Sustainable Communication Networks
Prof. Dr. Anna Förster

Modeling LoRaWAN using Machine Learning

Prerequisites:	- Basic knowledge of wireless communication protocols
	- Basic knowledge in C programming
Level:	This topic is appropriate for Master Students
Language:	German or English

INTRODUCTION

In the OMNET++ simulator, LoRa networks are usually modeled using the FLoRa framework which provides a full implementation of LoRa's PHY layer and also the MAC layer (LoRaWAN). In case of simulating a large number of nodes or a long model time, the problem is however that the simulation requires a long wall-clock time to complete. One important reason for this effect is that the LoRa/LoRaWAN implementation generates a large amount of simulation events for each transmitted packet which are costly in terms of CPU usage.

PROJECT DESCRIPTION

In order to accelerate the simulation, the idea is to replace the full-featured LoRa model by a statistical model using a machine learner (ML). In order to obtain ground truth data nedded to train the ML, a number of LoRa scenarios is run in OMNET++. The trace files of these simulations are then evaluated by the ML. In the evaluation and testing phase, the ML is then provided with the input data from trace files such as transmissions by neighboring stations and background interference; the ML then has to infer the metrics for the transmission of the station under test, such as the packet loss probability or the end-to-end delay. In order to analyse the accuracy of the ML, the inferred metrics are compared with the metrics obtained directly from the trace files.

In a second step, the trained machine learner is then integrated into the OMNET simulator so that it computes the response of the LoRa stations during the ongoing simulation run. The ML is then again evaluated w. r. t. its accuracy by comparing it with simulation runs with the same scenario configuration, but the full LoRa implementation. Furthermore, the aforementioned simulation runs are analysed w. r. t. their simulation runtime in order to identify how much runtime is saved using the ML model vs. the full implementation.

This project can be arranged for a student's project or Master thesis.

CONTACT

If you are interested in this work, please contact us via mail: projects@comnets.uni-bremen.de