# Towards Network-Aware Resource Provisioning in Kubernetes for Fog Computing applications

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**Abstract -**

## 1 Introduction

- Starting with the IoT devices
- Management of IoT devices, transitioning from Cloud to Fog Computing
- some use-cases of IoT using fog computing
- Fog computing Infrastructure
- VMs vs Container-based solutions (VM Cloud infra vs Kubernetes)
- Kubernetes brief overview
- Kubernetes in-terms of Fog Computing (network consideration and issues)
- last paragraph about proposed solution for network related issues, and strucutre of seminar paper

In recent years with the evolution of technology, Internet of Things (IoT) devices are increasing day by day. According to Ericsson mobility report[], there will be 17% (approx. 22.3 billion) increase in IoT devices by 2024. Functionally IoT is defined as "The Internet of Things allows people and things to be connected Anytime, Anyplace, with Anything and Anyone" [**European commission 2008**]. IoT devices have served mankind in ways such as from smart houses to smart cities, smart transportation systems and many medical applications. These IoT applications enables many devices connected to network and generates alot of heterogeneous data also known as BigData which requires special data processing models and Infrastructure support. But with the increasing number of devices, orchestration, communication between these devices and data generation are one of the main problems that need to be addressed.

## 2 Backgroud

- Kubernetes Internal Archietecture and Main Components
- Kubernetes works as an Orchestrator
- Kubernetes resource provisioning
- Concluding the section with pitfals of default scheduler of Kubernetes

### 2.1 Kubernetes Main Components

- Write about the Archietecture of Kubernetes with diagram
- Write about the building blocks of Kubernetes and their working

### 2.2 Kubernetes as Orchestrator

- Orchestrator main functions
- Comparison of available Orchestrator (OpenStack vs Kubernetes)

- Workflow of Kubernetes as an Orchestrator (steps)

### 2.3 Kubernetes Resource Provisioning

- write about the default Kubernetes scheduler
- its main Components
- workflow of default scheduler

## 3 Kubernetes Network-based Resource Provisioning

- write about why we need network-based resource provisioning
- main factors consideration (e.g bandwidth and latency)
- workflow of network-based scheduler

## 4 Performance Evaluation

- Write about the considered use-case of Fog Computing for Evaluation

### 4.1 Expermentation Setup

- setup of Kubernetes base on the mentioned use-case of Fog Computing with diagram

### 4.2 Analysis of Kubernetes Default and Network-based Resource Provisioning

- write about the Performance difference between default Kubernetes scheduler and network based scheduler with supporting result tables and graphs

## 5 Comparison of Network-based Resource Provisioning Solutions

- Compare different solutions based on the following criteria:

### 5.1 Orchestrator

- write about the differences between Kubernetes(main-paper)[3] and other available cloud solutions such as Fogernetes[4] and [2].

### 5.2 Resource Provisioning Techniques

- difference between different resource scheduling techniques such as [5], [1] etc.

## 6 Conclusion

## 7 Further Research Topics

- after writing the seminar, if there is any improvement that can be done, will be added in this section.

## References

[1] D. Haja, M. Szalay, B. Sonkoly, G. Pongracz, and L. Toka. "Sharpening Kubernetes for the Edge". In: https://dl.acm.org/doi/10.1145/3342280.3342335. SIGCOMM 2019 - Proceedings of the 2019 ACM SIGCOMM Conference Posters and Demos, Part of SIGCOMM 2019, 2019.

[2] A. Reale, P. Kiss, M. Tóth, and Z. Horváth. *Designing a decentralized container based Fog computing framework for task distribution and management*. Tech. rep. http://www.naun.org/main/UPress/cc/2019/a022012-044.pdf. 2019.

[3] J. Santos, T. Wauters, B. Volckaert, and F. De Turck. "Towards network-Aware resource provisioning in kubernetes for fog computing applications". In: http://physics.nist.gov/Document/sp811.pdf. IEEE Conference on Network Softwarization Unleashing the Power of Network Softwarization, NetSoft 2019, 2019.

[4] C. Wöbker, A. Seitz, H. Mueller, and B. Bruegge. "Fogernetes: Deployment and management of fog computing applications". In: https://ieeexplore.ieee.org/document/8406321. IEEE/IFIP Network Operations and Management Symposium: Cognitive Management in a Cyber World, NOMS 2018, 2018.

[5] L. F. Bittencourt, J. Diaz-Montes, R. Buyya, O. F. Rana, and M. Parashar. "Mobility-Aware Application Scheduling in Fog Computing". In: (2017). https://ieeexplore.ieee.org/document/7912261.