Universität Stuttgart

INSTITUT FÜR
KOMMUNIKATIONSNETZE
UND RECHNERSYSTEME
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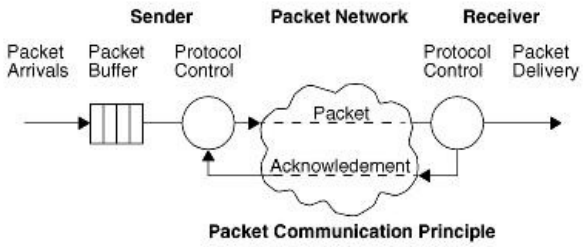
Bachelor thesis No. 935

# Real-Time Performance of Communication Protocols

**Methods**
Performance Evaluation
Protocol design

**Topics**
Communication networks
Real-Time

## Background



Packet Communication Principle

Communication protocols are used to control the correct exchange of information between end systems or between end systems and network entities across transmission channels. Their purpose address various functions as admission control, flow control, or error control. End systems can be user terminals, or machines ("M2M" Communication). Control is executed automatically and has to meet specific Quality-of-Service (QoS) requirements which are defined by specific Service Level Agreements (SLA). Basic protocol mechanisms for packet communication are the "Send and Wait" (S&W), the "Go-back-n" (GBN), and the Selective Repeat (SR) protocols.

## Problem Definition

For proper operation, the parameters of a protocol have to be adapted to the physical resource properties as transmission bit rate, propagation delay, packet size, bit error rate, and the statistical source traffic characteristics. In the past, most protocol performance studies aimed at typical mean values as the throughput rate and the average end-to-end transfer delay. Many novel application areas, as in case of M2M communication, distributed energy supply ("Smart Grid"), autonomous driving, sensor-based traffic control ("Smart City"), integrated manufacturing processes ("Internet 4.0"), or human health surveillance require strict guarantees on network latency thresholds. Similar applications are in the future "Tactile Internet" for front-end/back-end 5G mobile networks. The protocol analysis is based on an extended system model described by task graph and logical synchronization elements. These models can be stepwise reduced mathematically by aggregation of tasks to become finally described by a queuing system model for which we have proper methods for their performance analysis. Based on such analysis results protocol parameters can be optimized to meet the SLAs of the application processes.

## Acquired Knowledge and Capablilties

The student will become familiar with a most up-to-date application area in the Future Internet, advanced analytical protocol analysis methods, and verification by simulations using the IKR SimLib framework and analytical evaluation programming in Java.

**Requirements**
Programming Experience in Java

**Desirable knowledge**
Performance Modelling and Simulation
Communication Networks II

## Contact

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