BMBF 6G Research Hub 6G-life
and
6G Future Lab Bavaria

Prof. Dr.-Ing. Wolfgang Kellerer
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Background

- Germany’s federal and state governments push for a **leading role in 6G technology** at an early stage
- Novel focus on **universities and startups**
- Strong push for an early **ecosystem establishment** via 4 university research hubs – one platform – industry projects
- Important objective is **technology sovereignty**

- **BMBF Research Hub 6G-life**
- **StMWi 6G Future Lab Bavaria**
BMBF 6G Research Hub 6G-life

- Started August 15, 2021
- 70 Million € for 4 years
- > 60 Principal Investigators

- 6G: focus is on **humans and their communication and interaction with machines** and the **virtual world** → holistic research on innovative concepts for scalable communication, novel methods, flexible software concepts and adaptive hardware
- Important fields of application: **Industry 4.0** and **healthcare**.
- Four key performance indicators: **Latency, Resilience, Security** and **Sustainability**
- **Digital Sovereignty**
- 10 Million € for **Start-ups**
6G-life core: innovative methods
Innovative Methods

novel methods for communication networks based on

• Post Shannon Theory
• AI for network control and new services
• Protocol and codec design for Human-Machine Collaboration
innovative methods to guide novel hardware and software concepts
Flexible Software

networks and equipment are dominated by SW

- In-network computing and ORAN
- 6G application in virtual worlds (digital twins and holograms)
- Low latency and energy efficient compiler and OS design
Adaptive Hardware

Novel hardware concepts for future needs and applications

• New materials for robotics and humans in virtual worlds
• Joint sensing and communication
• Flexible energy saving
innovative methods to flexibly tune our KPIs to support 6G communication
Scalable Communication

to support flexible communication network architectures including
• Cellular networks with Campus and HAP extensions
• Tactile Internet
• Quantum Communication
• Body Area Networks
Selected 6G technology focus fields in 6G-life

- 6G: human in the center – extension of the human intelligence and human abilities
- Application fields: Industry 4.0 and healthcare

- Ultra-scalable 6G architecture
- AI for network control and AI support in-network
- Joint sensing and communication
- New materials, e.g. for robotics
- Post Shannon Theory
- Quantum communication
- Post-quantum security
6G-life applications and testbed

Industry 4.0 and healthcare

1.6 Terabit fiber link

Image sources: TUM MRI, TUM LTI, TUM, TUD, 5G Campus, CeTI
6G-life innovation ecosystem

Strong support of existing Startups and university Spinoffs

our current partners

CADAMI

Mimetik

CampusGenius

Olive Robotics

Meshmerize

Enari

PowerON

Wandelbots
6G Future Lab Bavaria

- Started on May 1, 2021
- 4 Million € for 3 years
- 13 Principal Investigators in 8 Subprojects

The lighthouse project at TUM researches on **selected fundamentals of 6G** and prepares them for further investigations, development and standardization. Research focus is on the coupling of the digital and the physical world ("Digital Twin"), as well as on sustainability, resilience and security.

*6G fundamental research - 6G experimental platform - 6G roadmap*
Thank you

http://www.6g-life.de

https://www.6g-future-lab.de/
## 6G-life Innovation Areas

### Scalable Communication

- communication network architectures including
  - Cellular networks with Campus and HAP extensions
  - Tactile Internet
  - Quantum Communication
  - Body Area Networks

### Innovative Methods

- novel methods for communication networks based on
  - Post Shannon Theory
  - AI for network control and new services
  - Protocol and codec design for Human-Machine Collaboration

### Flexible Software

- networks are dominated by SW
  - In-network computing and ORAN
  - 6G application in virtual worlds (digital twins and holograms)
  - Low latency and energy efficient compiler/OS design

### Adaptive Hardware

- Novel hardware concepts for future needs and applications
  - New materials for robotics and humans in virtual worlds
  - Joint sensing and communication
  - Flexible energy saving
Example: Video Image information for 6G resource management

Concept
- Channel estimation based on video image processing
- AI-based estimation is performed in edge cloud
- Significant increase in throughput and reliability