Master Thesis – Optimized Transformation of Dataflow into Kubernetes Deployment

Background
Mobile telecommunication networks, especially 5G and coming 6G, are increasingly complex distributed systems that perform advanced computations. At the same time the timing constraints are very tight, both for the computations and the transport of data between compute nodes. Solutions for handling the complexity therefore must not add overhead to the processing of data. One track we investigate is to use dataflow modeling and from these models generate relevant parts.

The system-level parts of a dataflow implicitly describe a deployment, but we would like to use standard techniques like Kubernetes as much as possible for the actual management, so an automatic transformation is desirable. These cloud techniques however incur significant overhead in the transport of data so for our particular use-case, how can we tweak this into a zero-overhead framework?

Thesis Description
This thesis is divided into several steps with the end goal of showing a prototype and some measurements. The following steps are envisioned as part of the thesis work:

- Investigate how the Kubernetes framework can be tweaked to zero-overhead communications.
- Implement automatic transformation from dataflow model to Kubernetes configuration, as well as required tweaks of the Kubernetes framework and our in-house application source-code generator.
- Analyze performance of a generated deployment compared to a host-native variant.

The thesis will be concluded with a presentation of the results for the Ericsson team.

Qualifications
This project aims at students in computer science, computer engineering, electrical engineering or similar.

Extent
1-2 students, 30hp each

Location
Ericsson AB Mjärdevi, Linköping

Preferred Starting Date
Spring 2022

Keywords
System Modeling, Kubernetes, Containers, Low-level Networking, Go, C/C++, Optimization

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