Hochschule Karlsruhe
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bw NET

Machine-learning based Multipath Wireless Access on an Infrastructure for Latency Critical AI-Applications

Reza Poorzare

Hans Wippel

Oliver P. Waldhorst

Christian Zirpins

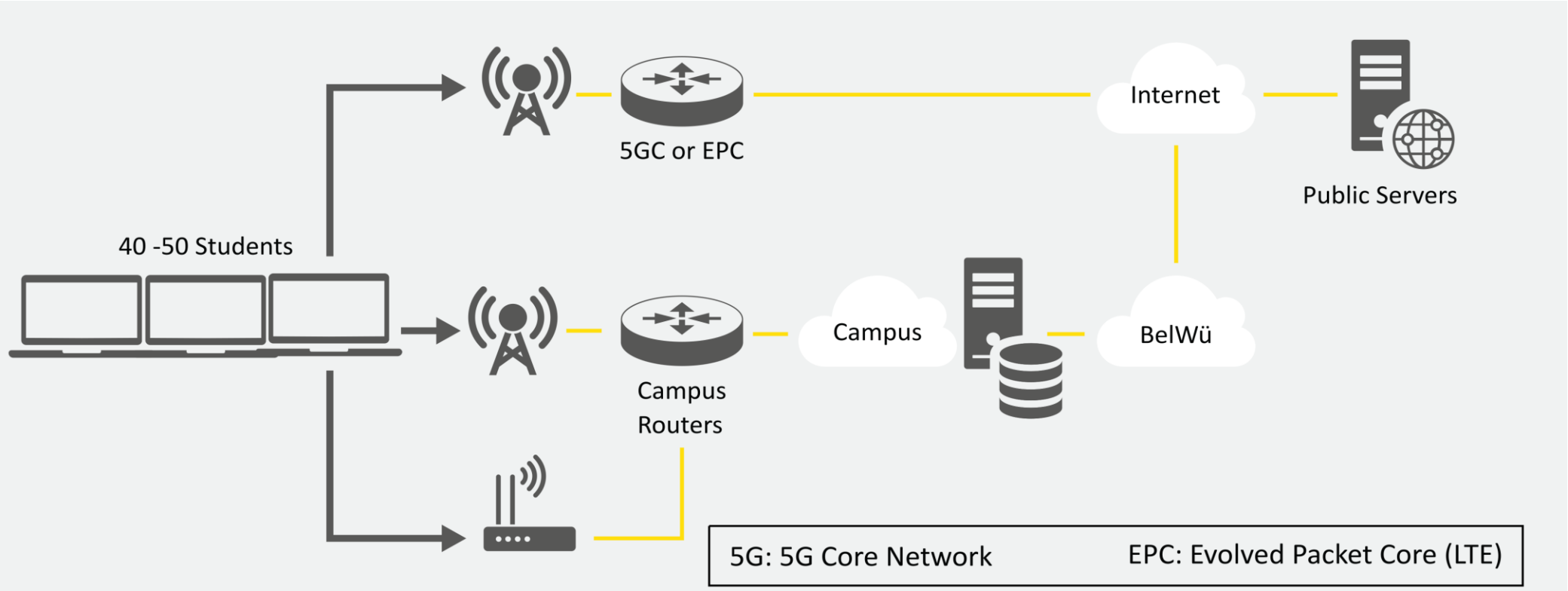
Introduction

- Having issues within labs and classes
  - Public servers
  - Private servers
- Corona Pandemic
- Having more than one Network Interface Card (NIC)

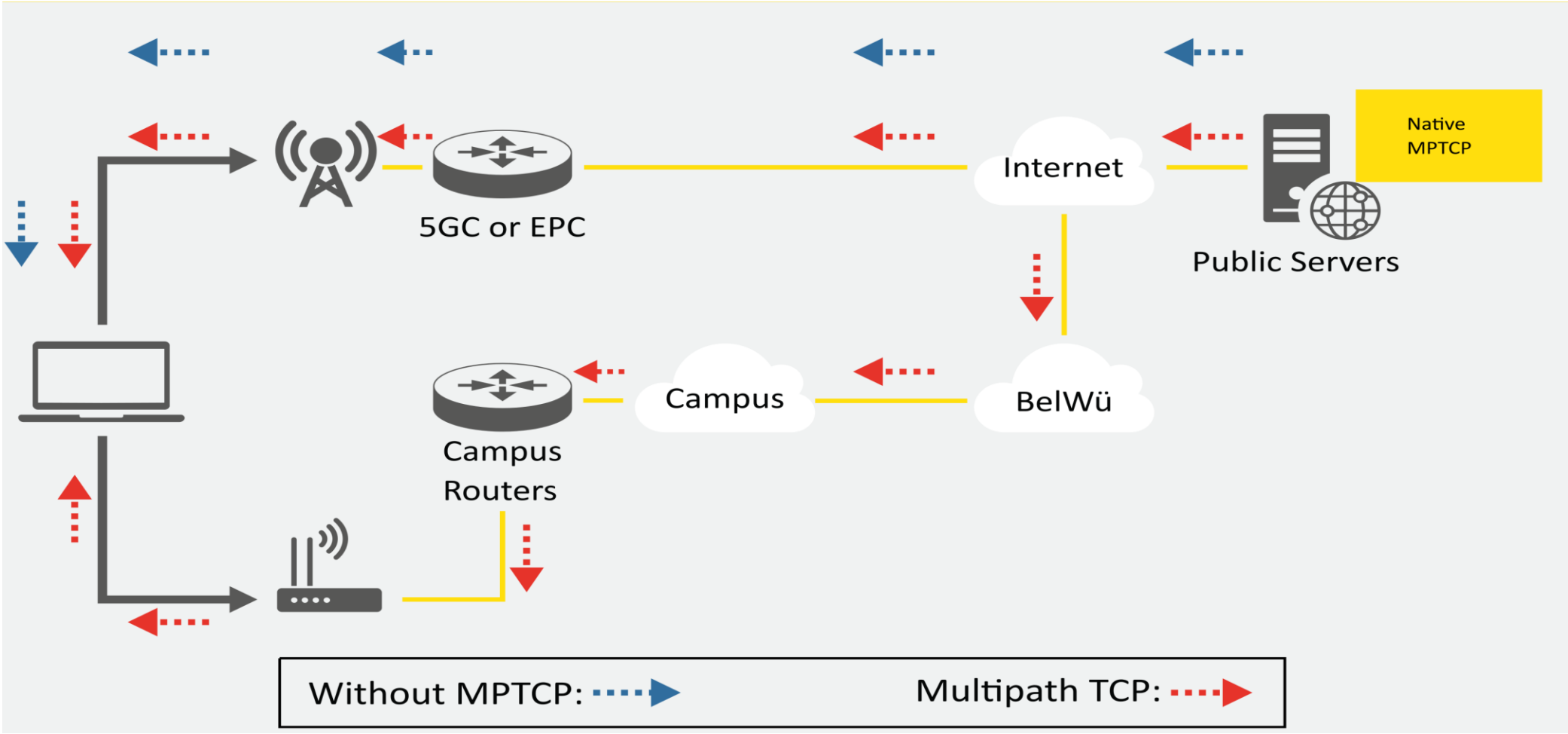
Using multiple paths in a more orchestrated way in a machine learning approach and balancing flows between multiple clients.

Classroom Scenario

Components are deployed that enable the use of parallel data paths to destinations inside and outside the campus network or the BelWü.

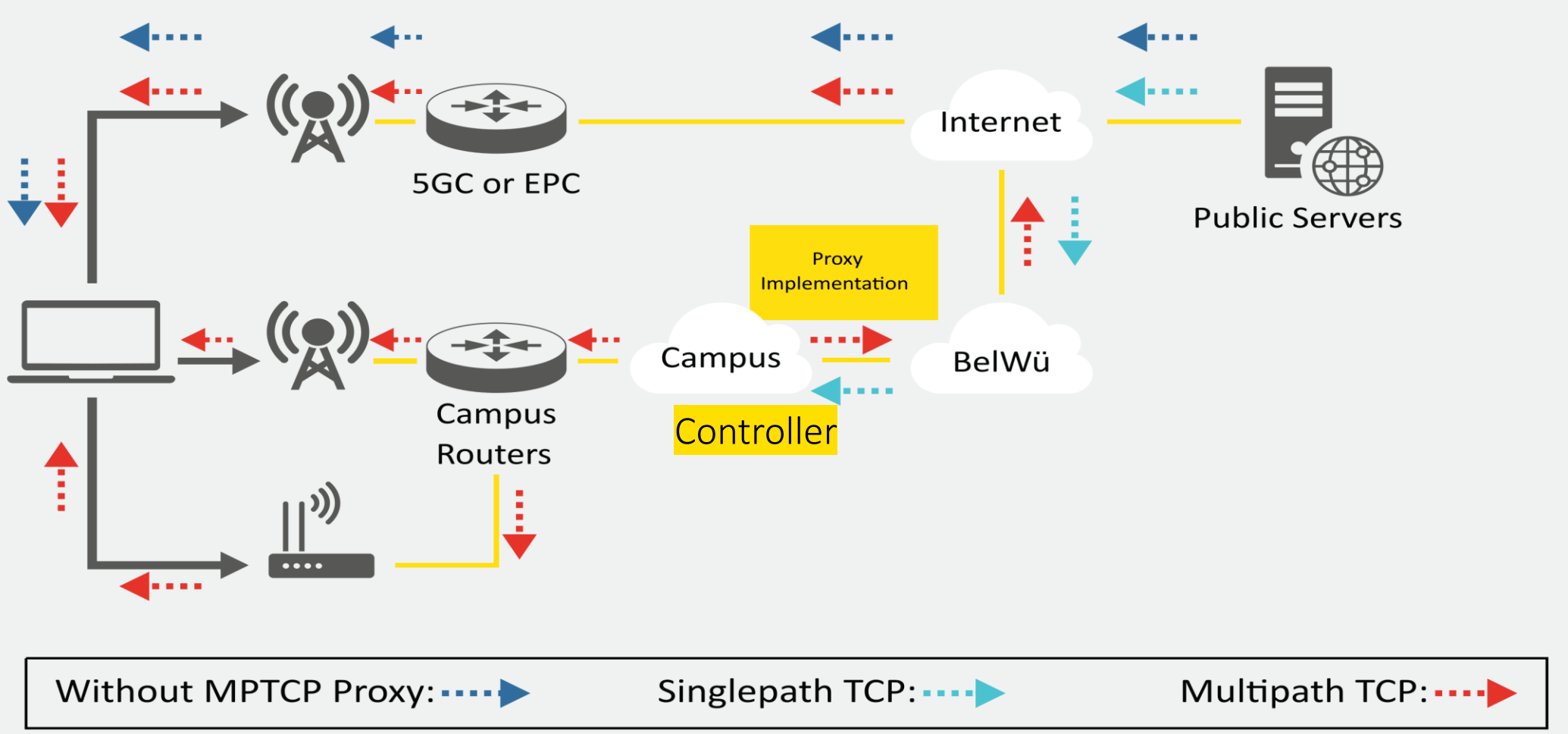


Classroom Scenario – Native Implementation



MPTCP: Multipath TCP

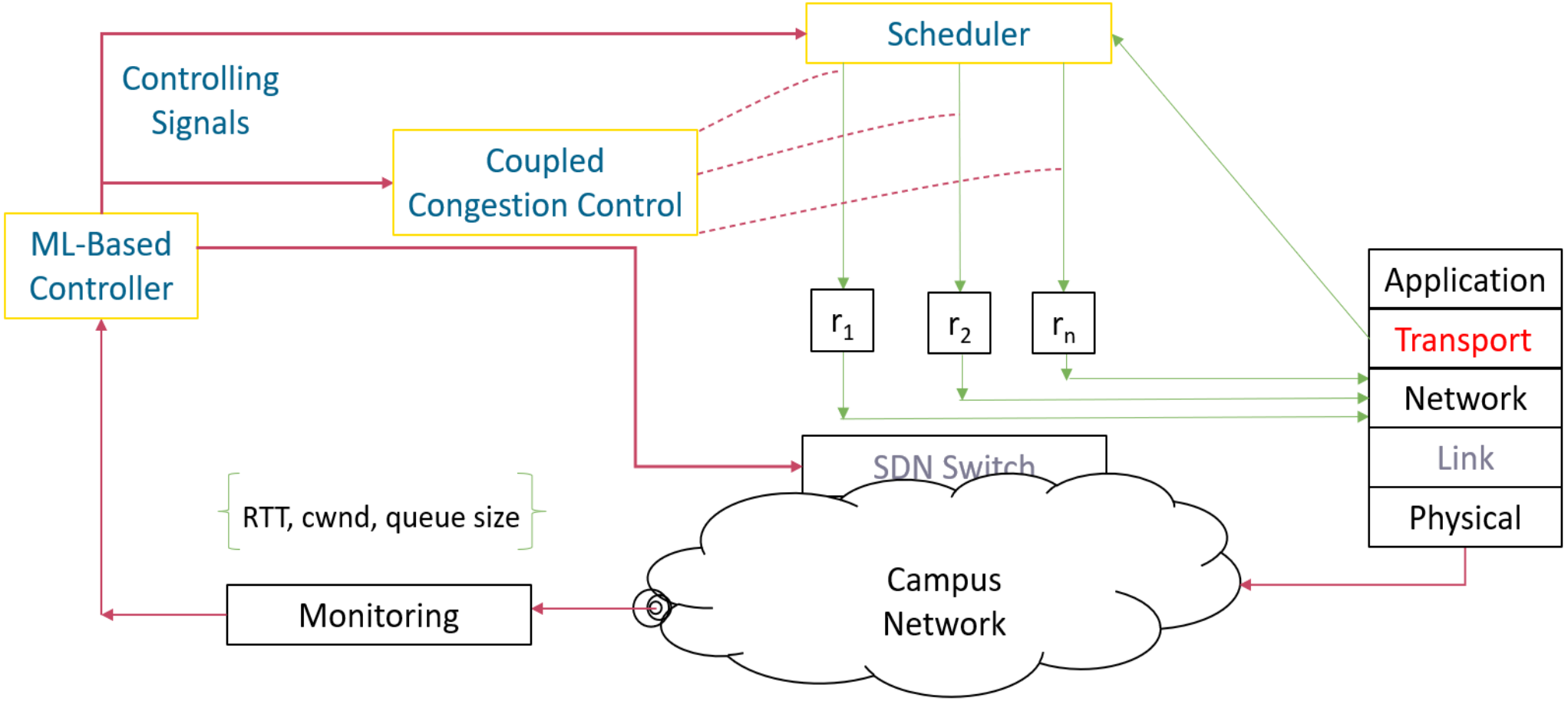
Classroom Scenario – Proxy Implementation



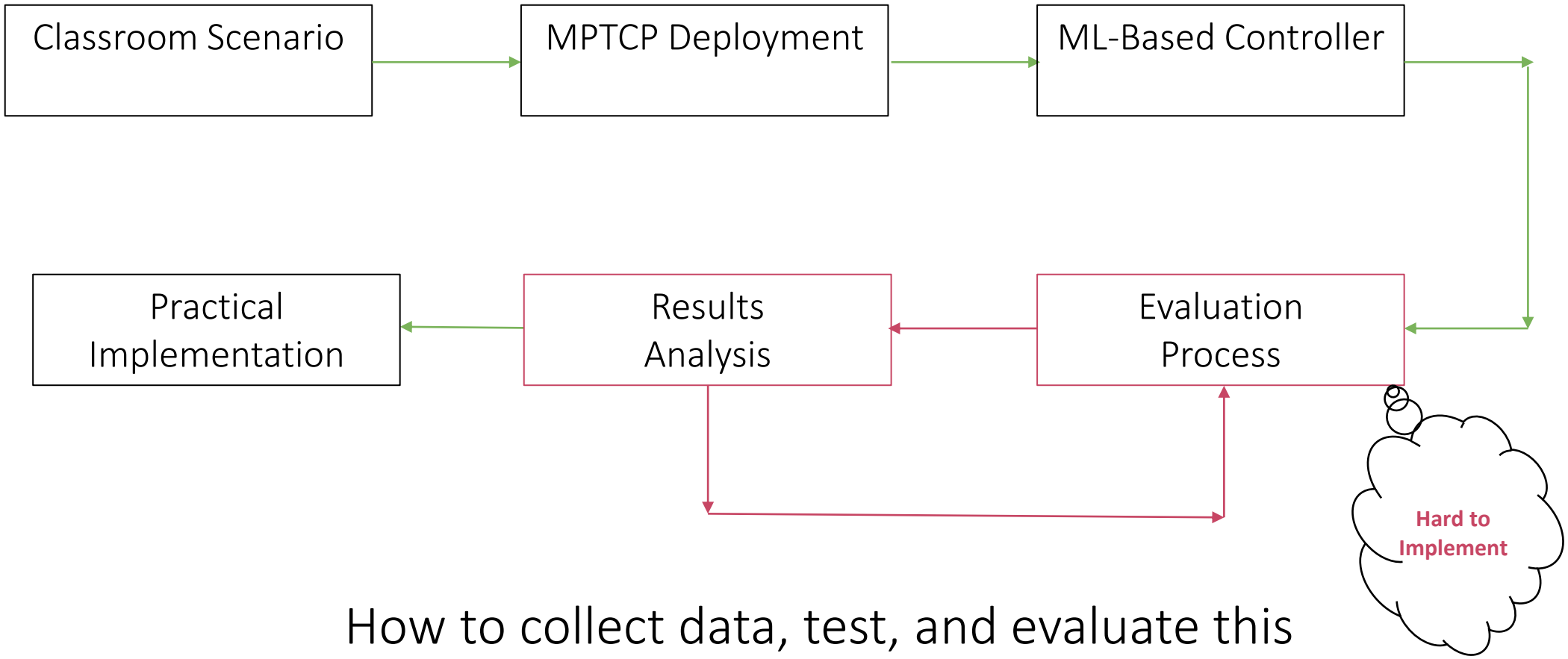
ML-Based MPTCP Controller

MPTCP deployment enhancement

SDN: Software-Defined Networking



Evaluation Challenges



How to collect data, test, and evaluate this scenario before the implementation?

What to Implement for the Evaluation

Implementation of the classroom scenario:

- 40 nodes as students
- Traffic generators
- ML–Based Controller
- Proxy
- MPTCP capability

What is needed for the Evaluation

The necessary requirements:

- Low latency
- High Performance
- CPU and GPU resources
- A controlled environment for students
- Having multiple NICs for each node

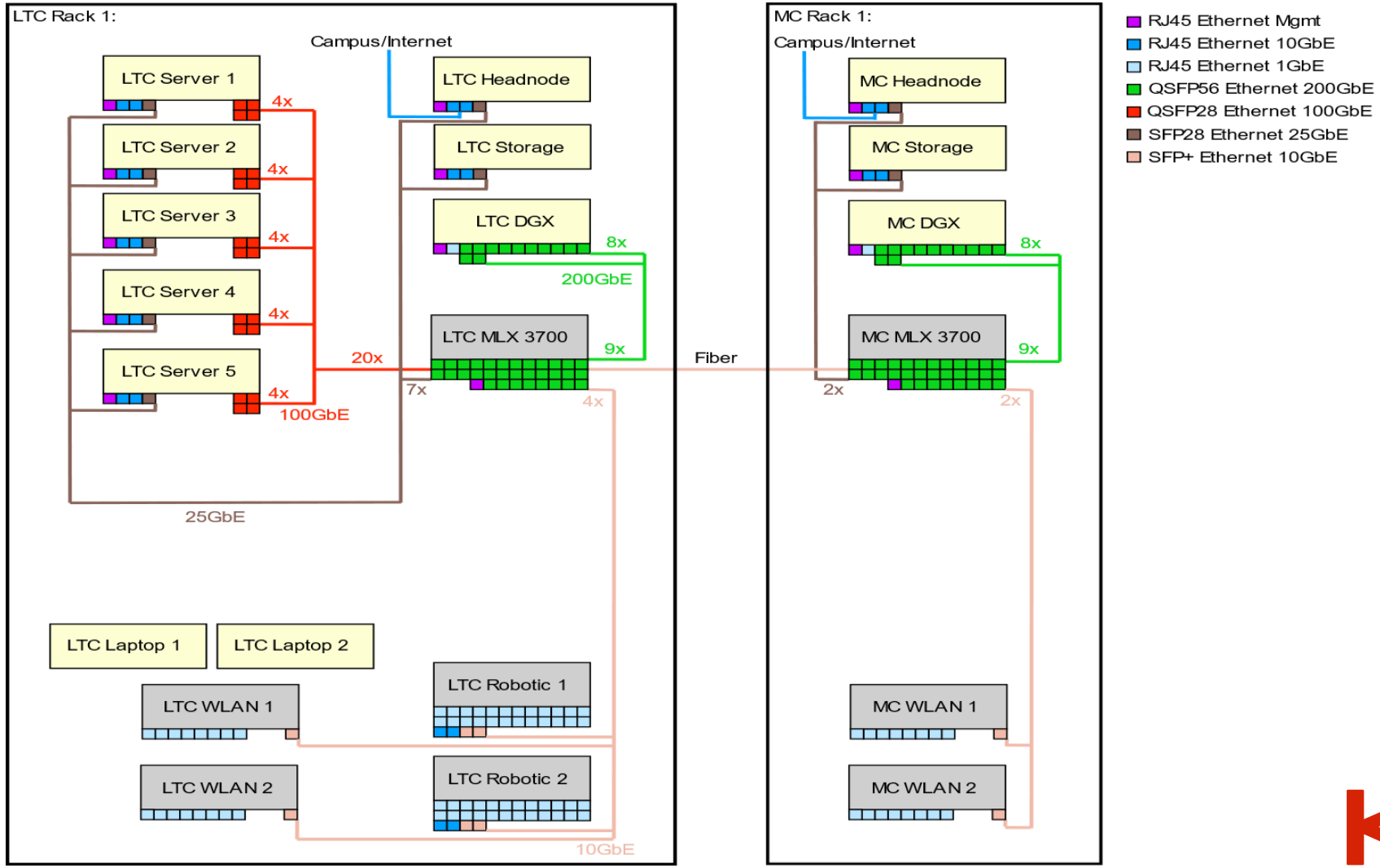
Evaluation Hardware

ILKA :

- Infrastructure for Latency Critical AI-Applications (Infrastruktur für latenzkritische KI-Anwendungen)

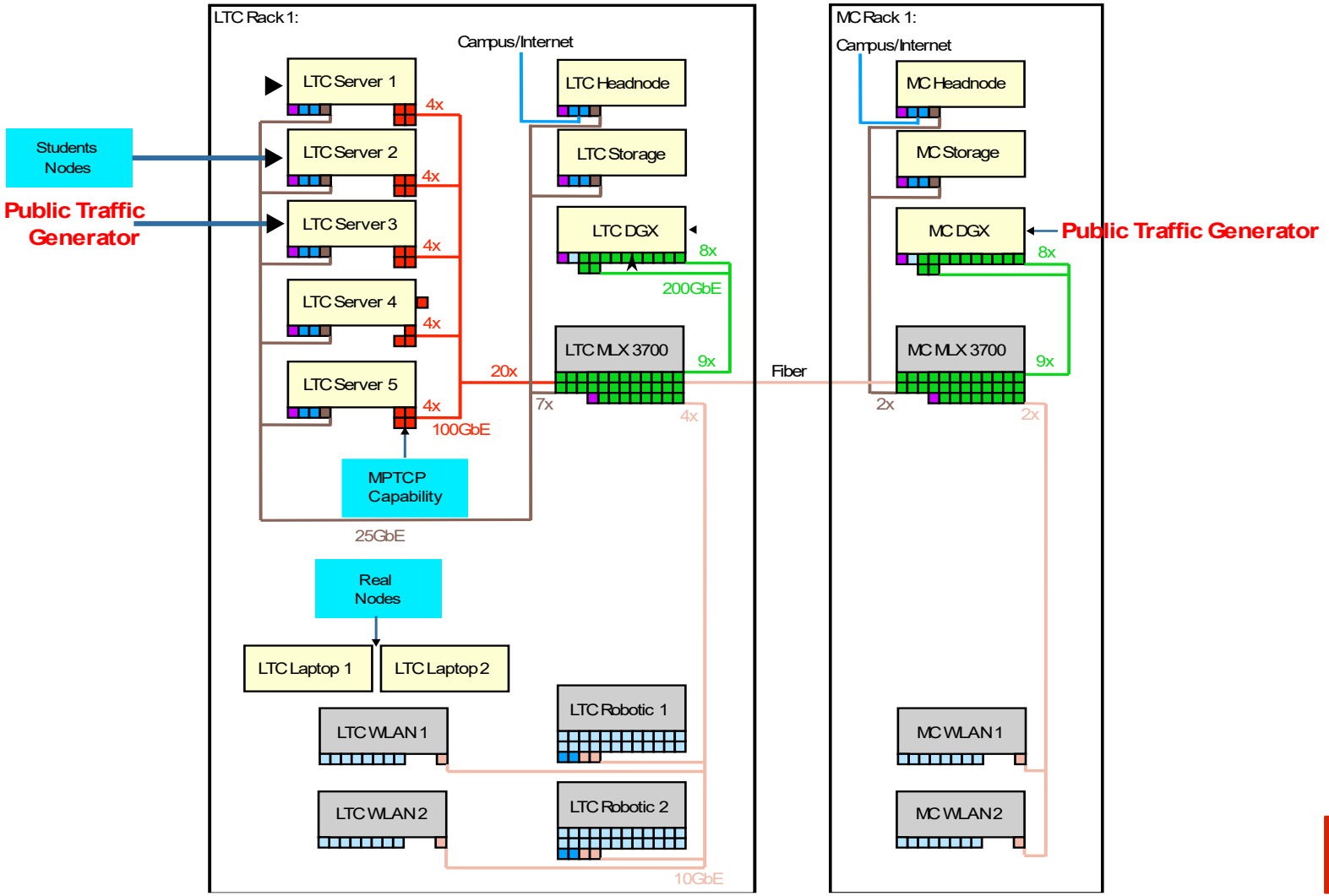
Goals:

- low latency infrastructure for machine learning applications
  - Powerful GPU/CPU Servers and Fast networking



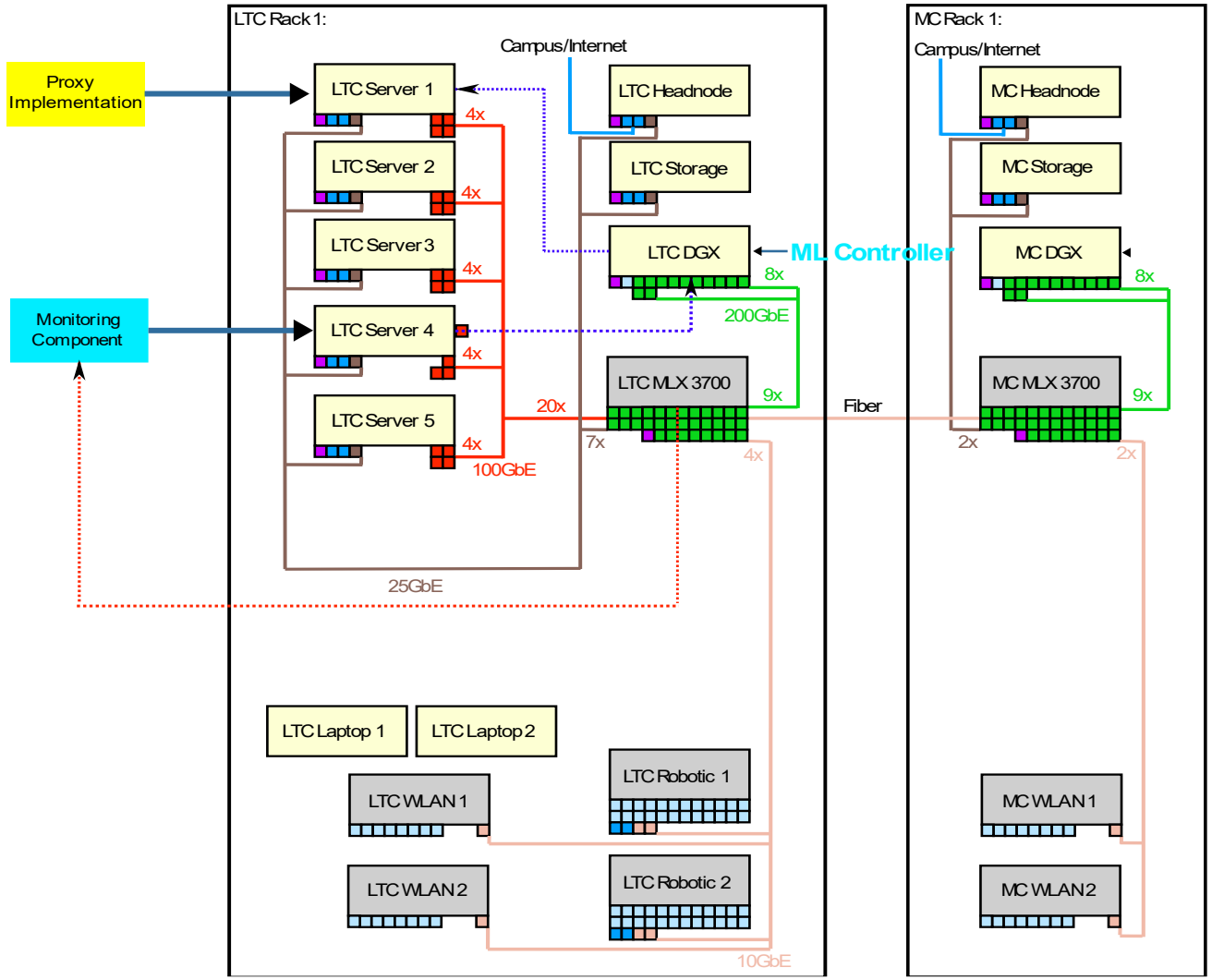
Evaluation Setup Mapping – End Systems

- HTTP request generators as students
- Traffic generators or having servers with dummy data files
- MPTCP Capability
- Laptops as real nodes
- Wi-Fi6 access points for real node wireless connectivity



Evaluation Setup Mapping – Network Part

- A light-weighted proxy
- Network Monitoring (bwNET2020+ monitoring)
- ML Controller:
  Rule-based -->
  Supervise learning -->
  Reinforcement learning



Conclusion

Challenges:

- The classroom scenario can benefit from an orchestrated controller
- Difficulties of the real implementation setup
- ILKA can fulfill the demands for the evaluation

Approach:

- Mapping all required components to the ILKA infrastructure for the evaluation purpose

Next Step:

- Modification and evaluation of the ML-controller within the classroom scenario over ILKA

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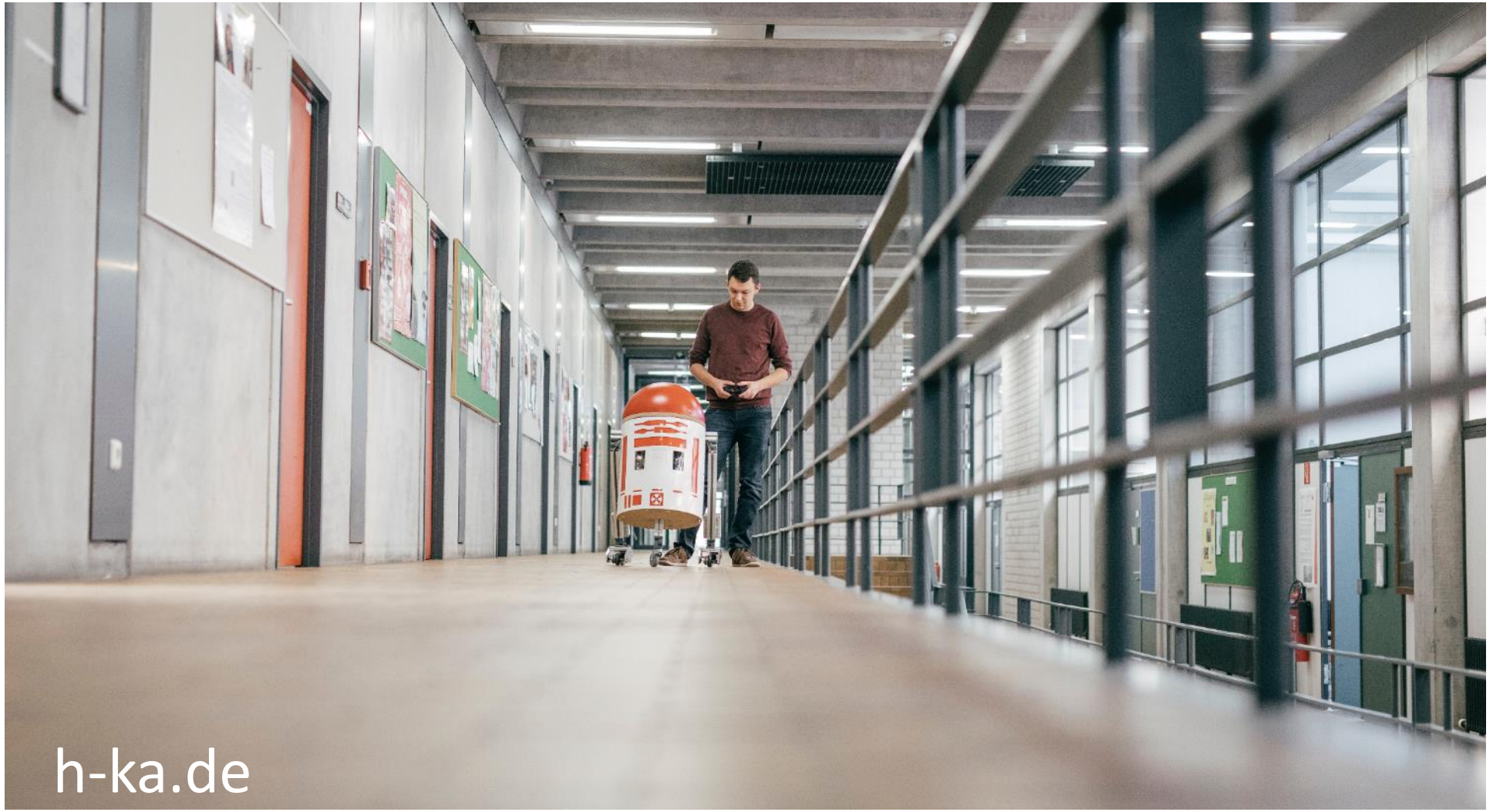

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