University of Stuttgart
Germany

Simulation-based resilience prediction of microservice architectures

Proposal Fachstudie

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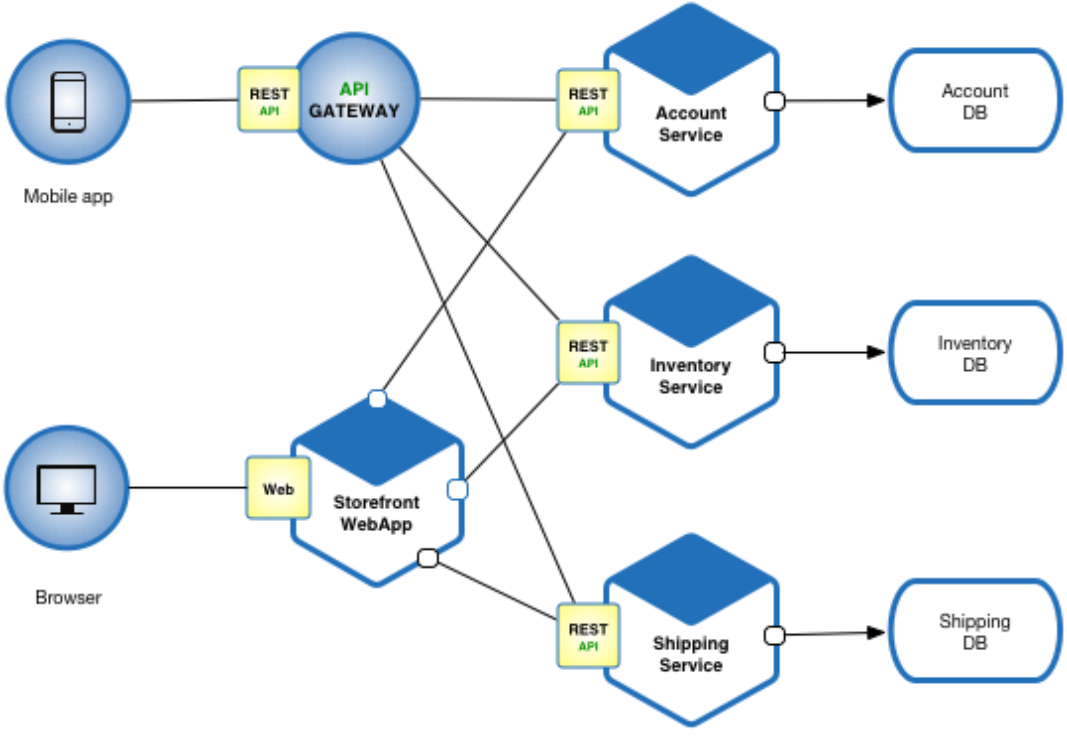
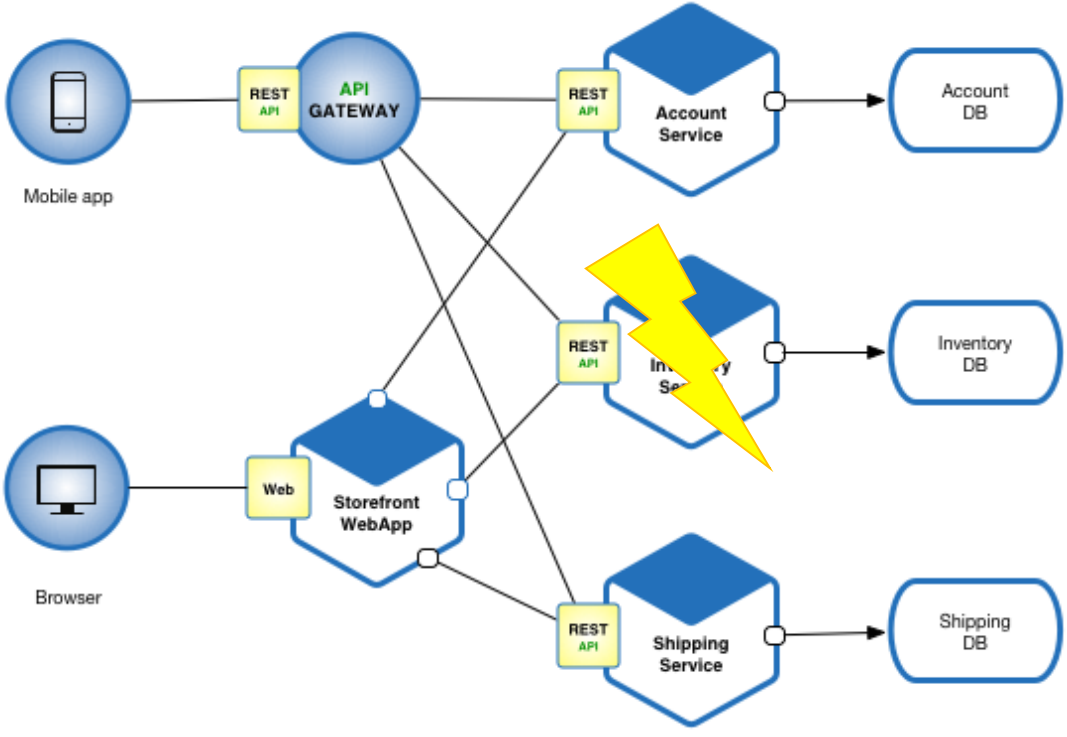
Microservice Architecture



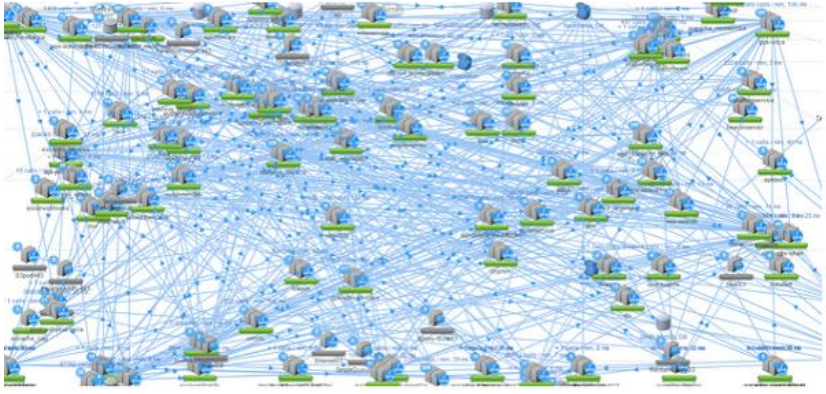
http://microservices.io/i/Microservice_Architecture.png

Failures in Microservice Architectures



http://microservices.io/i/Microservice_Architecture.png

Complexity of Microserivce Architectures



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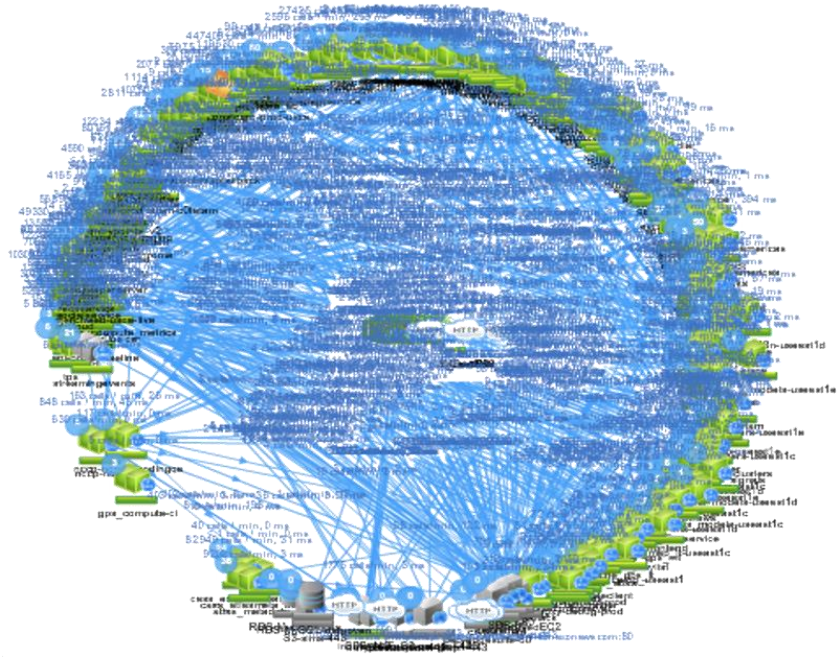
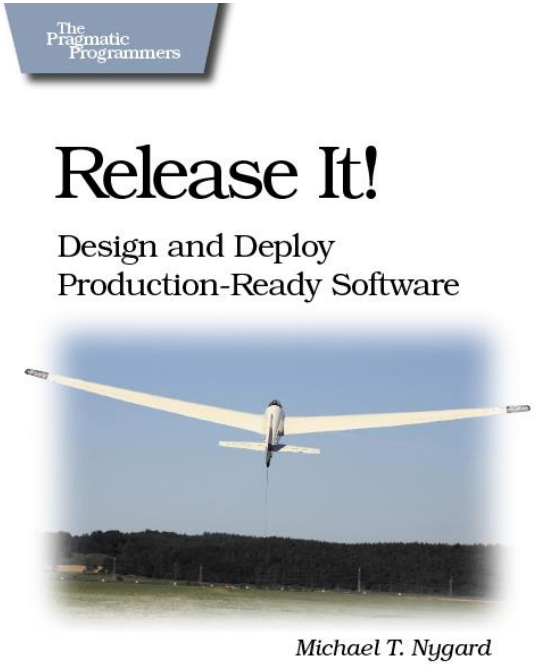


http://www.embarc.de/wp-content/uploads/2015/07/Abbildung-1-copy.png

Stability/Resilience Patterns

- Common architecture patterns are used (Circuit Breaker)
  - The use of patterns is not visible to the outside
  - Effectiveness of patterns only shown to gathered metrics



Do my resilience mechanisms work as expected?

Conclusion

Does a microservice shutdown propagate through the overall system?

State of the Art

Resilience Testing in Microservices

- Simian Army (Netflix)

- Search Chaos Monkeys (Azure)

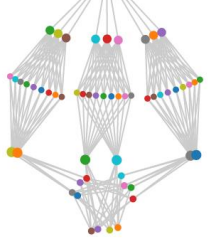
  ➡ Only working in a real time environment

State of the Art

Architecture Simulation for QoS Evaluation

CloudSim

Palladio/SimuLizar



Spigo

Further alternatives are objective of research

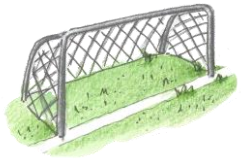
State of the Art

Limitations

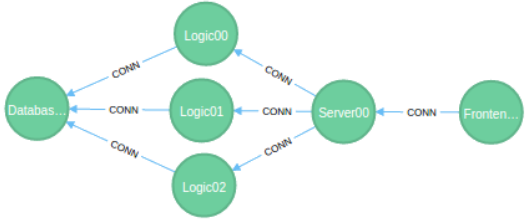
- Resilience testing in production environment is dangerous and expensive
- Most current simulators can’t simulate occurrence of failures
- Or are not mature enough (Spigo)

https://1wpnews.files.wordpress.com/2013/02/limitations.jpg

Goals

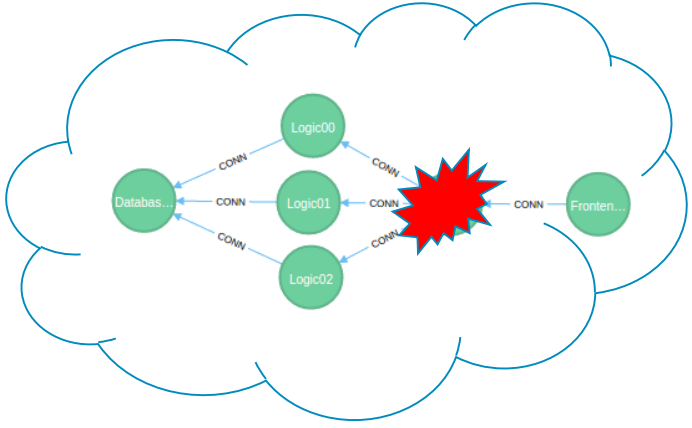


- Offline simulation of microservices



{"serviceName":"Frontend","dependency":"Server","count":"1"}
{"serviceName":"Server","dependency":"Logic","count":"1"}
{"serviceName":"Logic","dependency":"DataBase","count":"3"}
{"serviceName":"DataBase","dependency":"","count":"1"}
{"serviceName":"ChaosMonkey","Killing":"","count":""}

Goals



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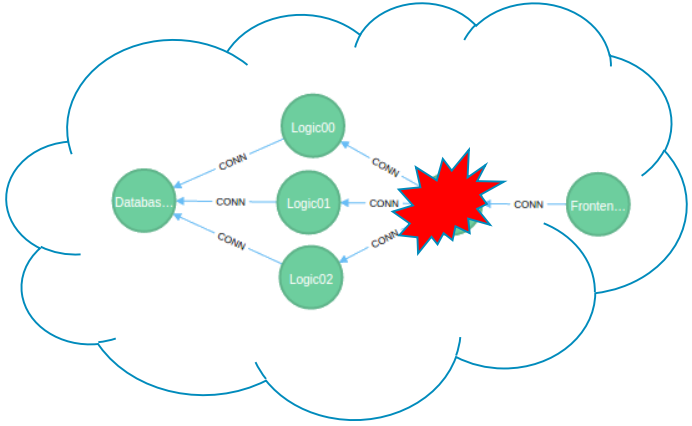


Output:

Status:

System crashed

Trace:

Server dependency is not running anymore

Solution Approaches

- Research and evaluation for existing solutions

- Development of a simulation tool:
  - Create a new tool
  - Expand an existing tool

http://crooksandliars.com/files/primary_image/15/10/fsolution.png

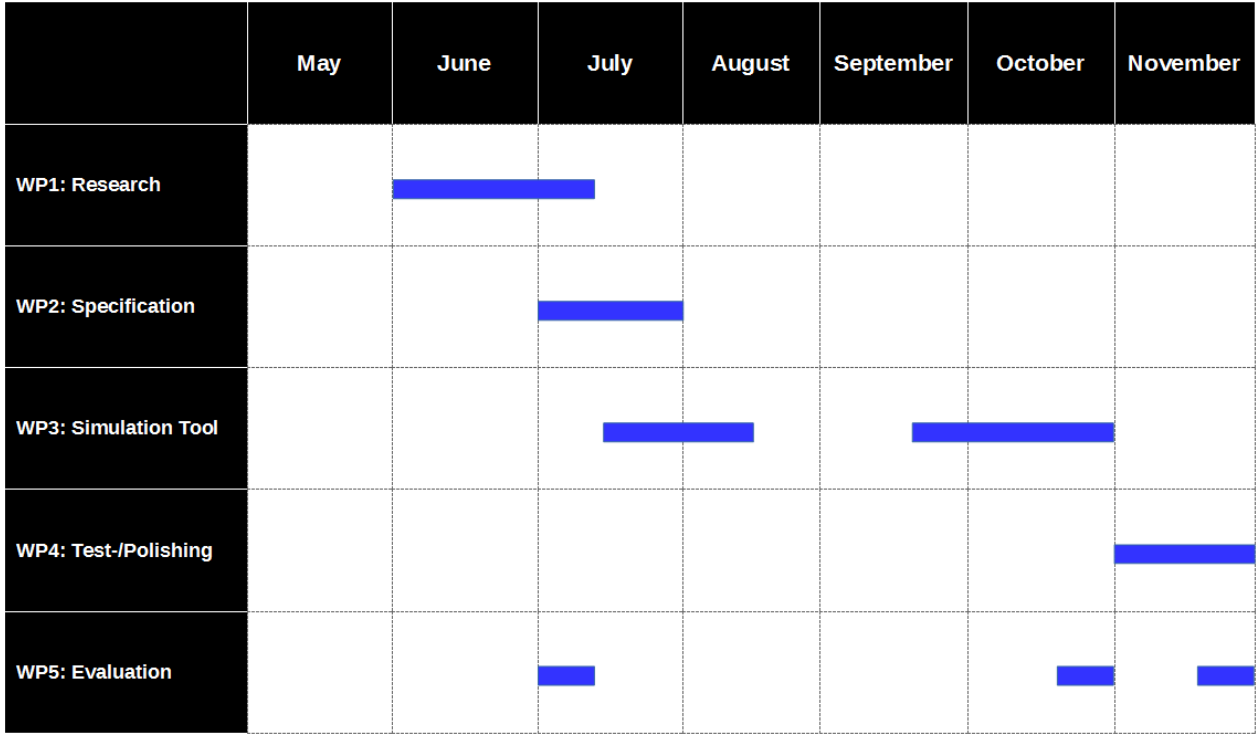
Agenda

- Research
  - What is the state of the art and what tools could be used for our purposes?
- Specification
  - What kind of metrics should we use?
  - Input, Output, Error modes, Events, Description language

- Simulation Tool
  - What should our Simulator for microservice architectures with resilience prediction achieve?
- Evaluation
  - What are the results of our work?

http://www.snoug.ch/SNOUG/webXNew.nsf/0/32CC27AD84423A45C1258048002F33C0/$FILE/agenda2.jpgh

Agenda


May
June
July
August
September
October
November
WP1: Research
WP2: Specification
WP3: Simulation Tool
WP4: Test-/Polishing
WP5: Evaluation