This work analyzes the adaption of a real-time communication network on the level of network components and on the protocol level. The adaptive network component is based on a reconfigurable Ethernet switch that adapts its resource utilization to the communication load and to the real-time requirements. By using a prototypical implementation of the reconfigurable switch, the data rates, the latency, and the jitter were evaluated for the different switch variants. The results prove better real-time requirements for the switch with higher resource utilization.

On the protocol level, a self-optimizing protocol was developed that requires neither previous planning of the communication nor clock synchronization to guarantee hard real-time requirements. This protocol allows an adaption of cycle time for each particular node during run-time. Based on the reconfigurable switch a mathematic model is introduced to analyze the real-time properties and the self-synchronization process of the real-time protocol. Further analyzes have been performed utilizing a computer based network simulation and a prototypical evaluation of the protocol. A comparison of the adaptive protocol and industrial real-time protocols results in a comparable performance and a lower jitter for the adaptive protocol, which is just for the adaptive protocol independent of the amount of network nodes.