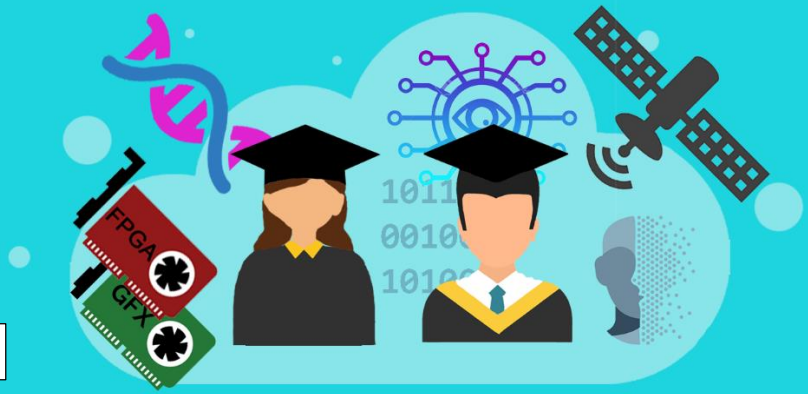


Diploma Thesis

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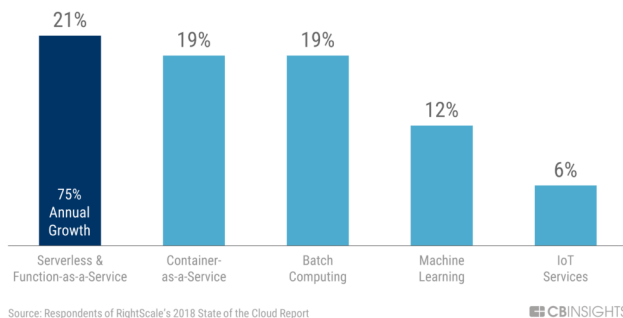


Automated Fine-Grained Resource Management on Serverless Computing Architectures

Serverless computing represents the next frontier in the evolution of cloud computing being an emerging paradigm that greatly simplifies the usage of cloud resources and suits well to many tasks. Today several public cloud vendors already support serverless. Examples include AWS Lambda (Amazon), Azure Functions (Microsoft), Google Cloud Functions and IBM Cloud Functions. A recent report from Markets and Markets reported that the serverless market is expected to reach USD 14.93B by 2023.

Serverless is the highest growth public cloud service

Adoption of public cloud services by broad cross-section of IT professionals as of January 2018



Serverless removes the burden of configuration and management issues (resource allocation, fault-tolerance, load balancing, availability, scalability and others) from the developers. On the other side, from the cloud provider's perspective, employing an "efficient" consolidation strategy to pack as many applications of different users as possible is challenging. Higher resource sharing leads to decreased performance predictability in serverless frameworks.

Figure 1: Serverless growth

further complicate this challenge.

Additionally, the fine-granularity nature of serverless computing and the heterogeneity of platforms offered (GPUs, FPGAs, etc)

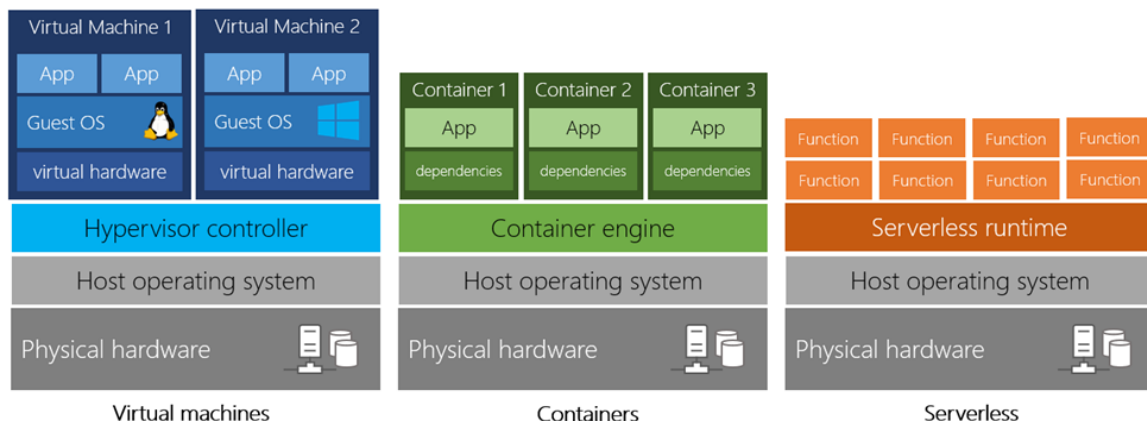


Figure 2: An overview of the evolution of virtualization technologies

In this thesis, we will explore different techniques in order to achieve high utilization of resources and high performance at the same time. First we will study the serverless paradigm, and then we will configure a state-of-the-art serverless open-sourced framework.

Keywords:

Cloud computing, Serverless Computing, Resource management, Kubernetes, High Performance Computing (HPC)

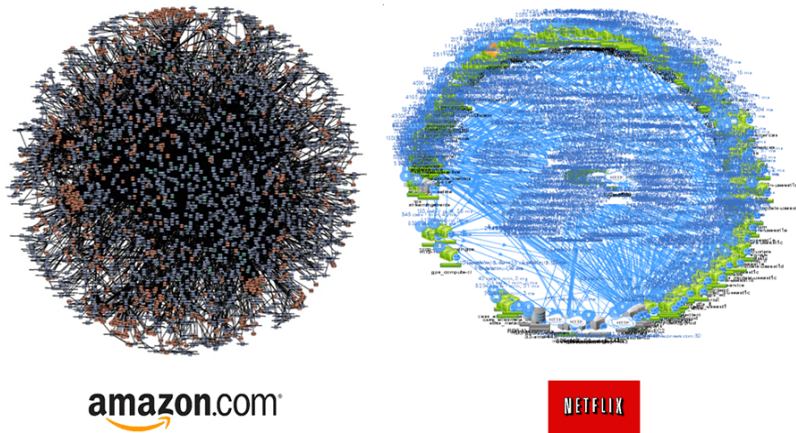


Figure 3: Microservice-architecture adopted by leading organizations

Related Work:

- [Gan, Yu, et al. "An open-source benchmark suite for microservices and their hardware-software implications for cloud & edge systems." Proceedings of the Twenty-Fourth International Conference on Architectural Support for Programming Languages and Operating Systems. 2019.](#)
- **OpenWhisk**
- [Serverless introductory video by AWS Lambda](#)

Prerequisites:

- Linux, Bash/Shell scripting, eager to learn new things
- Experience on other programming languages (Golang/Python/Java) would be a plus

Knowledge & Experience the student will acquire:

- A broader understanding of cloud computing architectures
- Research experience
- Research various state-of-the-art, open-source frameworks (Kubernetes, Knative OpenLambda)

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