5G Research Hub Munich
Focus Application Area: eHealth

Prof. Dr. -Ing. Wolfgang Kellerer and Prof. Dr. -Ing. Eckehard Steinbach

Chair of Communication Networks and Chair of Media Technology
Department of Electrical and Computer Engineering
Technical University of Munich

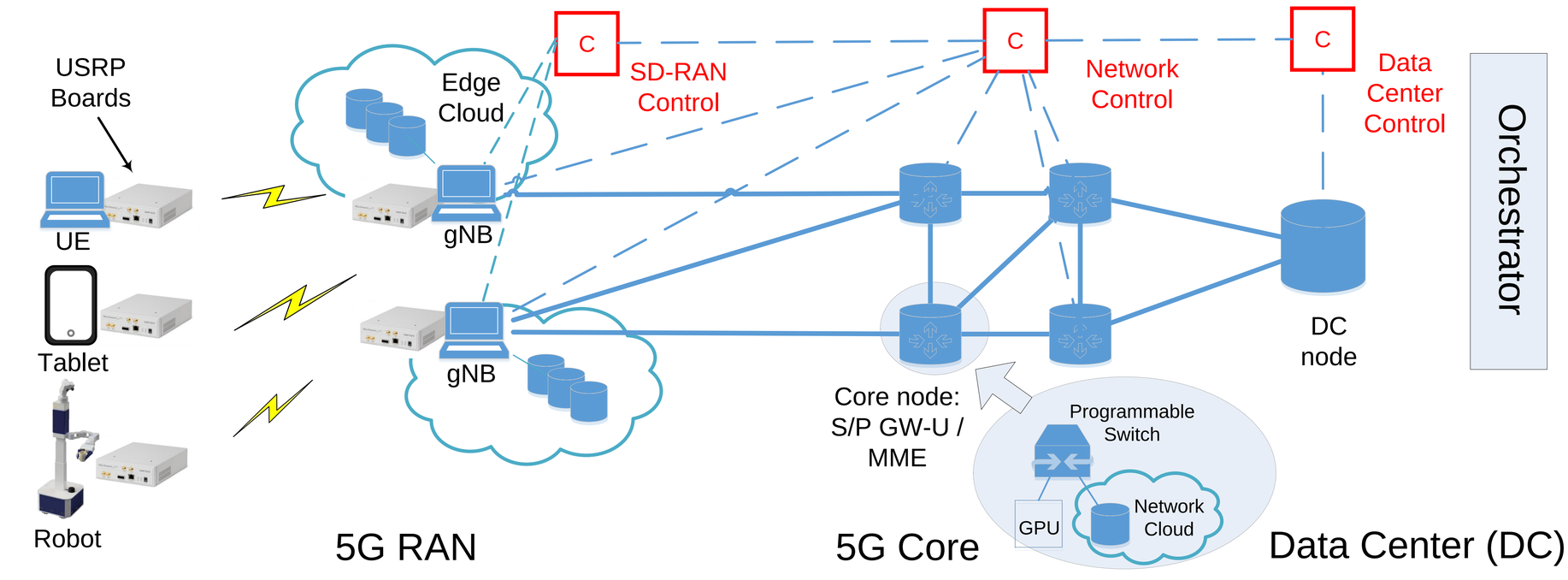
Sponsored by

Bavarian Ministry of Economic Affairs, Regional Development and Energy

Objectives

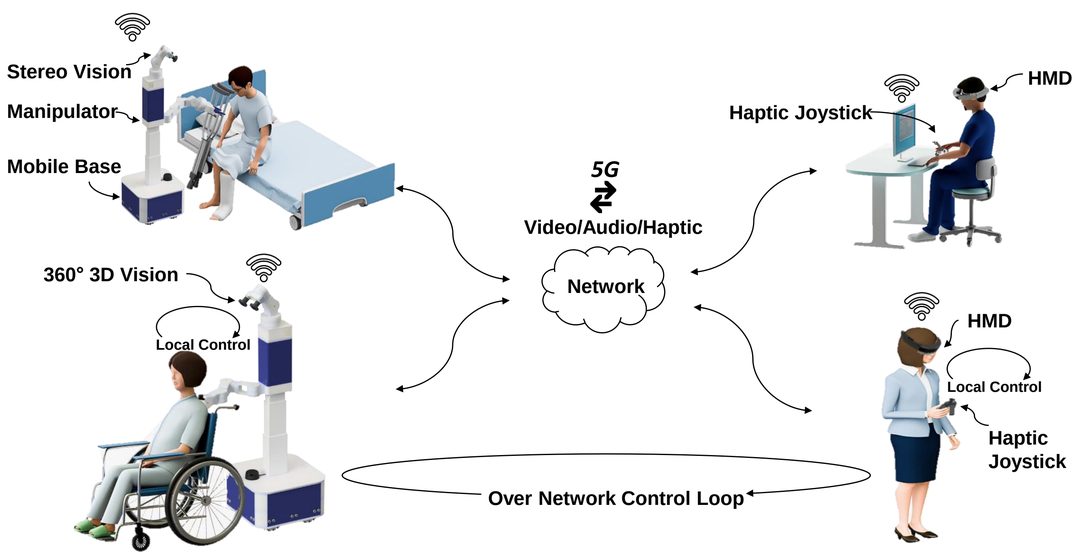
- Development of an experimental 5G platform as a modular framework being open for emerging applications
- Continuous adaptation to the upcoming 5G standards
- Fundamental research to significantly shape the state of the art for selected areas in 5G technologies and applications

Network Model

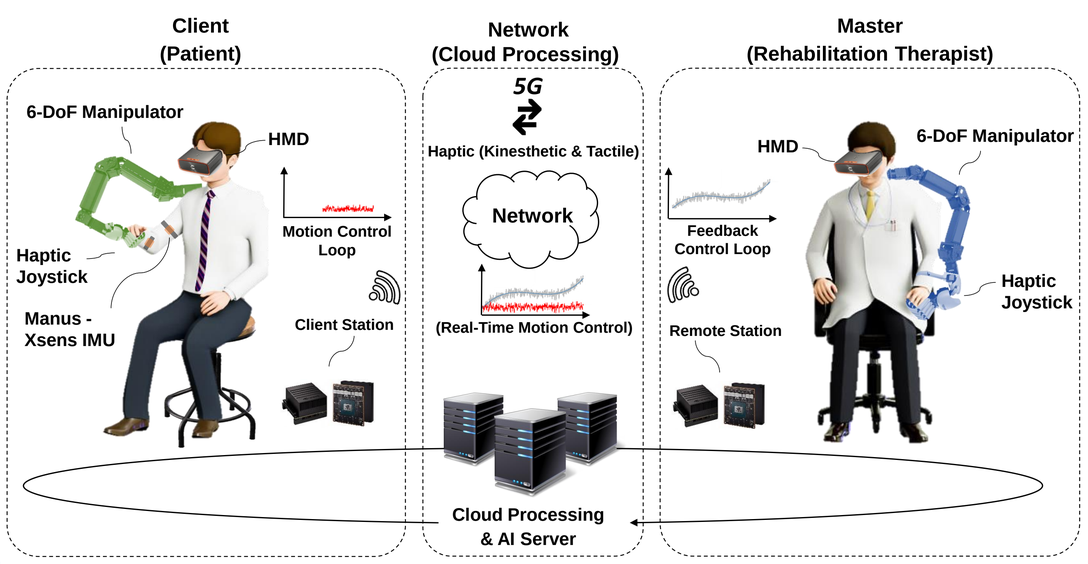


Use Cases

Phase 1: Telepresence Scenario



Phase 2: 5G Edge Cloud-based Control and Interaction



Research Directions

Radio Access Network

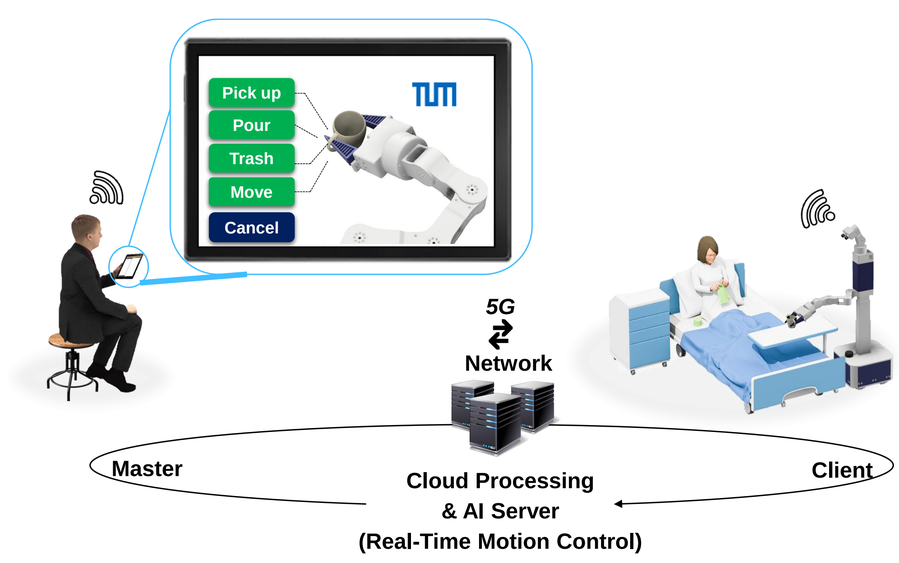
- Low latency high reliability to support critical application functions
- Radio network slicing for reliable co-existence of different applications
- RAN functions split and its impact on latency and reliability
- Dynamic base station coordination and radio resource management
- Reliability in 5G New Radio

Core Network

- Resource provisioning and isolation of data and control plane incl. network hypervisors
- Function placement and operation in distributed edge cloud environments
- In-network processing to support emerging 5G applications
- Hardware acceleration and offloading of virtualization functions

Telepresence Robot

- 3D 360° immersive experience of the remote scene (with delay compensation)
- HMD and tablet interface for natural remote control
- Semi-autonomous edge-based manipulation and object recognition
- Edge-based navigation and SLAM
- Edge-based real-time motion control and monitoring
- User-in-the-loop real-time haptic & kinesthetic feedback



Related Publications

[1] A. Papa, M. Klügel, L. Goratti, T. Rasheed, and W. Kellerer, “Optimizing Dynamic RAN Slicing in Programmable 5G Networks,” in IEEE International Conference on Communications (ICC), 2019.
[2] Jacquelin, Augustin and Vilgelm, Mikhail and Kellerer, Wolfgang, “Grant-Free Access with Multipacket Reception: Analysis and Reinforcement Learning Optimization,” in IEEE/IFIP Wireless On-demand Network systems and Services Conference (WONS), Wengen, 2019, pp. 1-8.
[3] N. Đerić, A. Varasteh, A. Basta, A. Blenk and W. Kellerer, "SDN Hypervisors: How Much Does Topology Abstraction Matter?, “ in 2018 14th International Conference on Network and Service Management (CNSM), Rome, 2018, pp. 328-332.
[4] A. Blenk, P. Kalmbach, J. Zerwas, M. Jarschel, S. Schmid and W. Kellerer, "NeuroViNE: A Neural Preprocessor for Your Virtual Network Embedding Algorithm," IEEE INFOCOM 2018 - IEEE Conference on Computer Communications, Honolulu, HI, 2018, pp. 405-413.
[5] A. Blenk, A. Basta and W. Kellerer, "HyperFlex: An SDN virtualization architecture with flexible hypervisor function allocation," in 2015 IFIP/IEEE International Symposium on Integrated Network Management (IM), Ottawa, ON, 2015, pp. 397-405.
[6] Karimi, Mojtaba, Tamay Aykut, and Eckehard Steinbach. "MAVI: A research platform for telepresence and teleoperation." *Technical Report*, *arXiv preprint arXiv:1805.09447*, 2018.
[7] T. Aykut, C. Burgmair, M. Karimi, J. Xu and E. Steinbach, "Delay Compensation for Actuated Stereoscopic 360 Degree Telepresence Systems with Probabilistic Head Motion Prediction," *2018 IEEE Winter Conference on Applications of Computer Vision (WACV)*, Lake Tahoe, NV, 2018, pp. 2010-2018.
[8] T. Aykut, M. Karimi, C. Burgmair, A. Finkenzeller, C. Bachhuber, E. Steinbach, Delay Compensation for a Telepresence System with 3D 360° Vision based on Deep Head Motion Prediction and Dynamic FoV Adaptation, IEEE Robotics and Automation Letters (with IROS presentation option), July 2018.