

Bachelor's Thesis

« Dynamic Channel Adaptation through Reinforcement Learning in IEEE 802.15.4 DSME. »

Background

Over the last few years, wireless networks have become increasingly popular in industrial applications due to their flexibility and cost-efficiency. Therefore, the IEEE 802.15.4 standard has been extended by several sub-standards to increase reliability and scalability in these applications. One of these sub-standards is the *Deterministic and Synchronous Multi-channel Extension* (DSME). It provides TDMA/FDMA-based channel access. An open-source implementation of DSME, called openDSME¹, is currently developed at the Institute of Telematics. It is capable of running on various hardware platforms as well as in the discrete event simulator OMNeT++² as an integration into the INET³ framework.



In DSME, *channel adaptation* can be used to select a set of channels feasible for transmission. The idea is to discard channels that are likely to result in collisions or are exposed to background noise. This way, the overall throughput, and reliability is increased as packets are less likely to be retransmitted. For estimation of the link quality, different metrics can be used like the *link quality indicator* (LQI), *received signal strength indicator* (RSSI) or *packet reception ratio* (PRR).

Channel adaptation can be solved through *reinforcement learning* (RL). A learning agent first selects random channels for communication and gradually learns which channels need to be sorted out. The key is finding appropriate rewards for the RL algorithm.

Goal of the work

The goal of this work is to investigate channel adaptation strategies using RL. Different algorithms should be discussed and an appropriate algorithm should be selected and implemented. Results should be obtained from network simulation and hardware experiments. For this, solid knowledge of C++ is required and basic knowledge about communication networks should be present. Experience with RL and network simulators is not required but beneficial.

¹<http://opensme.org/>

²<https://omnetpp.org/>

³<https://inet.omnetpp.org/>

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