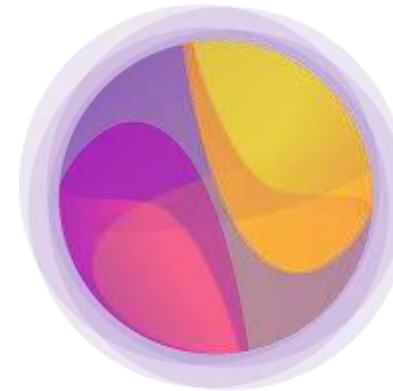


Emerging 6G Communication Technologies supporting advanced Robotics and Healthcare Applications

Prof. Dr.-Ing. Wolfgang Kellerer

SPICE | Startup | Partner | Investor | Community | Event #4
Wednesday, 13.11.2024
Munich Urban Colab



6G-life



GEFÖRDERT VOM



Sponsored by

Bavarian Ministry of Economic Affairs,
Regional Development and Energy

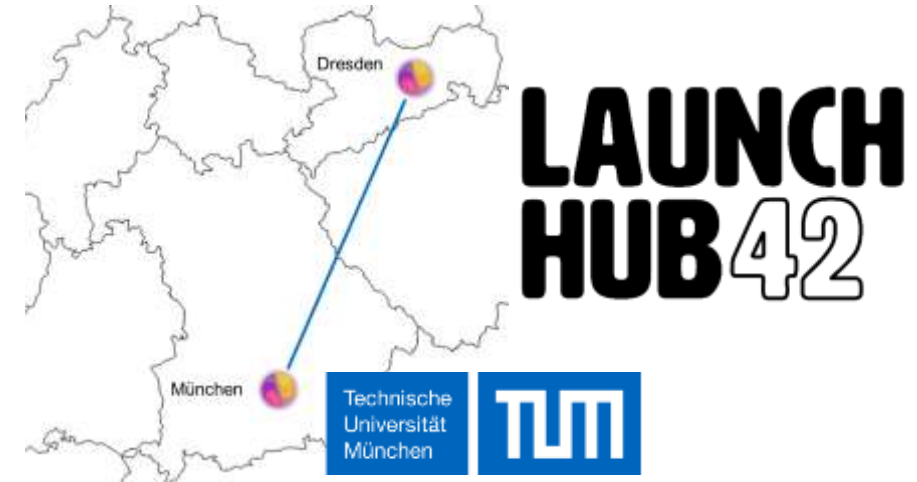


Future Communications initiative at TUM

- BMBF 6G Research Hub 6G-life
- BMBF 6G Lighthouse 6G-ANNA



- StMWi Bayern 6G Future Lab Bavaria
- StMWi 6G und Quantentechnologie
- STMWi Bayern Innovativ Thinknet 6G

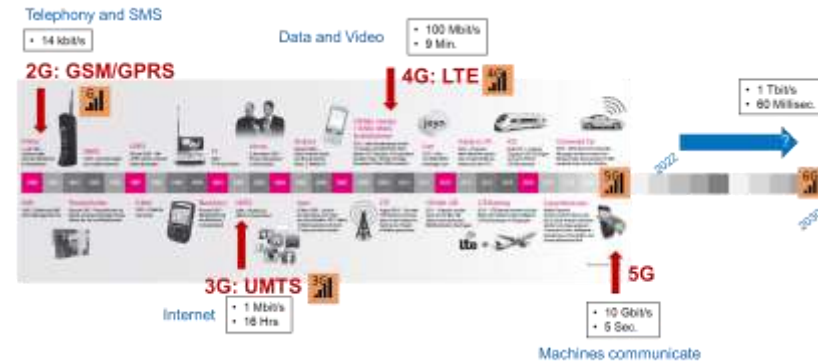


60 PIs, 160 researchers, 10 Mio€ for startups



13 PIs, 16 researchers

Was is new with 6G?



- 4G: Video and Internet (Smartphone)
- 5G: Machine-to-Machine Communication
- **6G: put the human in the center – *Extension of the human intelligence and the human capabilities***



What are the 6G drivers?

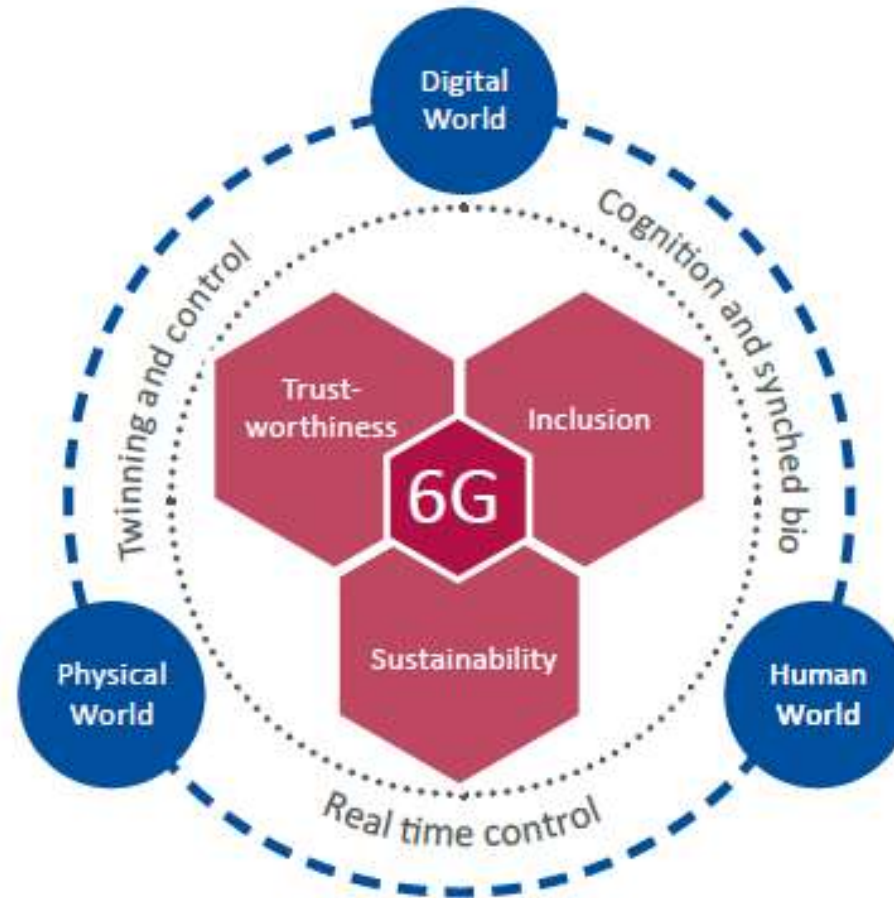


Figure 1 A vision of 6G
(Source: **Hexa-X project**)

What are the 6G drivers?

our use cases

Robotics



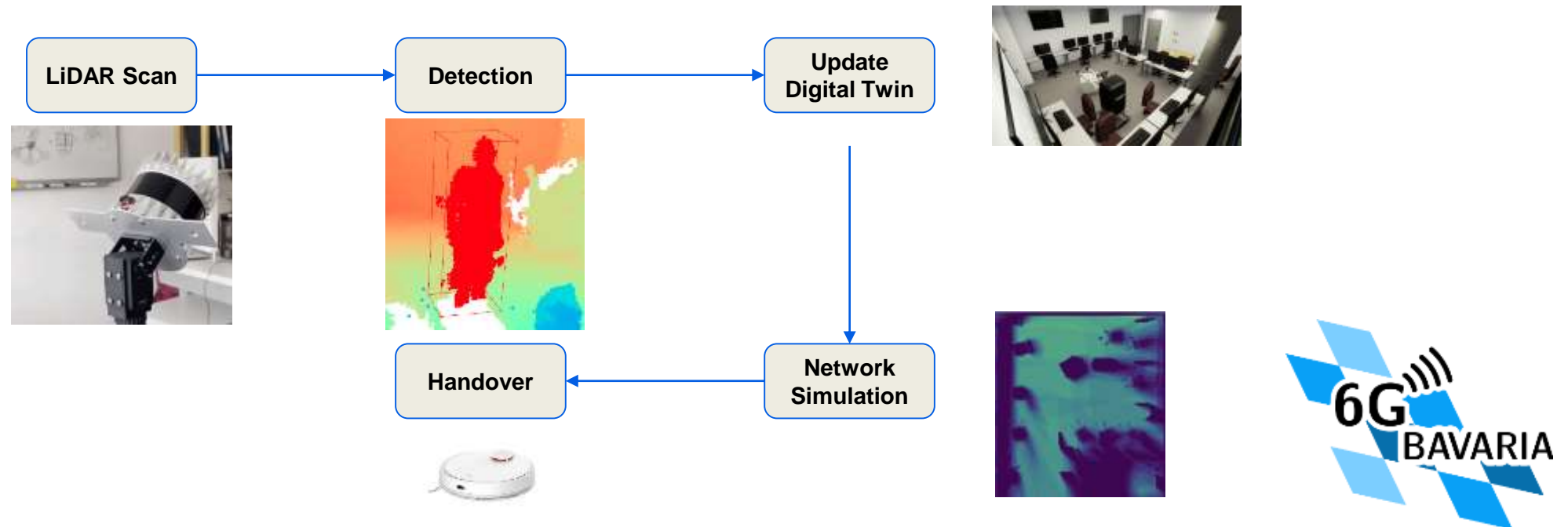
Healthcare



Figure 1 A vision of 6G
(Source: **Hexa-X project**)

Example: Digital Twin in 6G

- Concept: real-time coupling of the real environment (physical space) and the virtual environment (virtual space) to improve communication → handover



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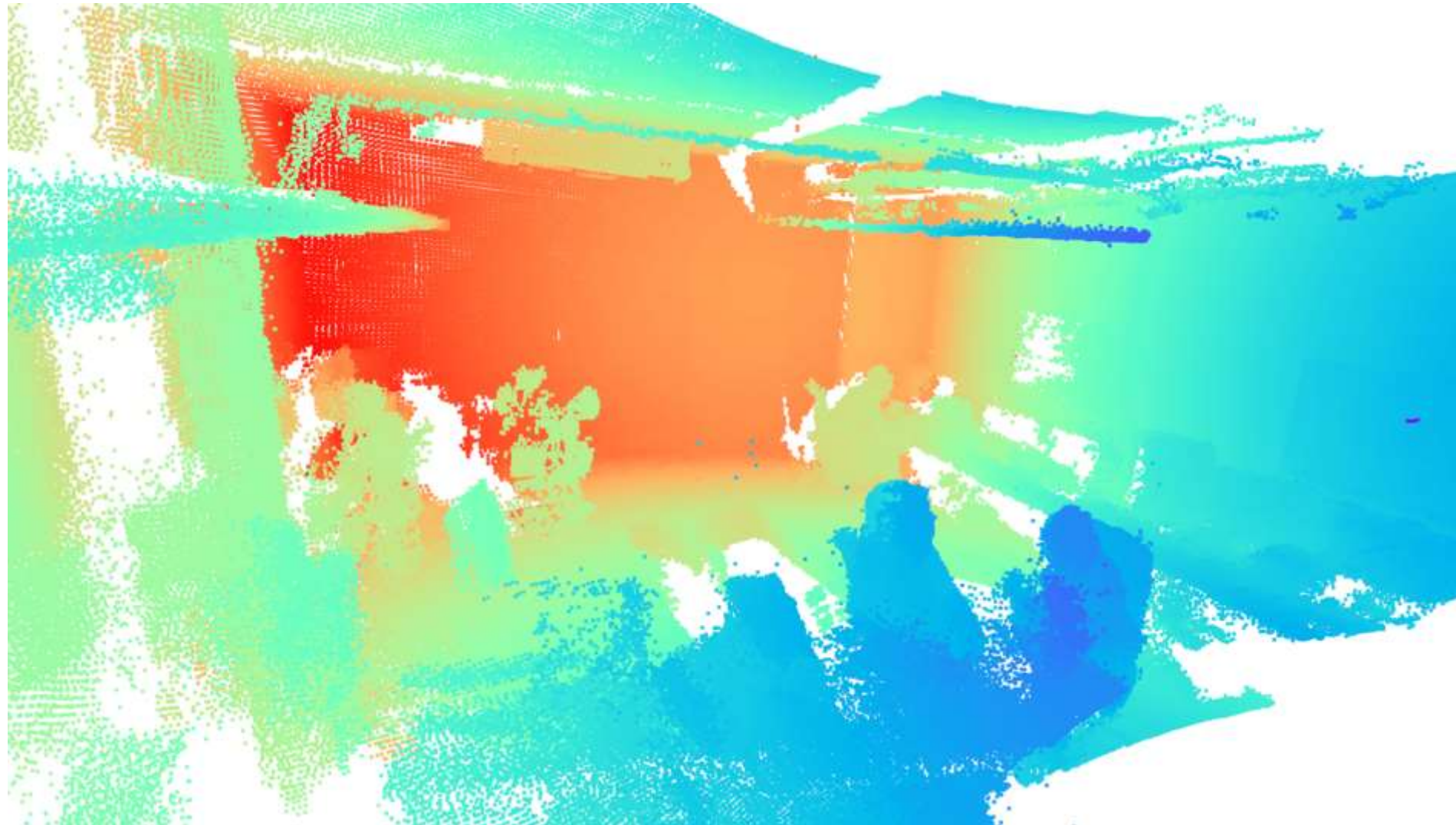
This work has received funding by the Bavarian Ministry of Economic Affairs, Regional Development and Energy as part of the project 6G Future Lab Bavaria



Initial Scan



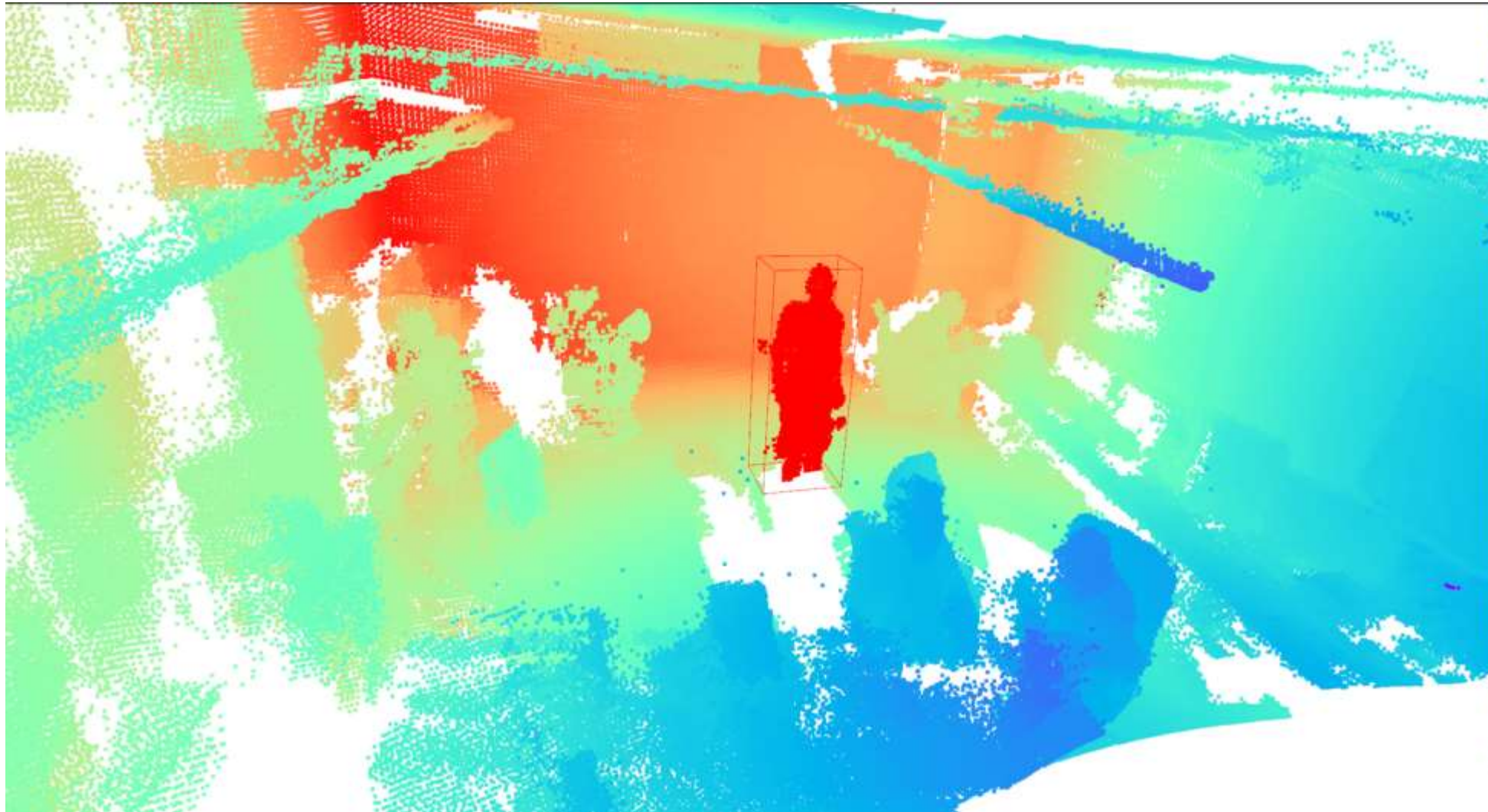
Initial Scan



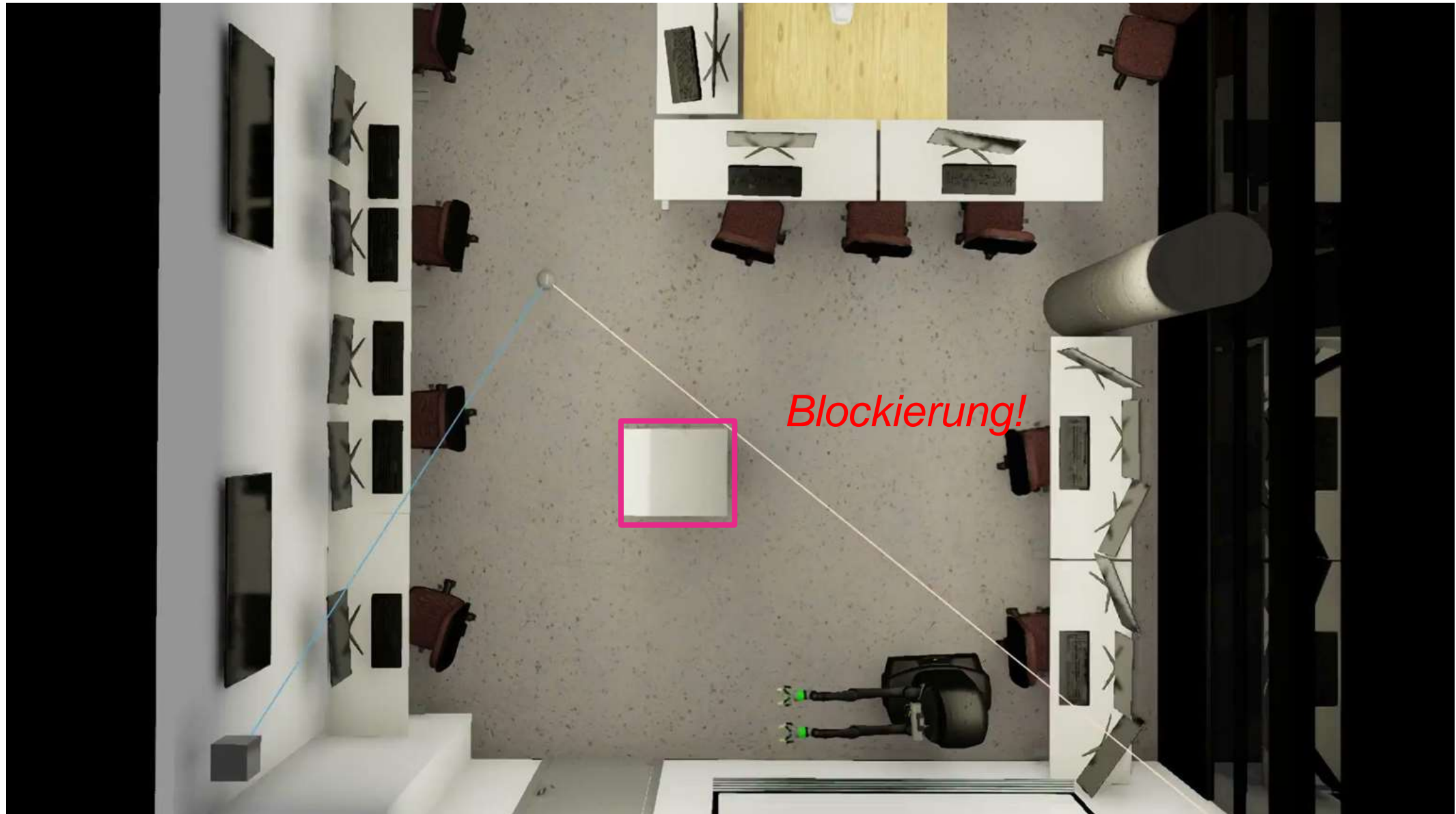
Second Scan



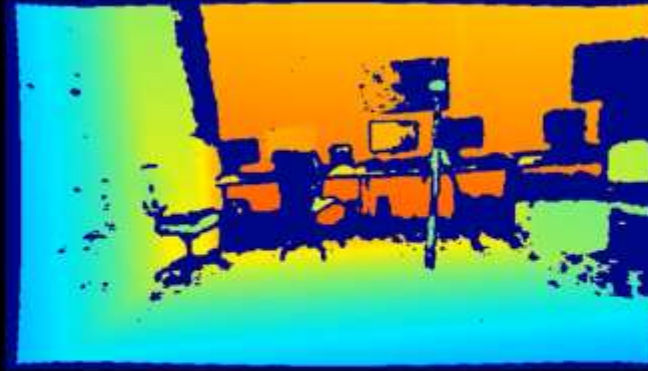
Second Scan



Digital Twin: Handover Prediction



Depth Camera



Physical World



Virtual World



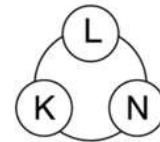
OCTOPUS: Optimized Cross-border TeleOperated Medicine Pouring Using NextGen Seamless Communication Networks

Edwin Babaians, Praveen Gorla, Serkut Ayvaşık, Jan Plachý, Zdenek Becvar, Wolfgang Kellerer, Eckehard Steinbach

Technical
University
of Munich



MIRMI



Sponsored by:

Bayerische Staatskanzlei

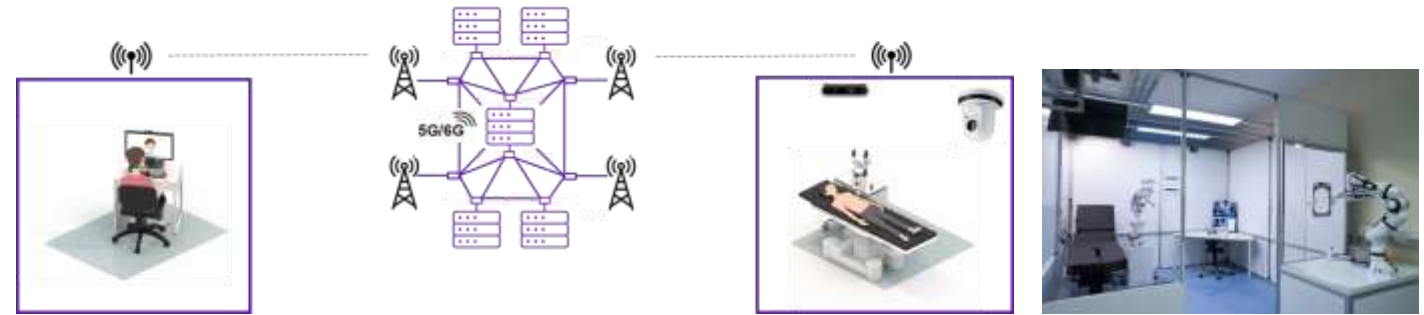


Healthcare

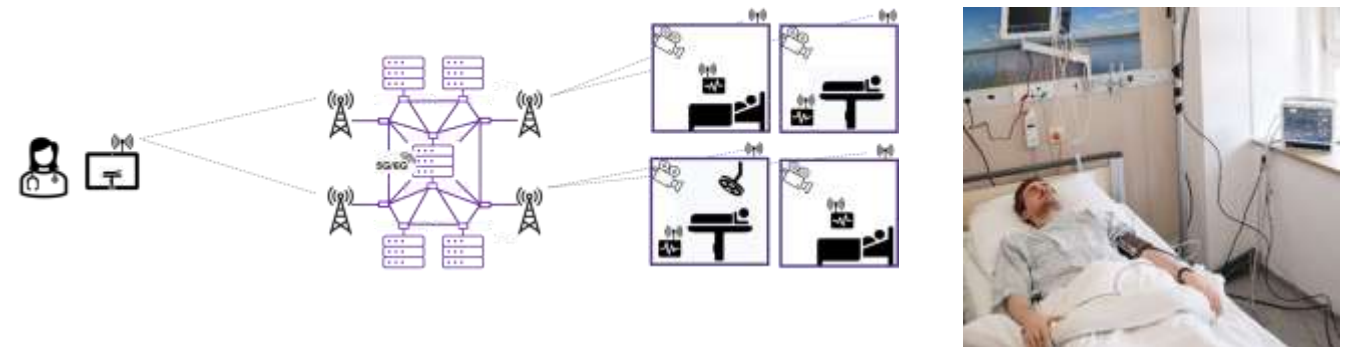
Testbed remote-surgery



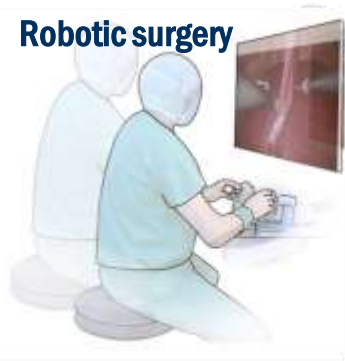
Testbed semiautonomous telerobotic examination suite



Testbed context-sensitive patient monitoring



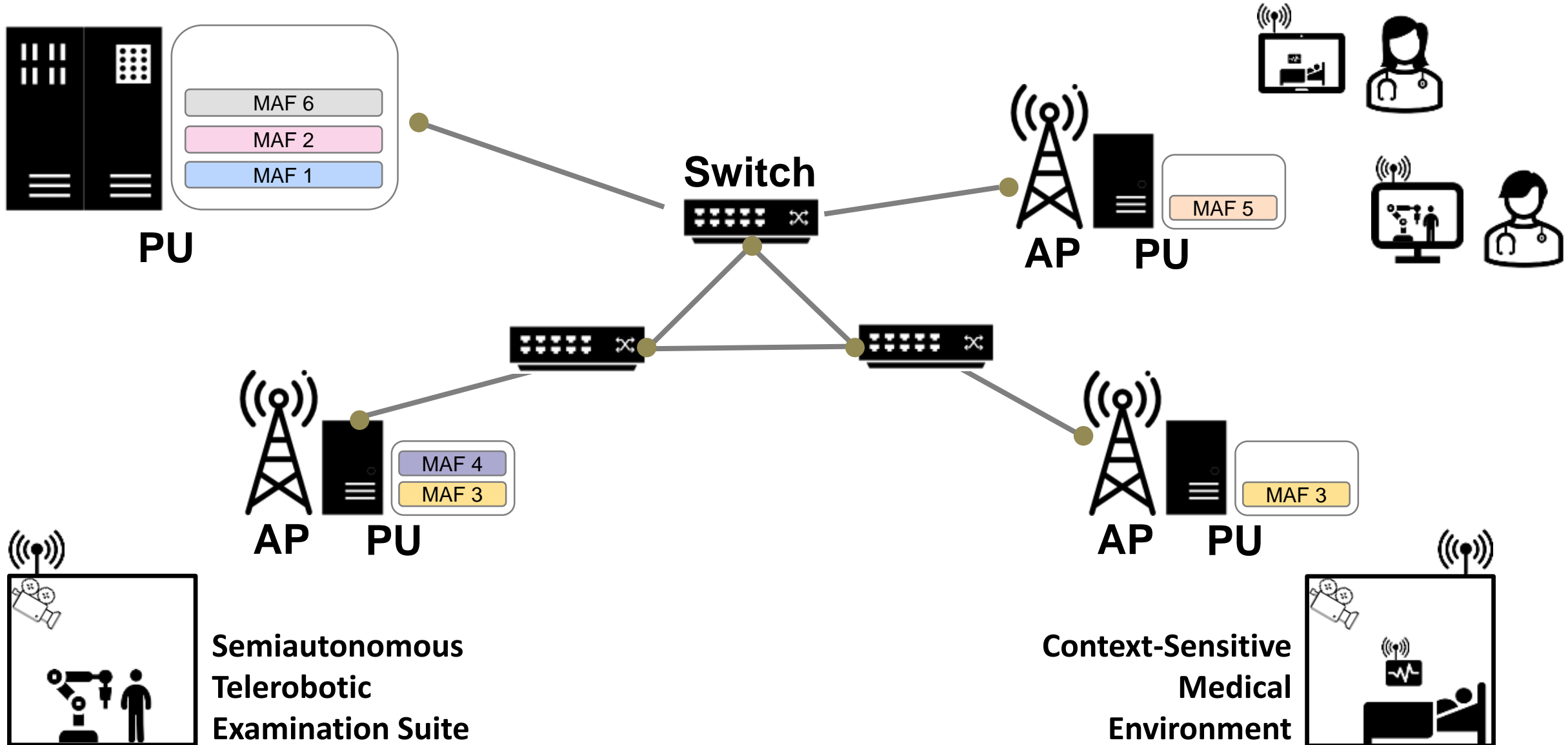
Robotic surgery



- Digital twin
- Prediction of events
- Immersive HCI
- Brain representation
- Modular regulatory framework

Remote expert





Semiautonomous Telerobotic Examination Suite



Science meets entrepreneurship

- Results from fundamental scientific projects → consider early how to
 - Sustain the created knowledge
 - Boost impact towards industry
- Impact through
 - Publications
 - Patents
 - Educated engineers
- Startups = golden way
 - Business-ready technologies
 - Know-how and value creation in Germany/Europe
 - Technology sovereignty

6G-life Startup Initiative: currently 20+ interactions

Sensors



HMI



Robotics



Communication



Cloud Computing



6G-life Startup Incubator: Launchhub42

BMBF Startup Connect



GEFÖRDERT VOM



Bundesministerium
für Bildung
und Forschung

6G Experimental Platform

<https://www.5g-munich.de/html/demo.html>

Thank you



Literatur

- K. Trommler, M. Hafner, W. Kellerer, P. Merz, S. Schuster, J. Urban, U. Baeder, B. Gunzelmann, A. Kornbichler: ***Six Questions about 6G*** – White Paper. Bayern Innovativ / Münchner Kreis, 2022.
- K. Trommler, M. Hafner, W. Kellerer, P. Merz, S. Schuster, J. Urban, U. Baeder, B. Gunzelmann, A. Kornbichler: ***Six Insights into 6G***. Bayern Innovativ / Münchner Kreis, 2022.
- **The Future of Communication Technology**. Trend Report 2023. Available in the CDTM Bookshop (CDTM – research - bookshop)
- Noch schnelleres Internet: Münchner Zukunftslabor tüftelt an 6G | Sat1:
https://www.sat1.de/serien/1730-sat1-bayern/videos/noch-schnelleres-internet-muenchner-zukunftslabor-tueftelt-an-6g-v_33f5sb9h1jdk

5G CampusNetz @ TUM



6G-life

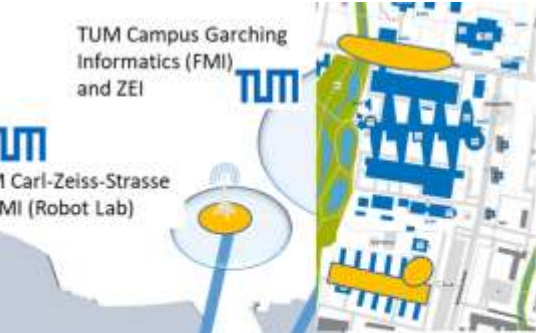
TUM Campus Garching
Informatics (FMI)
and ZEI



TUM Carl-Zeiss-Strasse
MIRMI (Robot Lab)



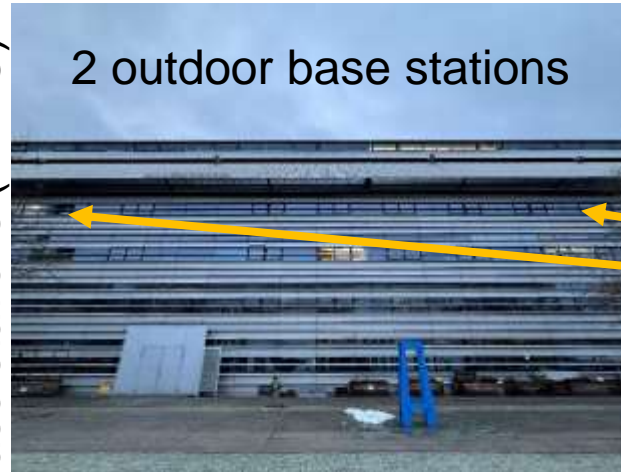
TUM Georg-Brauchle-Ring
Munich Inst. of Robotics and
Machine Intelligence (MIRMI)
(Robot Lab)



TUM Main Campus
Chair of Communication Networks
(RAN and Core Network)



10 indoor and 4 outdoor
base stations (MIMO)



2 outdoor base stations



1 trailer with
3 sector base station



10 indoor base stations