Open Thesis / Project

Enhancing Low-Power Wireless Protocols based on Concurrent Transmissions
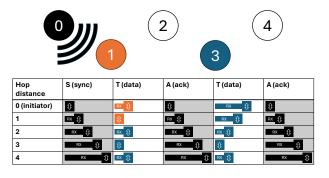
Thesis Type
Master Project / Master Thesis

Motivation
Flooding-based protocols based on concurrent transmissions are considered one of the most reliable and efficient ways to transmit data within low-power wireless systems. Such protocols are well-suited for both data collection and dissemination in multi-hop networks, and many variants and optimizations have been created since the publication of Glossy [1], one of the most influential works on the topic. Several open-source stacks based on concurrent transmissions exist: an example is Open-SF (OSF) [2], which runs on modern hardware and includes features such as the implementation of an IPv6 adaptation layer on top of flooding.

A joint effort from both industry and academia (including also TU Graz) has recently started to work on an enhanced version of OSF to be released under the Linux Foundation, in order to create a complete plug-and-play solution ready for commercial use.

The goal of this thesis is to contribute to such an enhanced version of OSF by tackling some of the open challenges, such as the runtime configuration of key parameters and the secure joining of a network.

[1] https://github.com/open-sf/osf

[2] https://ieeexplore.ieee.org/document/5779066

Goals and Tasks
Within this context, students can explore several directions and perform different tasks, such as:

- Understanding synchronous flooding primitives (e.g., Glossy and Crystal) implemented in OSF.
- Implementing a scheme adjusting at runtime key protocol parameters, such as the flooding period and number of transmissions per flood.
- Implementing a discovery mechanism that allows to wirelessly exchange these key protocol parameters with new nodes joining the network.
- Implementing a secure pairing scheme for nodes joining the network enabling encryption of the key exchange as well as device authentication.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical/Digital Engineering.

Required Prior Knowledge

- Solid skills in C programming;
- Hands-on experience with embedded systems and low-power micro-controllers;
- Basic knowledge of wireless systems;
- Basic understanding of security concepts.

Contact Person

- Dr. Fikret Basic
  basic@tugraz.at
- Dr. Markus Schuss
  markus.schuss@tugraz.at
- Assoc.Prof. Carlo Alberto Boano
  cboano@tugraz.at