Open Thesis / Project

Simulating the Performance of IoT Protocols using Data Collected on Real-World Testbeds

Thesis Type
Master Project / Master Thesis

Motivation
In the Internet of Things (IoT) realm, an effective selection and optimization of low-power wireless communication protocols is crucial due to their impact on the overall system performance and reliability. Choosing the right protocol and tuning its parameters to meet specific application requirements is complex, due to the diversity and depth of application scenarios in which IoT devices are expected to operate. Ideally, protocol optimization is conducted through empirical data from IoT testbeds, which allows to reflect true operational conditions and to introduce real-world unpredictability into the evaluation process. However, experimentation on IoT testbeds is often difficult due to their limited availability, and the time it takes to test a sufficient number of potential parameter configurations, which often prevents comprehensive testing.

Our goal is to explore how effectively simulation tools can replicate the outcomes of IoT testbed environments, utilizing only a limited subset of data derived from actual testbed experiments. This method integrates data collected in real-world IoT testbeds into simulations to refine and accelerate the evaluation process of IoT protocols, ensuring that the simulated outcomes remain within an acceptable range of fidelity compared to testbed results. By doing so, we would enhance the scalability and speed of performance evaluations, while maintaining an acceptable degree of accuracy.

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

- Getting familiar with state-of-the-art low-power wireless IoT protocols;
- Test selected protocols on IoT testbeds to gather performance data and metrics;
- Analyze the gathered data to identify key aspects that affect protocol performance;
- Extend simulation tools by allowing investigation of the identified aspects, and by integrating data collected in real-world testbeds;
- Compare the simulation outcomes with that of real-world testbeds, and maximize the accuracy with which simulation can match the protocol performance obtained in real-world testbeds.
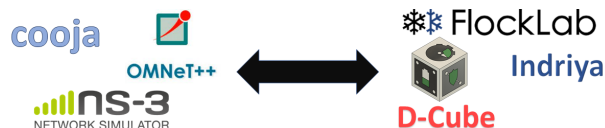
Target Group

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

Required Prior Knowledge

- Good C and Python programming skills;
- Basic knowledge of communication networks and embedded systems.
- Knowledge of the topics covered within the "Embedded Internet" course is of advantage.

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