COMPUTER SCIENCE
DATAVETENSKAP

Master/CivIng. Thesis Proposal 30 hp

Software Defined Networking Configuration Automation for TSN

For enabling Data-driven Industrial IoT applications that have tight constraints on latency and reliability, adding real-time capabilities to standard Ethernet within the context of IEEE 802.1, Time Sensitive Networking (TSN) is considered the key enabling technology for deterministic and convergent networks. TSN is a set of standards that cover different aspects of deterministic networking, including increased reliability, latency control, time synchronization and resource management. However, the many and complex configuration options make it very difficult to configure, manage and operate such networks. Configuration of TSN mechanisms must ensure that high priority and time-critical information is forwarded without interference. This entails complex procedures to define proper parameters for the time-aware scheduler and its reservation of timeslots for Ethernet frames.

TSN elements can be configured using distributed protocols or from a centralized point. Using distributed protocols leads to convergence problems and complex deployment. Software-Defined Networking (SDN) has received a lot of attention [3] because it allows applications to control the network and routing configuration in a dynamic way from a centralized entity. A control plane installs forwarding rules through a network operating system (NOX) [3]. This enables applications implemented on top of it to manage and configure network state through a north-bound API (NBI). SDN decouples forwarding logic and configuration from the data-plane elements, which makes SDN flexible and configurable. SDN enables the programmable and automatic update of network configurations, which makes SDN based architecture for TSN very promising.

The main aim of this thesis is to research how SDN principles can be used to build a network control plane that allows configuring the forwarding states and parameter configurations for TSN elements. The outcome will be an SDN-based architecture for TSN, architectural design of centralized network configuration (CNC) together with Open Source contributions to AccessTSN. CNC maintains a global network state (resources and topology) and uses this information to find a path that fits the communication requirements between TSN talkers and listeners along with proper resource configuration of involved TSN entities using a Network Optimizer. It issues proper configuration of TSN functions inside the TSN elements, which will implement a south-bound API using e.g. Netconf/YANG.

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