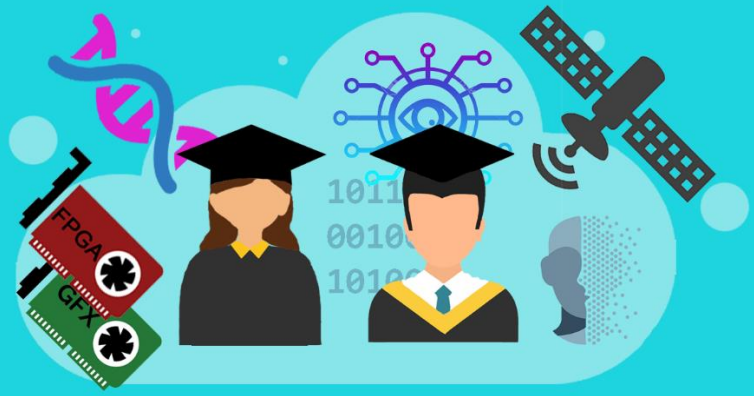


Diploma Thesis

Microprocessors and
Digital Systems
Laboratory

Academic year 2021-2022



Serverless Computing Topics

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 architecture market is expected to reach USD 21.1B by 2025.

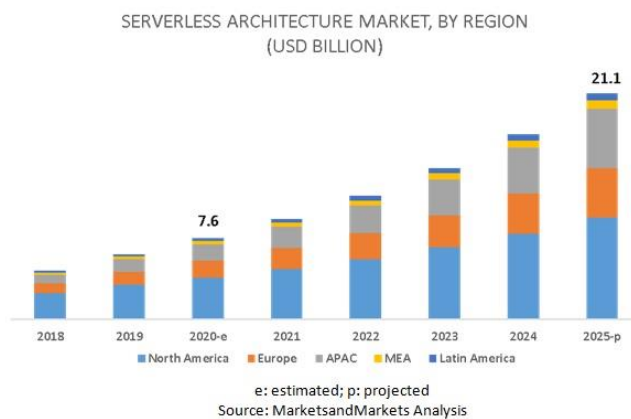


Figure 1: Serverless growth

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.

Additionally, the fine-granularity that characterizes serverless computing and the heterogeneity of platforms offered (GPUs, FPGAs, etc) further complicate this challenge.

The diploma thesis topic can be any including but not limited to the following:

1. Interference- & Heterogeneity-aware Serverless function placement
2. Function-level scheduling in Serverless workflows deployed on shared Virtual Machines
3. Explore vertical and horizontal auto-scaling on heterogeneous machines
4. Function composition into containers & pro-active container initialization
5. Energy-Cost prediction of serverless workflow execution
6. ...

Keywords:

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

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.](#)
- [SAND: Towards High-Performance Serverless Computing](#)
- [Apache OpenWhisk](#)
- [Serverless introductory video by AWS Lambda](#)

Prerequisites:

- Linux, Bash/Shell scripting, eager to learn new things
- Experience on other programming languages, e.g. Golang, Python, would be a plus

Knowledge & Experience the student will acquire:

- A broader understanding of cloud computing architectures
- Work on technologies for automation and deployment
- Research, and become familiar with various state-of-the-art, open-source frameworks, (i.e., Kubernetes, Knative, Apache Openwhisk)

Contact:

Achilleas Tzenetopoulos Ph.D. student: (atzenetopoulos@microlab.ntua.gr)

Dimosthenis Masouros Ph.D. student: (dmasouros@microlab.ntua.gr)

Sotirios Xydis Ass. Prof.: (sxydis@microlab.ntua.gr)

Dimitrios Soudris Prof.: (dsoudris@microlab.ntua.gr)