## 1. Allgemeines

This dissertation deals with near real-time decision-making processes in resource-constrained computing environments at the edge of the network (e.g., micro data center, Raspberry Pi). The rising demands for Internet of Things (IoT) sensors require critical data processing closer to data sources. Driven by data trends, probability, and approximate data analytics, modern IoT systems should take proactive decisions relying on limited capabilities of edge infrastructures. Although there are several studies available, the state-of-the-art still lacks efficient data management strategies in near real-time edge analytics, especially, in targeting proactive IoT systems and critical decision-making processes. The main goal of this work is to provide a generic data management framework with integrated strategies and methods that should enable efficient and near real-time edge data analytics. Besides novel edge concepts and strategies showing the theoretical contribution, I aim to provide their practical applicability through novel algorithms and simulations based on sensor data coming from real-world IoT systems.

## 2. Ergebnisse

During the funding period, contributions and results of the work are published in two high-quality venues, IEEE Transactions on Services Computing (IEEE TSC) and European Conference on Software Architecture (ECSA). We propose complete EDMFrame, an edge data management framework featuring a generic mechanism for recovery of multiple gaps in incomplete datasets, using single-technique and multiple-technique recovery. Further, we devise an adaptive storage management mechanism for reducing data stored at the edge, keeping only the data necessary for predictive analytics. For better support of future edge analytics, a novel, holistic approach for architecturing elastic edge storage services is presented as well as seven principles for the architecture design and engineering of edge data services. Other preliminary results show promising solutions that can directly impact the quality of decision-making processes in time-sensitive IoT systems such as smart homes and smart cities.

## 3. Geplante weiterführende Aktivitäten

Although a major part of the research is finished, this work is not yet completed, and consequently, writing my PhD dissertation is still waiting for more research and publishing activities to be done. In Q3/2020 and Q4/2020 I plan to focus on final experimental procedures and remaining implementation parts as well as submitting work done in further conference/journal venues. The remaining work includes (i) validation of the symbolic data representation on edge analytics tasks; (ii) implementation of self-adaptive analytics placement based on data locality; (iii) completion of downsized, lightweight ML models for resource-constrained edge infrastructures. Final writings and revisions of PhD dissertation are planned for Q1/2021. Once PhD dissertation is officially accepted, it will be available on the project website under CC-BY according to the netidee agreement.

## 4. Anregungen für Weiterführung durch Dritte

IoT solution architects, system integrators, and developers can utilize given insights from this work and directly improve decision-making processes in IoT systems considering data movement, efficient data analytics, data management, and storage in resource-constrained edge infrastructures. Consequently, this can lead to having more intuitive systems and making the necessary transformation from reactive to proactive IoT systems as well as initiating the creation of novel IoT applications in different research and development (R&D) departments. Besides theoretical concepts that are available to the scientific community through several published conference and journal papers, the most important algorithms are also accessible through GitHub open source, thereby bringing high scientific values as well as practical values when dealing with real-world challenges.