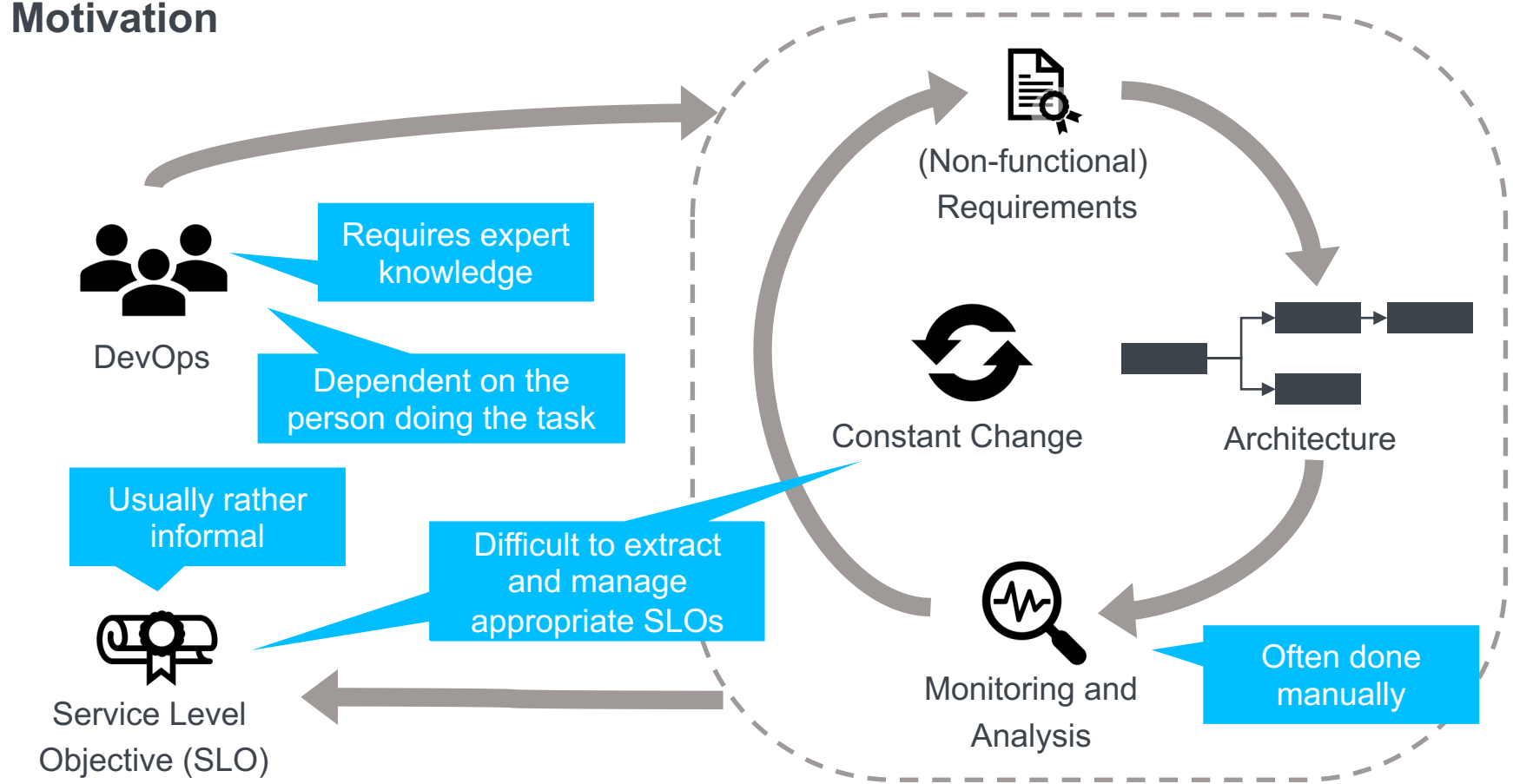
University of Stuttgart
Institute of Software Engineering (ISTE)
Software Quality and Architecture Group (SQA)

# Iterative and Incremental Refinement of Microservice-based Architectures and SLOs

Agility with Microservice Programming

Sandro Speth, Sarah Stieß, Sebastian Frank, and Steffen Becker

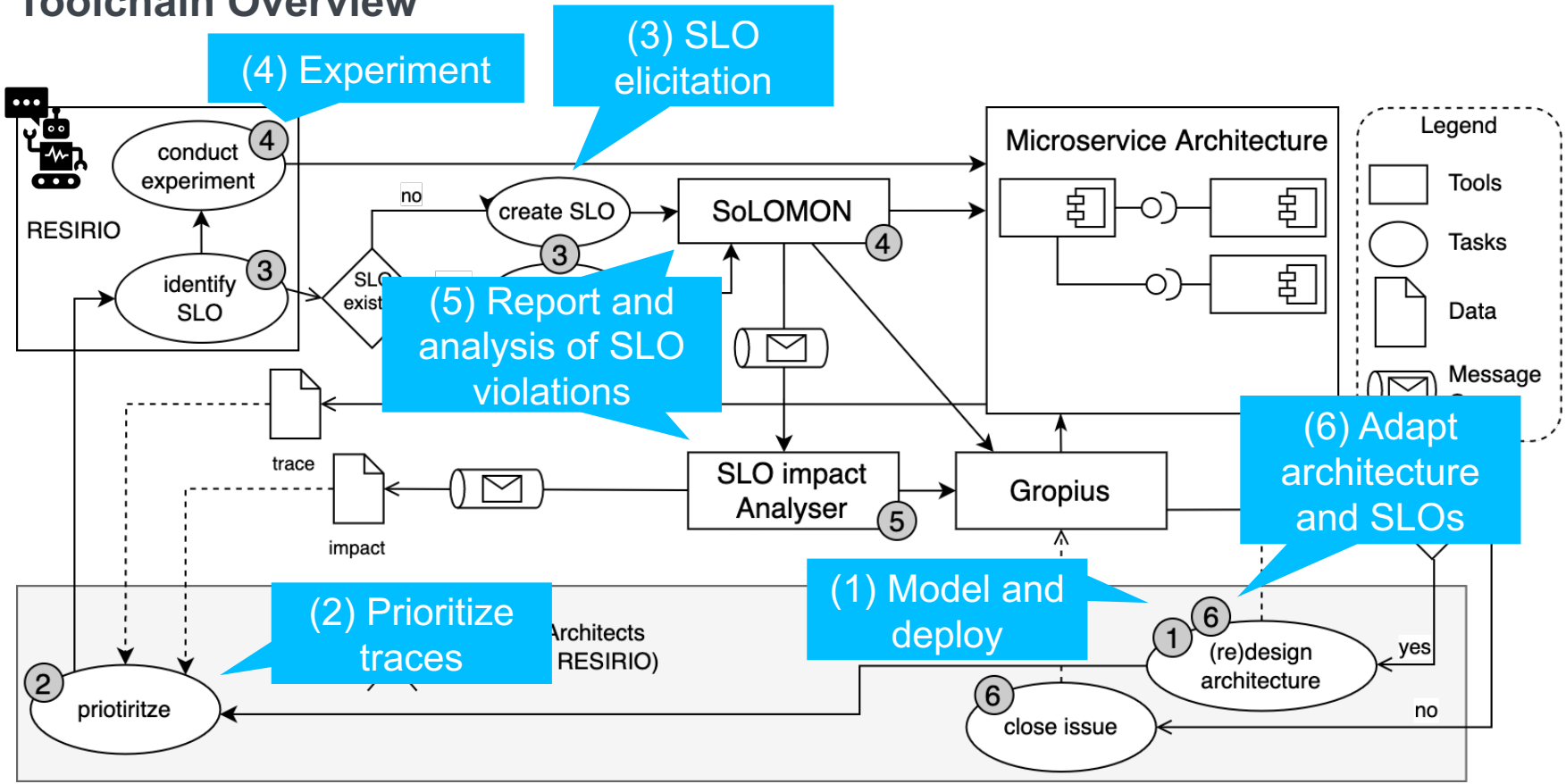
# Motivation


(Non-functional) Requirements
Requires expert knowledge
DevOps
Dependent on the person doing the task
Constant Change
Architecture
Usually rather informal
Difficult to extract and manage appropriate SLOs
Service Level Objective (SLO)
Monitoring and Analysis
Often done manually

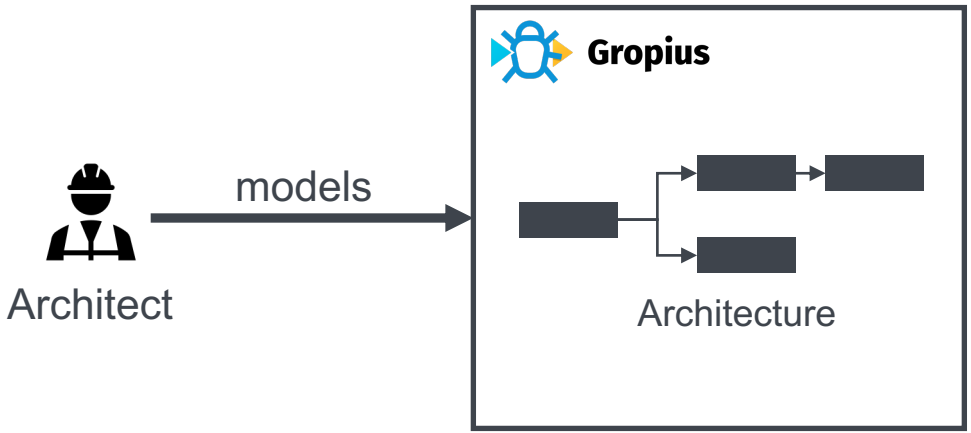
# Objective

We require an ***interactive*** toolchain to support the software architect in ***iteratively*** and ***incrementally adapting SLOs*** and ***architecture*** alongside each other

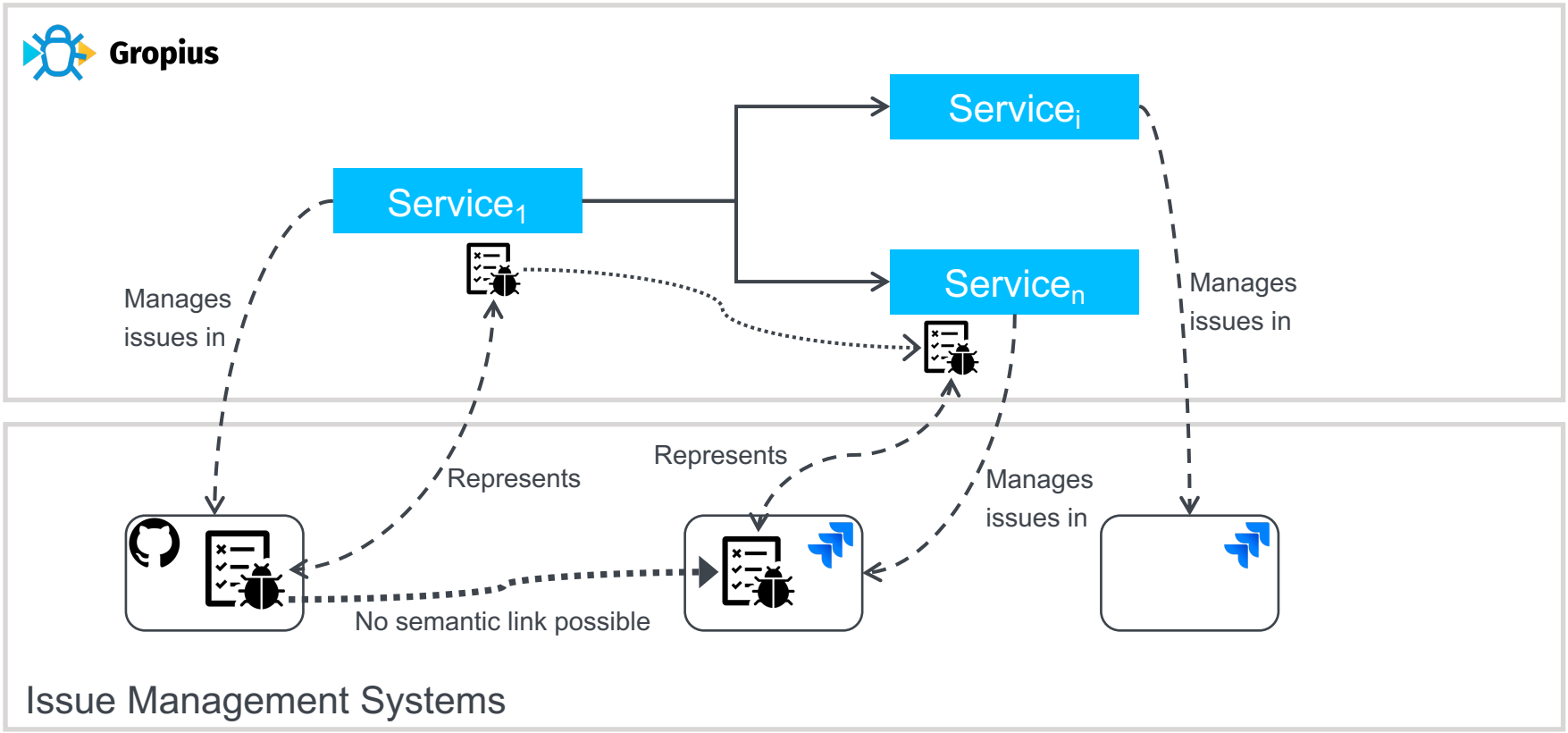
# Toolchain Overview



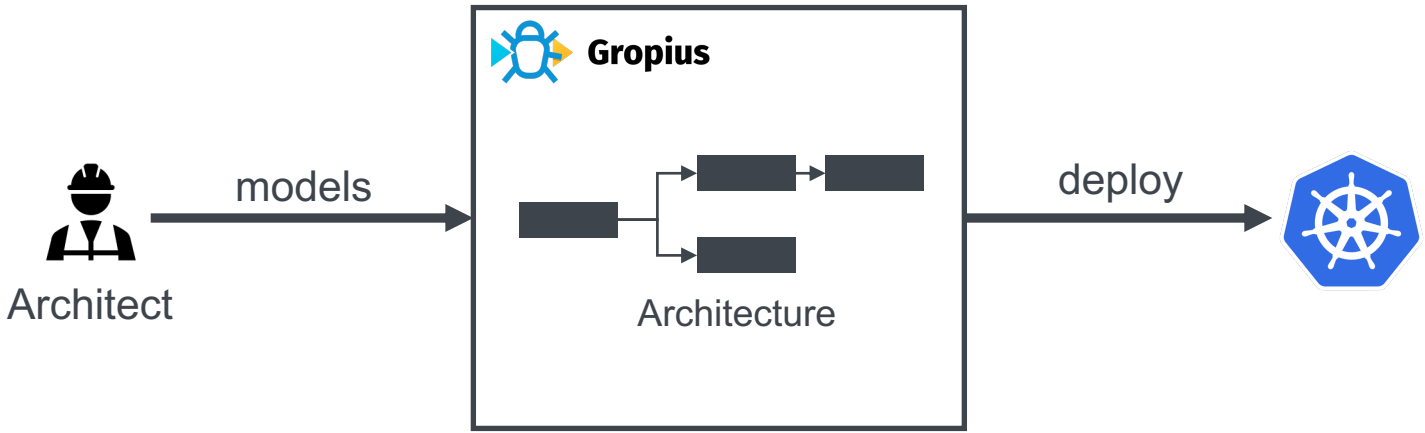
# Model and Deploy



# Gropius

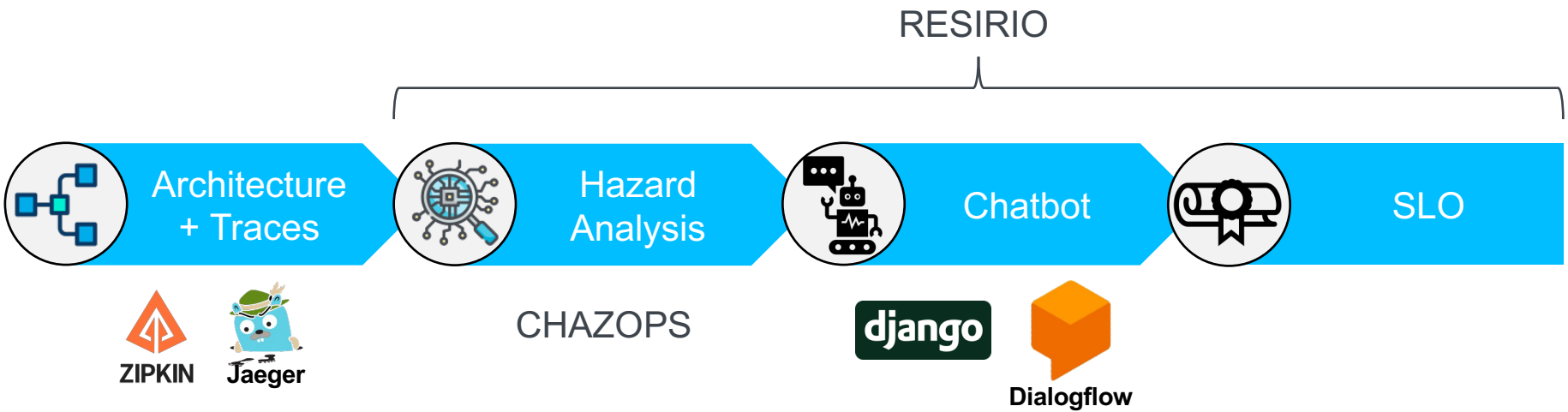

Gropius
Service$_i$
Service$_1$
Service$_n$
Manages issues in
Manages issues in
Represents
Represents
Manages issues in
No semantic link possible
Issue Management Systems

# Model and Deploy



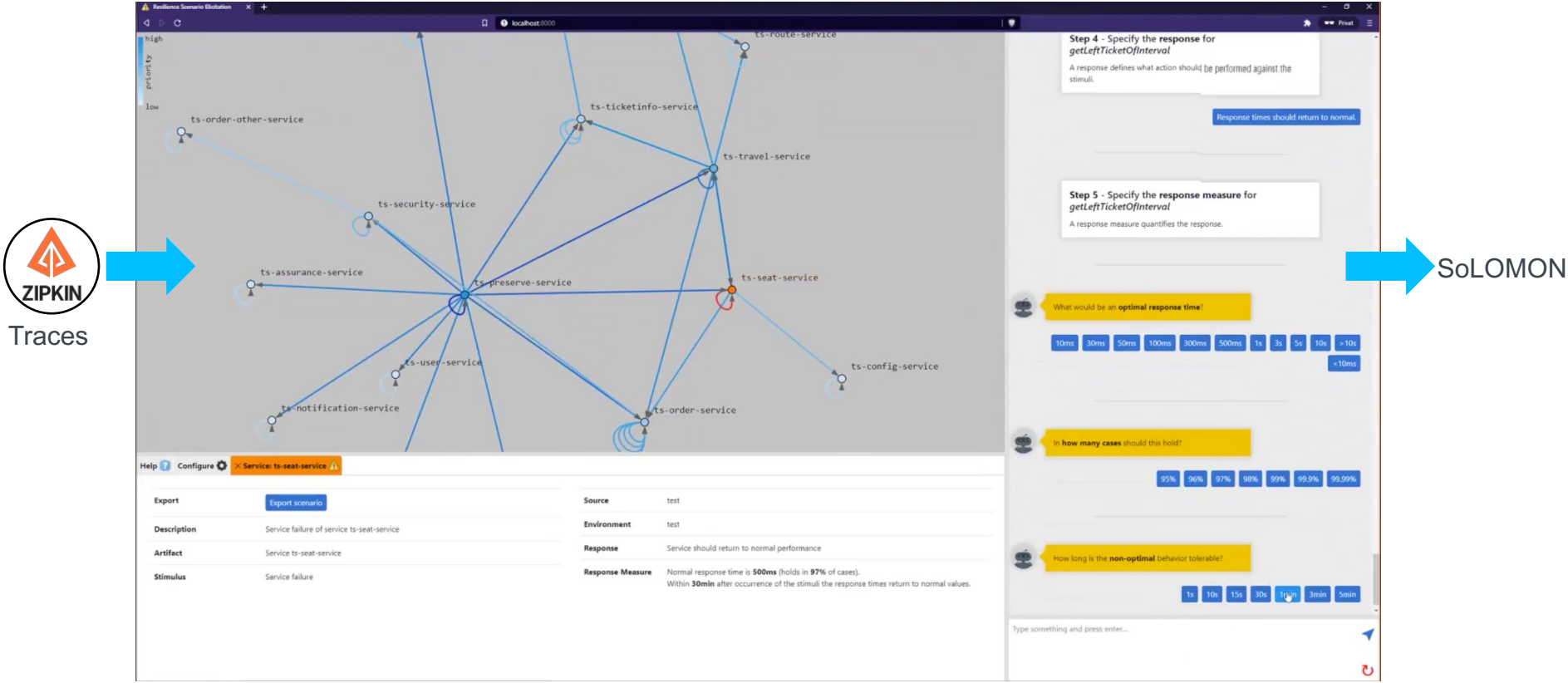
[1, 6]

# Prioritize Traces

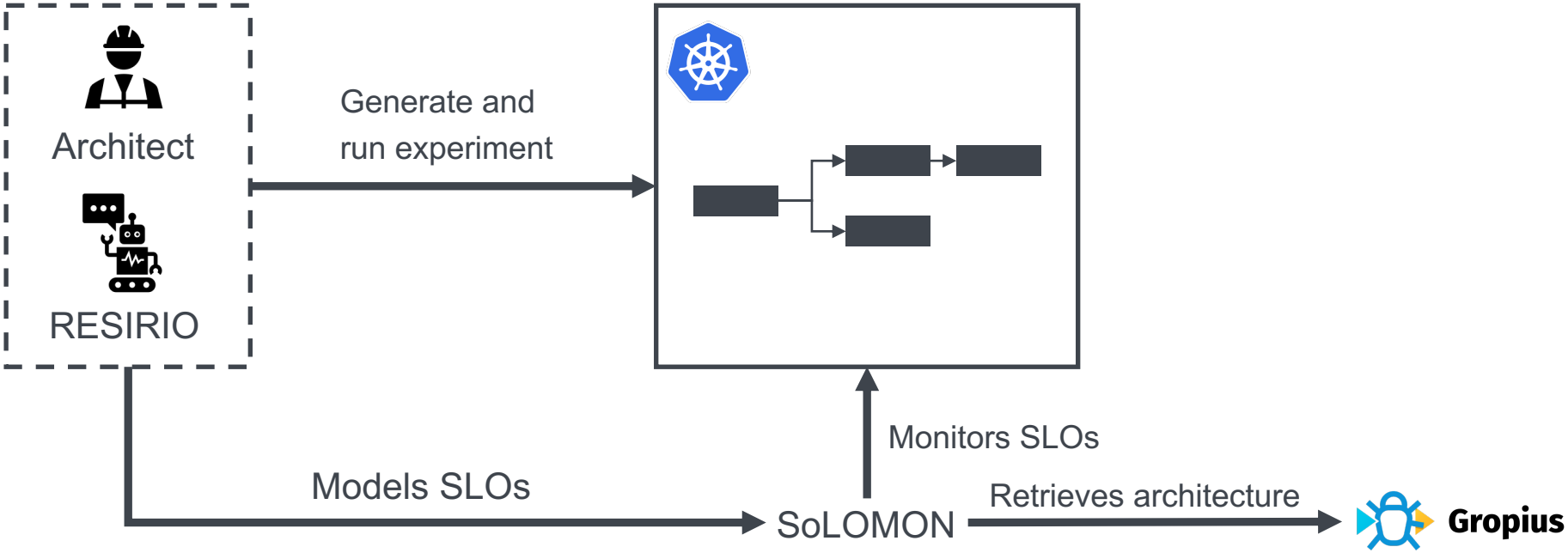


# SLO Elicitation

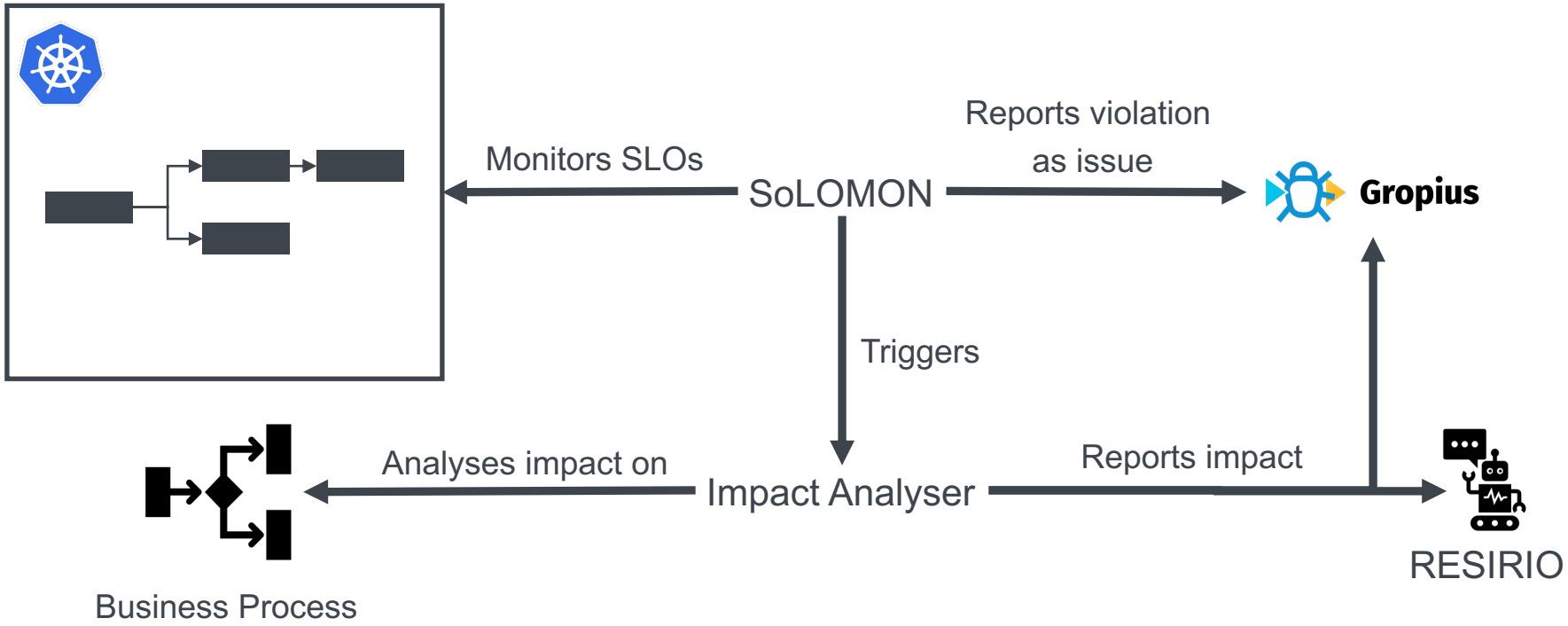
[1, 6]



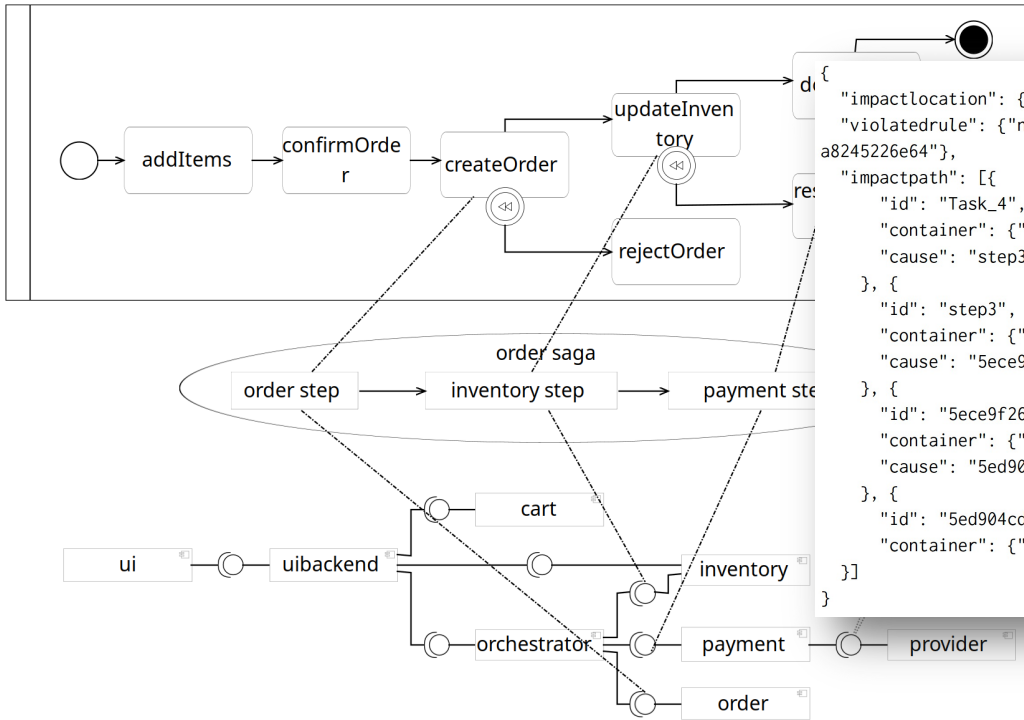
# Conduct Experiment



# Reporting and Analysis of SLO Violations



# Impact Analyser





```
{
  "impactlocation": {"name": "doPayment", "id": "Task_4"},
  "violatedrule": {"name": "provider_avail_avg_slo", "id": "5e25b2a4-6b5d-4317-95e7-6
a8245226e64"},
  "impactpath": [{
      "id": "Task_4", "name": "doPayment", "type": "Task",
      "container": {"id": "Process_1", "name": "OrderTeaProcess", "type": "Process"},
      "cause": "step3"
    }, {
      "id": "step3", "name": "payment step", "type": "SagaStep",
      "container": {"id": "saga1", "name": "order saga", "type": "Saga"},
      "cause": "5ece9f26e02c501a"
    }, {
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      "container": {"id": "5ece9eacff6c500f", "name": "payment", "type": "Component"},
      "cause": "5ed904cd2ff07003"
    }, {
      "id": "5ed904cd2ff07003", "name": "provider-cs", "type": "ComponentInterface",
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  }]
}
```
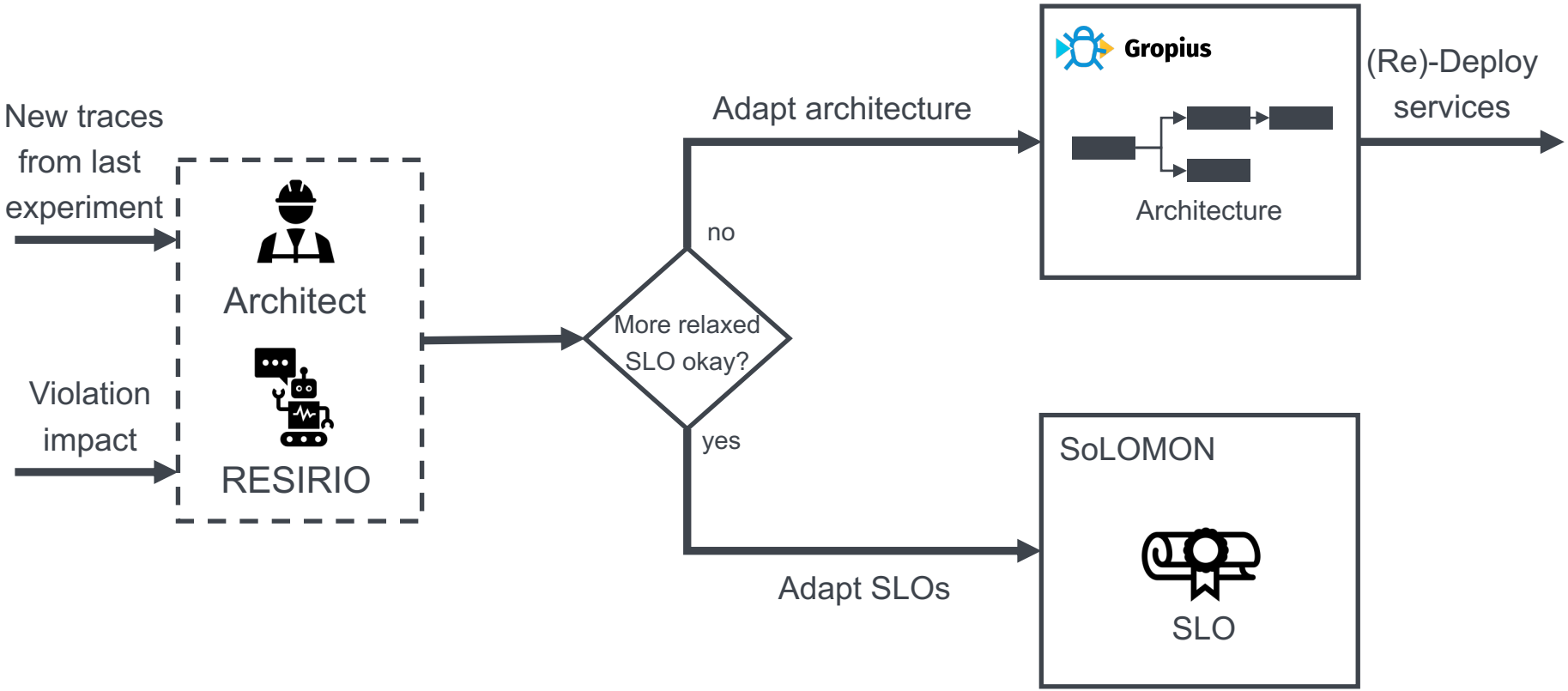
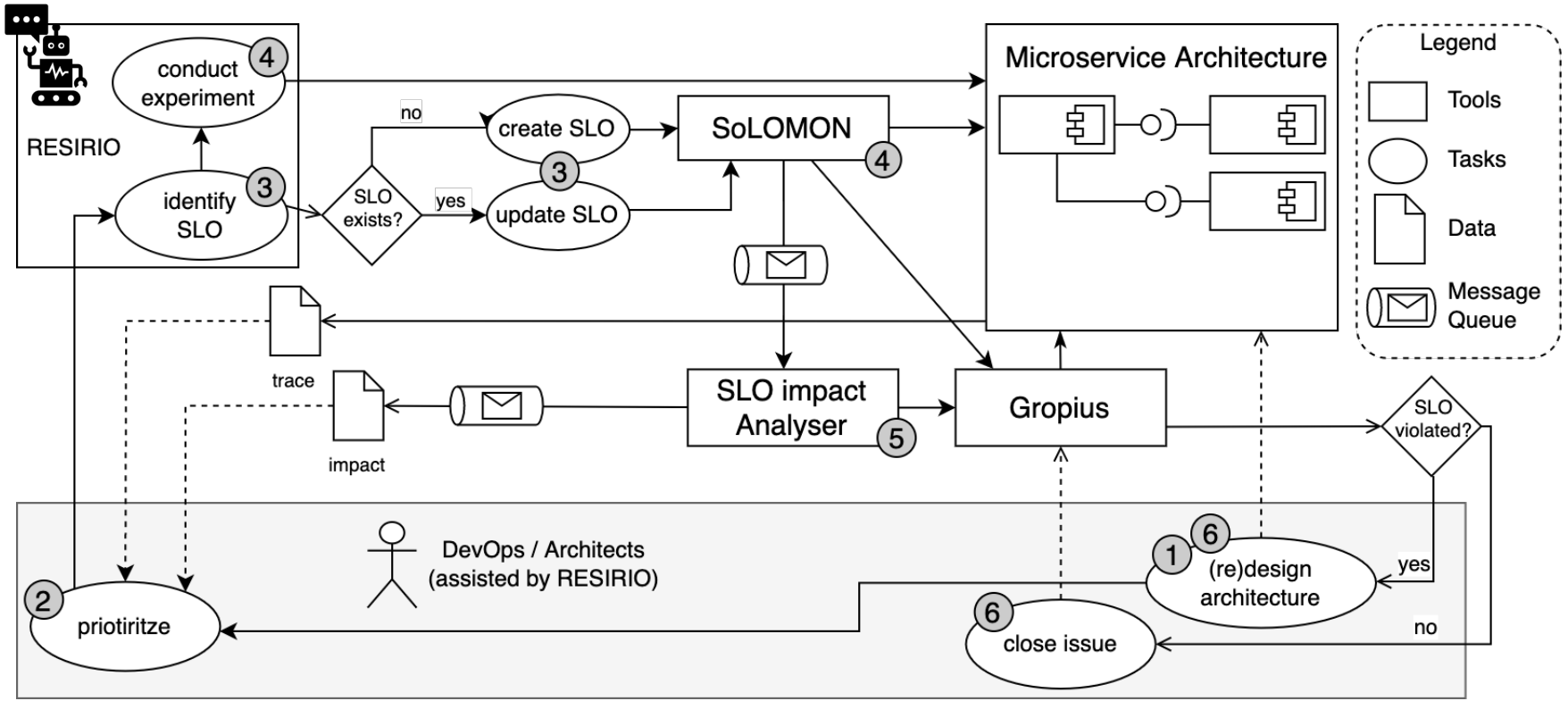

# Adapt Architecture and SLOs



# Summary


RESIRIO
conduct experiment
4
identify SLO
3
SLO exists?
no
yes
create SLO
3
update SLO
SoLOMON
4
Microservice Architecture
Legend
Tools
Tasks
Data
Message Queue
trace
impact
SLO impact Analyser
5
Gropius
SLO violated?
yes
no
DevOps / Architects (assisted by RESIRIO)
2
priotiritze
1
6
(re)design architecture
6
close issue

# References

[1] S. Frank, A. Hakamian, L. Wagner, D. Kesim, and A. van Hoorn, “Scenario-based Resilience Evaluation and Improvement of Microservice Architectures: An Experience Report.,” 2021.

[2] S. Speth, “Semi-automated Cross-Component Issue Management and Impact Analysis,” in Proceedings of 2021 36th IEEE/ACM International Conference on Automated Software Engineering (ASE), Nov. 2021, pp. 1090–1094. doi: 10.1109/ASE51524.2021.9678830.

[3] S. Speth, S. Becker, and U. Breitenbücher, “Cross-Component Issue Metamodel and Modelling Language,” in Proceedings of the 11th International Conference on Cloud Computing and Services Science (CLOSER 2021), May 2021, pp. 304–311. doi: 10.5220/0010497703040311.

[4] S. Speth, U. Breitenbücher, and S. Becker, “Gropius — A Tool for Managing Cross-component Issues,” in Software Architecture - Proceedings of the 14th European Conference on Software Architecture (ECSA 2020), Sep. 2020, vol. 1269, pp. 82–94.

[5] S. Stieß, “Tracing the Impact of SLO Violations on Business Processes across a Microservice Architecture with the Saga Pattern,” Master’s Thesis, University of Stuttgart, 2021.

[6] C. Zorn, “Interactive Elicitation of Resilience Scenarios in Microservice Architectures,” Master’s Thesis, University of Stuttgart, 2021.

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# Thank you!

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