Chair of Network Architectures and Services
Department of Informatics
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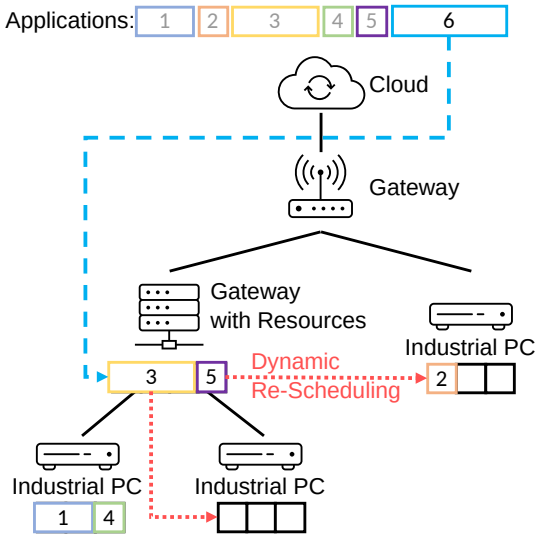
Thesis M.Sc.

Dynamic Scheduling of Applications in Edge Network Infrastructure

Motivation

Future manufacturing plants will be heavily using local edge / fog computing infrastructure. Such infrastructures need to enable the scheduling of applications on IIoT devices depending on their resources and Quality of Service (QoS) constraints e.g., latency, throughput or energy-efficiency. Since scheduling applications and satisfying QoS constraints is NP-hard, it cannot be solved efficiently in polynomial time. For the optimal scheduling, related work proposed the use of Integer Linear Programming [1, 2] and Dynamic Programming [3] with the drawback of poor scalability (increased time- and resource-consumption). Heuristics like [2, 4] and meta-heuristics like the genetic algorithm, particle swarm optimization and ant colony optimization approximate the optimal scheduling more time-efficiently.



Since the topology and constraints of an IIoT network can change over time due to maintenance, hardware failure, hardware upgrades or expansion, a previously optimal solution may not satisfy the QoS constraint in the new network and we need to reschedule some or all applications dynamically at run-time.

The goal of this thesis is to find and implement suitable scheduling approaches for just-in-time rescheduling of applications in an edge / fog computing infrastructure. Furthermore, the scalability of the implemented approaches should be evaluated against each other with a simulation (e.g. OMNeT++).

This thesis is done in cooperation with Siemens.

Your Task

- Find and implement suitable application scheduling algorithms
- Evaluate the performance of different approaches with a simulation and compare the advantages and disadvantages of each approach

Literature

[1] V. Cardellini, V. Grassi, F. Lo Presti, and M. Nardelli, "Optimal operator placement for distributed stream processing applications," in *Proceedings of the 10th ACM International Conference on Distributed and Event-Based Systems*, ser. DEBS '16. New York, NY, USA: Association for Computing Machinery, 2016, p. 69–80. [Online]. Available: https://doi.org/10.1145/2933267.2933312

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