6G Zukunftslabor Bayern - 6G Future Lab Bavaria

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Project Coordinator

Thinknet 6G Summit
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Bavarian 6G Initiative

- Launched in the Kabinettsitzung on Sept. 14, 2020
- Consists of three pillars

1. 6G-Pilot: „6G Zukunftslabor Bayern – 6G Future Lab Bavaria“ @ TUM

2. Networking platform for academia and industry: „Thinknet 6G“ @BI

3. Call for 6G Collaboration Projects (started in Spring 2021)
6G Future Lab Bavaria

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

- research on selected fundamentals of 6G
- focus on the coupling of the digital and the physical world ("Digital Twin"), as well as on sustainability, resilience and security.
Partners → Fundamental, interdisciplinary research

- Prof. Eckehard Steinbach, Media Technology
- Prof. Reinhard Heckel, Machine Learning
- Prof. Klaus Diepold, Data Processing

- Prof. Wolfgang Kellerer, Communication Networks
- PD Carmen Mas Machuca, Communication Networks
- Prof. Georg Carle, Network Architectures and Services, Informatics
- Prof. Jörg Ott, Chair of Connected Mobility, Informatics

- Prof. Holger Boche, Theoretical Information Technology
- Prof. Gerhard Kramer, Communications Engineering
- Prof. Wolfgang Utschick, Signal Processing Methods
- Prof. Antonia Wachter-Zeh, Coding for Communication and Data Storage

- Prof. Andreas Herkersdorf, Integrated Systems
- Prof. Georg Sigl, Security in Information Technology

application, AI, digital twin
flexible, resilient and sustainable end-to-end network
resilient, sustainable cognitive radio
hardware platform and security
Digital Twin (DT) in 6G

- General Concept for the DT: Establish real-time connection between real and virtual spaces

example results of joint subproject of Prof. Eckehard Steinbach and Prof. Wolfgang Kellerer
Benefit of using a Digital Twin in 6G

- Example: Mobility Management

THz frequencies:
- coverage < 15 m
- more blockages

- frequent handovers
- precise beam steering

digital twin of the environment with dynamic updates

better communication possible

→ Proactive handover
Digital Twin of an Indoor Environment

base station

moving robot

base station
First Scan
Second Scan
Second Scan
Digital Twin: Handover Prediction

blockage!
Mobility-related evaluation

<table>
<thead>
<tr>
<th>Handover</th>
<th>Handover rate</th>
<th>Outage time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>0.098</td>
<td>96.6</td>
</tr>
<tr>
<td>Blockage-aware</td>
<td>0.052</td>
<td>87.0</td>
</tr>
</tbody>
</table>

Smooth connectivity

Standard
- Less computational effort
- Reduces outage time
- Reduces handover rate
- Reduces signaling

Blockage-aware
- ~45 %
- ~10 %
6G Experimental Platform

- Based on 5G Testbed platforms

AI-enabled edge clouds

programmable core network

sliced, SW-defined radio access network

cooperations
6G Testbeds @ TUM

5G / 6G Testbed at Chair of Communication Networks / Chair of Media Technology

ACES Lab at Chair of Theoretic Information Technology

5G CampusNetz @ TUM
(under development)
Joint lab of Chair of Communication Networks (Kellerer) and Chair of Media Technology (Steinbach)

6G Experimental Platform

https://www.5g-munich.de/html/demo.html
Thank you

https://www.6g-future-lab.de/

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