Chair of Communication Networks, Prof. Dr.-Ing. Wolfgang Kellerer
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TUM

AoI-based Finite Horizon Scheduling with Gilbert-Elliot Channel Model
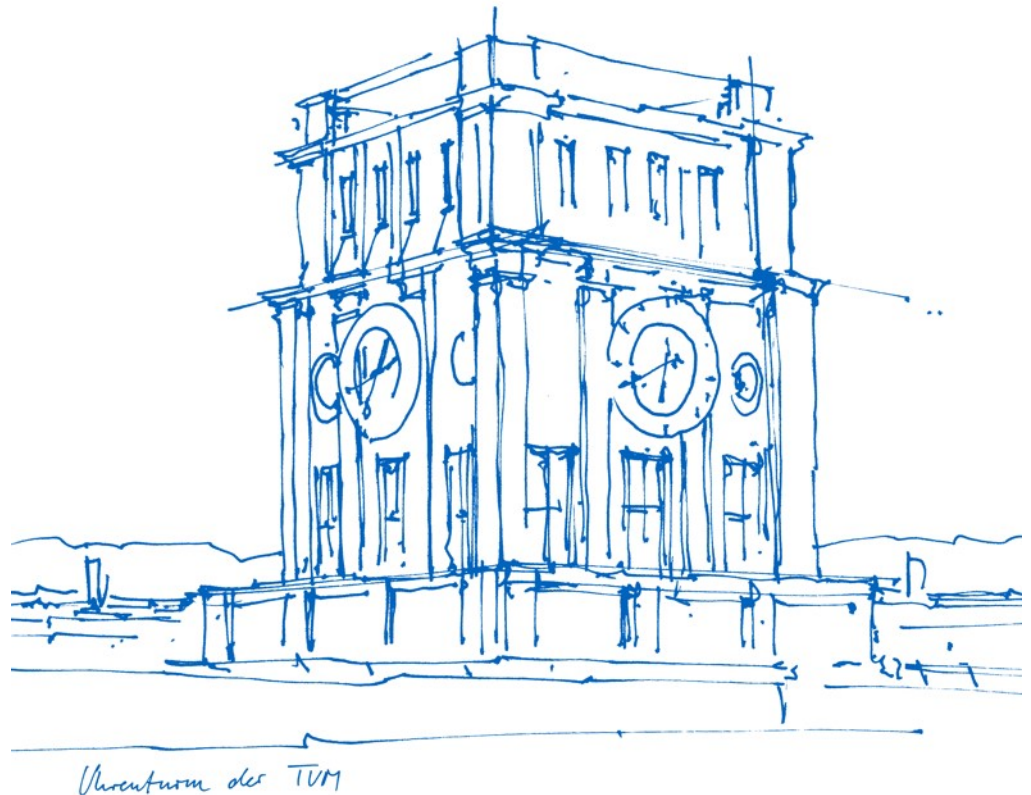
(Bachelor Thesis)

Kick-Off Presentation

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Uhrenturm der TUM

Motivation and State of the Art

- **Motivation**
  - Vehicular networks, industrial automation, Cyber-Physical systems etc. are emerging applications modeled as *Networked Control Systems (NCS):* feedback loops closed over a communication network.
  - Control over wireless networks inevitably introduces random delays, packet losses, time varying channel conditions
  - *Centralized resource scheduling problem* for a single wireless link shared by multiple heterogeneous NCS

- **State of the Art**
  - Adaptation of cross-layer metrics for communication protocol design i.e. *Age of information (AoI)*
  - [1] Proposes a *cost optimal* scheduler using *Dynamic Programming* over age penalties derived from *AoI* and system parameters
  - Most papers assume non time varying channel properties

Objective and Approach

- **Objective**
  - Investigate how an optimal scheduler performs in a channel model with realistic channel quality variation => *Gilbert-Elliot Channel Model* [2]
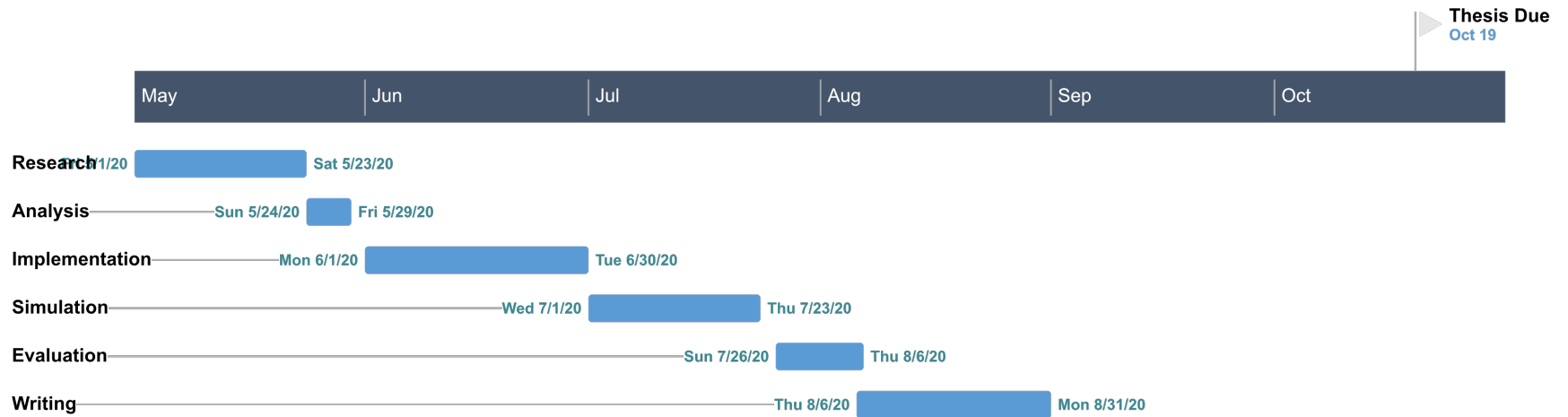
- **Approach**
  - Modeling of *Gilbert-Elliot Model* in a simulation network
  - Implementation of control and channel aware scheduler
  - Simulation of a case scenario using C++
  - Comparison of case study with existing one in [1] or real case scenarios e.g. inverted pendulum, vehicular networks
  - Evaluating AoI, MSE, complexity over finite Horizon H

Questions?

Timeplan

	May	Jun	Jul	Aug	Sep	Oct	

Thesis Due
Oct 19

Research 1/20 ▬▬▬▬ Sat 5/23/20

Analysis ────── Sun 5/24/20 ▬ Fri 5/29/20

Implementation ────── Mon 6/1/20 ▬▬▬▬ Tue 6/30/20

Simulation ────── Wed 7/1/20 ▬▬▬ Thu 7/23/20

Evaluation ────── Sun 7/26/20 ▬▬ Thu 8/6/20

Writing ────── Thu 8/6/20 ▬▬▬▬ Mon 8/31/20

References

[1] O. Ayan et al, "AoI-based Finite Horizon Scheduling for Heterogenous Networked Control Systems", *Preprint at https://arxiv.org/pdf/2005.02037.pdf (2020)*

[2] G. Hasslinger and O. Hohlfeld, "The Gilbert-Elliott Model for Packet Loss in Real Time Services on the Internet", *14th GI/ITG Conference - Measurement, Modelling and Evalutation of Computer and Communication Systems*, Dortmund, Germany, 2008, pp. 1-15.