Universität Stuttgart

INSTITUT FÜR
KOMMUNIKATIONSNETZE
UND RECHNERSYSTEME
Prof. Dr.-Ing. Andreas Kirstädter

Master thesis No. 1081

Simulator for Evaluating the Performance of IOTA in Time-Sensitive IoT Applications

Methods
Software design
Programming in C++
Traffic modeling

Topics
Communication networks
Service platforms

Background

The digital transformation increases the demand for trustworthy and scalable mechanisms for data attestation - particularly in areas such as supply chains, IoT systems, maintenance documentation, and digital content verification. Many of these use cases require also real-time performance. Traditional blockchain technologies often reach their limits due to high transaction costs and limited speed. IOTA, based on Directed Acyclic Graphs (DAG), promises efficient microtransactions. Although designed for real-time applications, IOTA's performance under realistic network conditions remains unexplored. Heterogeneous network technologies such as WLAN, IP multicast, or mobile networks significantly affect transaction speed and IOTA responsiveness. In addition, potential effects of network failures or targeted attacks have not yet been systematically analyzed. A suitable simulation tool is therefore essential to evaluate the real-time capability, scalability, and robustness of IOTA-based applications.

Your Task

You will design and implement a modular simulator on the basis of the ns3 toolkit to analyze the performance of IOTA-based systems in realistic heterogeneous network environments. The simulator should accurately model key network behavior and assess its effects on IOTA-specific mechanisms like Tangle processing, scheduling, and congestion control. You will focus in particular on evaluating the real-time performance and scalability of IOTA in typical IoT scenarios that require fast and reliable data handling. In addition, the simulator should allow for the modeling of partial network outages and denial-of-service attacks, to assess system resilience.

Acquired knowledge and skills

- In-depth understanding of the IOTA Tangle architecture and mechanisms
- System simulation

Requirements
Kommunikationsnetze I
Programming Experience in C++

Desirable knowledge
Performance Modelling and Simulation

Contact

Prof. Dr.-Ing. Andreas Kirstädter
room 1.345 (ETI II), phone 685-68060, E-Mail andreas.kirstaedter@ikr.uni-stuttgart.de