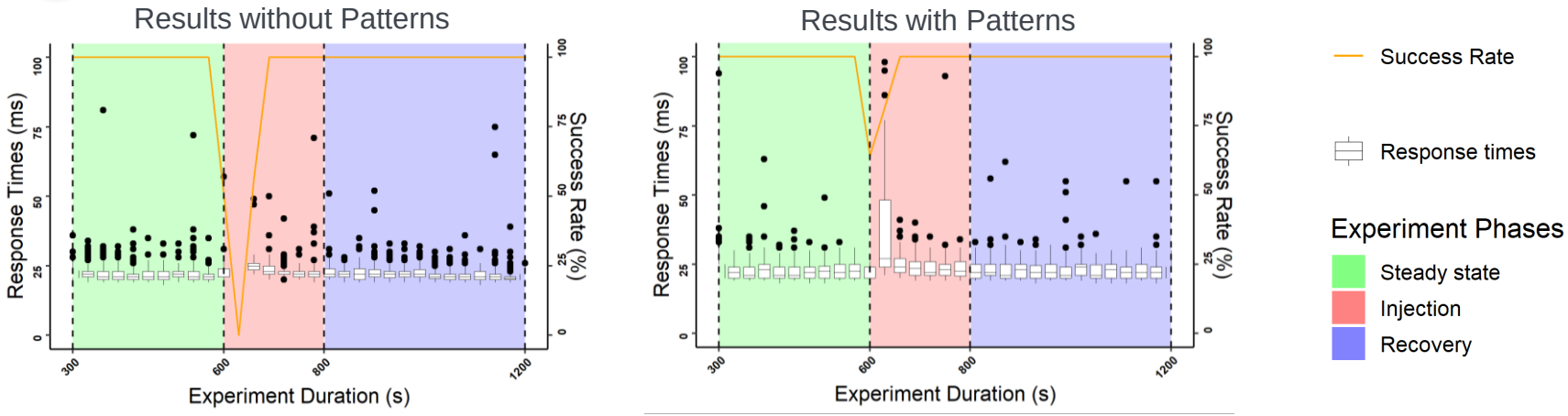
Environment

Regular Service Hours

Software Scenarios — Example



Experiment Results



- Application is able to recover from injected failures
- Improved Success Rate for the cost of slightly worse performance (higher mean of response times)
- Higher response times still satisfy scenario requirements

Selection of Resilience Patterns

NETFLIX
Eureka + Zuul

Load-Balancers

Resilience Libraries

Service Discovery Tools

Settled on Resilience4J Retry

+ Supports natural System Behavior

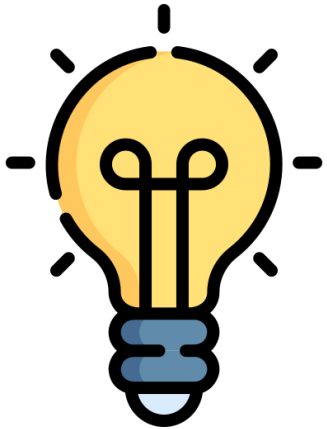
+ Great Spring Integration

Feedback and
Discussions

Conclusion & Lessons Learned

Resilience scenarios can successfully be transposed to chaos experiments

Eliciting resilience requirements increases hazard analysis



ATAM workshop requires considerable refinement that can be done offline

Chaos Experiments can be further automized