Simulation-based resilience prediction of microservice architectures

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Abstract. Current software simulators are tailored towards one specific purpose of conservative software simulation. Given the success of these tools it would be useful to run these tools on microservice architectures. This paper will focus on the development of a simulator that can be used for microservice architectures.

1 Introduction

Hier werden wir beschreiben was wir erreicht haben und wie wir unser Projekt angegangen sind. Es wird außerdem erläutert wie wir in diesem Paper vorgehen und was für Themengebiete genauer betrachtet werden.

2 Research

2.1 Tools in Comparison

Spigo During our research on existing tools for microservice simulation we discovered a tool called spigo. It was written by Adrian Cockcroft a Amazon Web Services employee in the programming language go. Therefore the name spigo comes from Simulate Protocol Interactions in Go.
On the first view the tool looked very promising. Spigo contains a fairly simple JSON input and the structure of the parameters is intuitive. Each microservice architecture consists of multiple microservices. Each microservice has a name, a package inheritance a counter of the instances and dependencies to other microservices. The reason we like this tool is because it can simulate the occourence of an error. Spigo uses the error monkeys from the simian army. But here lies already on of the biggest disadvanteges. One can only simulate the failure of a single microservice during the execution.

Simulizar Simulizar is an extension of the Palladio Component Model. The tool is able to adapt to changes that the software under simulation does at runtime. This helps i.e. at observing on load-balacing.

- analyizing self-adaptive systems (cloud-computing)

– non functional property prediction (performance/reliability/maintenance/-cost)
– modeldriven architecture
– helps to find bottlenecks/load-/scalingproblems

GreenCloud With this tool we tried a different approach. Greencloud was designed to calculate the energy consumption of datacenters[1, P.1]. Knowing that this was kind of a long shot we had the idea to take a simulator that simulates distributed objects and map microservice abilities and requirements to these objects. Since the simulator was written to overlook datacenters and their components, a mapping would mean that the entire microservice system would be mapped to a datacenter in the current GreenCloud simulator. Instances of microservices would compare to a server[1, P.2] that gathers metrics. These metrics are currently power consumption, CPU- utilization and workload [1, P.3] should be changed or replaced to throughput,workload and whatever metrics we require from a microservice. GreenCloud also includes connections[1, P.3] between servers. The connection could possibly used to be a mapping of microservice connections, that we can interfere to implement chaos monkeys.
Sounding good in theory but taking a closer look at the tool some problems lead to a problems. The focus of GreenCloud is obviously the simulation of power consumption. The previous mentioned connection between servers is not actually modeled but just taken into consideration regarding the power consumption of switches that connect servers together. Additionally there is no sign of the possibility to scale Instances (servers) which is a major part in a microservice system. Lastly workloads are only specified as the computing power they require (e.g. 3 Million Instructions per Second)[1, P.3]. Communication or a differentiation between machines(DB, Workstation, ...) takes additional resources and is currently not taken into account. This would make mapping to a microservice architecture incredibly hard. In hindsight it seems to be not very likely that using GreenCloud would be a good idea. The differences between provided capabilities by GreenCloud and required capabilities by the new tool is just to large.

3 Simulatorspecification

4 Simulatordocumentation

5 Conclusions

These are my conclusions.

References

[1] D. Kliazovich, P. Bouvry, Y. Audzevich, and S. U. Khan. Greencloud: A packet-level simulator of energy-aware cloud computing data centers. In *2010 IEEE Global Telecommunications Conference GLOBECOM 2010*, pages 1–5, Dec 2010. doi: 10.1109/GLOCOM.2010.5683561.