Poster presentation (GJWS5-GP-FAU1)

6G-Platform Germany: FAU @ 6G-Platform

Norman Franchi, FAU Erlangen-Nürnberg

This poster gives an overview of the recent activities of the FAU in three different working Groups of the 6G Platform Germany: Roadmap, Trust, and Resilience-by-Design. Let's discuss the status of the different working groups, especially the recently published White Paper "German Perspective of 6G - Use Cases, Technical Building Blocks and Requirements" (https://open.fau.de/handle/openfau/33572). The working group Roadmap has set itself the goal of identifying emerging application scenarios, new technologies, and future requirements that shape the 6G research, development, and standardization efforts in Germany and Europe. Therefore, the WG has collected, analyzed, and harmonized numerous 6G use cases from various academic institutions and companies under the 6G Platform. The White paper presents the most recent view on the identified 6G use cases and use case families, existing and novel technology building blocks needed to realize those use cases, as well as new requirements they entail.

Poster presentation (GJWS5-GP-FAU2)

6G-ICAS4Mobility : 6G Integrated Communication and Sensing for Mobility

Prof. Dr.-Ing. Norman Franchi (Friedrich-Alexander-Universität Erlangen-Nürnberg)

The German 6G-platform project 6G-ICAS4Mobility studies Integrated Communications and sensing (ICAS). The focus is on communication-centric sensing and multi-site radar fusion for mobile devices, using V2X sidelink. 6G-ICAS4Mobility provides measurements, simulations and hardware platforms for device-side ICAS in road vehicles and for drones.

The poster provides an overview of the project facts and the scope of the project, including use cases and system architecture.

Poster presentation (GJWS5-GP-FAU3)

6G-ICAS4Mobility: Channel modeling for ICAS vehicular applications

Maximilian Lübke (FAU Erlangen-Nürnberg)

ICAS is anticipated to play a crucial role in intelligent transportation systems, as it enables the simultaneous provision of sensing and communication functions using the same transmission and frequency spectrum. To develop concepts for the ICAS-related extension of the 3GPP channel model, we are working on a Geometry-Based Channel Model based on simulations in highway scenarios at 77 GHz. An improved multipath-component-distance threshold-based clustering algorithm is proposed to jointly group the paths for sensing and communication channels as clusters. These clusters are matched with the scenarios' physical interaction objects (targets). Based on the clustering results, cluster-level parameters (i.e., intra-cluster delay, azimuth, and Doppler spread) are explored. Furthermore, the clusters contributed from the same physical interaction object in both the communication and the sensing channels are regarded as "sharing the sensing clusters." To investigate the correlation and differences between the communication and sensing channels, a shared degree (SD) metric is analyzed.

Poster presentation (GJWS5-GP-FFHR)

Consensus-based Time Synchronization for Joint Communications and Sensing

Andreas Bathelt (Fraunhofer FHR), Manognya Ayalasomayajula (Fraunhofer FHR)

The intended cell-free structure of future communication networks presents an interesting baseline for Joint Communications and Sensing. It lready features the necessary communication structure needed for multi-static sensing. The only missing component is the synchronization of the individual agents of such a network. For the required coordination among the agents, only an agreement on a same, possibly “incorrect”, time basis is needed – which is a consensus problem.

Poster presentation (GJWS5-GP-FHHI)

Automation Technologies for Open Optical and Packet Transport Networks

Behnam Shariati, Fraunhofer HHI

The Open Optical Transport Network (OOPT) architecture, defined by the Telecom Infra Project (TIP), is currently being deployed by major operators. The OOPT ecosystem, with its multi-stakeholder and multi-vendor environment, faces challenges like interoperability, business-critical data sharing, and end-to-end control and automation. These issues are worsened by introducing AI-assisted network functions requiring real-time telemetry data. The recent interest in integrating Large Language Model (LLM)-based solutions has further complicated the situation. This poster presents an experimentally validated automation platform that addresses these issues. It leverages data spaces, carrier-grade data pipelines, and customized LLM assistants with NDA compliance. The presented solution complies with interoperability standards (e.g. OpenConfig and TAPI specifications) to control programmable network elements and leverages gNMI for telemetry streaming from open terminals and Optical Line System (OLS) controllers.

Poster presentation (GJWS5-GP-FIPT1)

5G Industry Campus Europe

Niels König (Fraunhofer IPT), Niklas Beckmann (Fraunhofer IPT), Robert Schmitt (WZL of RWTH Aachen University and Fraunhofer IPT)

The 5G Industry Campus Europe is a large-scale testing environment for 5G and 6G applications. It features 5G indoor networks across three different shop floors, fully equipped with machines and robots. Additionally, an outdoor network covers an area of 1 km² at the RWTH Aachen University Campus. The testbed utilizes 5G-NSA and 5G-SA on the industry spectrum of 3.7 to 3.8 GHz. On the shop floor of Fraunhofer IPT, a 5G-NSA mmWave network with 800 MHz is installed in the spectrum of 26.7 to 27.5 GHz. A simultaneous 4G network operates at 2.3 GHz as an anchor band.

The 5G Industry Campus Europe addresses various markets affected by 5G, including manufacturing, logistics, mobility, energy, construction, and health.

Poster presentation (GJWS5-GP-FIPT2)

Assessing mmWave RTT Performance for Industrial Applications

Niklas Beckmann (Fraunhofer IPT), Junaid Ansari (Ericsson), Jordi Biosca Caro (Ericsson), Niels König (Fraunhofer IPT), Robert Schmitt (WZL of RWTH Aachen University and Fraunhofer IPT)

At the shop floor of Fraunhofer IPT, in collaboration with Ericsson, mmWave RTT (Round Trip Time) performance results have been rigorously evaluated. This is crucial for applications requiring ultra-reliable low latency, such as real-time robotics control and automated guided vehicles. The performance tests involved measuring the RTT using various UDP payload sizes of 100B and 1000B. These tests are essential to ensure that the network can handle different data loads without compromising speed or reliability.

The analysis focused on key statistical metrics: the mean, the 99th percentile, and the 99.9th percentile of RTT. These metrics provide a comprehensive understanding of the typical and worst-case latency scenarios, ensuring the network meets stringent performance requirements. Such detailed RTT insights are pivotal in optimizing network configurations for advanced industrial use cases, ensuring seamless and efficient operations.

Poster presentation (GJWS5-GP-FTHH)

Optical Access Networks-as-a-Sensor

Johannes Fischer (Fraunhofer HHI)

Optical fiber-based telecommunication networks are evolving towards acting as a massive distributed sensor network providing functions like environmental sensing, infrastructure sensing and sensing for security. Applications range from smart cities over desaster prediction and infrastructure maintenance towards perimeter security. While there are many works on optical sensing in metro and long-haul network segments, the poster is looking into opportunities for applying optical sensing in the optical access network segment. In particular, an overview on implementation options and challenges in next-generation coherent access networks will be provided as well as an outlook on research planned in the newly started CELTIC-Next Flagship Project SUSTAINET-inNOvate. Furthermore, exemplary applications and sensing functions for this network segment will be highlighted.

Poster presentation (GJWS5-GP-RWTH)

High-Speed and AI-Empowered mmWave Testbed for Industrial Metaverse

Bumhee Lee, Mohsen Pourghasemian, Alexander Baron, Mohammad Shafi, Meliksah Canoglu, Guang Han, Firooz B. Saghezchi, Haris Gacanin (RWTH Aachen University)

This poster presents the innovative research and development activities conducted by the Chair for Distributed Signal Processing (DSP) at RWTH Aachen University, Germany, for developing a high-speed and AI-empowered mmWave testbed for Industrial Metaverse applications. The poster highlights our research and development activities on building a Software-Defined Radio testbed with SW/HW co-design using FPGA for ultrabroadband baseband signal processing for mmWave/THz systems. The testbed can be used to validate innovative wireless signal processing algorithms, either conventional or AI/ML-based solutions, for next-generation mobile networks. It also underlines deep learning as a research topic that we investigate for optimizing wireless PHY signal processing and radio resource management, and edge intelligence to empower Industrial Internet-of-Things (IIoT) use cases. Finally, it features the Extended Reality (XR) platform that we are developing to facilitate real-time interactions with wireless networks, digital twins and cyber-physical systems to monitor and optimize the production processes in real-time.

Poster presentation (GJWS5-GP-TUBR)

System-Level Time Synchronization: The key for safe data transmission in collective perception

Jonas Peeck (TU Braunschweig) (Author and Presenter), Selma Saidi (TU Braunschweig)

Collaborative autonomous systems depend on services like remote sensing, collective perception, or HD-map sharing, to make safe decisions while maintaining performance. For this, wireless real-time communication of large environmental data presents a major emerging challenge, particularly in safety-critical domains such as self-driving cars, autonomous assistance robots, or autonomous industrial robots.

A lack of awareness about the application-level data flow often restricts the utilization of wireless channel resources in order to limit critical interference and, therefore, avoid load peaks that cause deadline violations. However, this hinders the transmission of the required larger data volumes.

Precise time synchronization and synchronized object communication are both upcoming technologies. They are key for efficiently resolving wireless interference between large data object communication from collaborative autonomous systems within the application-layer context. This way collective environment perception scales well, whereby composable synchronous resource allocation reflects the dynamic nature of complex, open, and interactive systems.

Poster presentation (GJWS5-GP-TUDO1)

IRS-enhanced mmWave Connectivity for 6G Industrial Networks

Stefan Böcker (TU Dortmund University); Niels König (Fraunhofer IPT)

The adoption of Millimeter-Wave (mmWave) technology in industrial environments presents significant challenges in maintaining consistent Quality of Service (QoS) under dynamic and complex conditions. Our investigates the performance of a multi-cell mmWave network deployed in a large-scale industrial hall, emphasizing the mobility of end devices and their interaction with environmental factors. Measurements were conducted using a Non-Standalone (NSA) 5G network configuration with one sub-6 GHz anchor and two mmWave Radio Units (RUs) positioned for comprehensive coverage. The evaluation highlights key aspects such as Secondary Node (SN) changes, device orientation, and network load conditions. Results from mobile measurements reveal the influence of device alignment and environmental changes on performance, transmission power and connectivity, particularly in SN change areas. Additionally, the impact of static load generation on multi-cell network performance was examined, demonstrating the interplay between mobility and network capacity. These findings underscore the importance of precise device orientation and environmental awareness in optimizing mmWave deployments.

Poster presentation (GJWS5-GP-TUDO2)

The Resilient Network Challenge 2025

Stefan Böcker (TU Dortmund University)

In the first subproject, a national collaboration of the 6GEM and 6G-life research hubs and several startups, alongside Japanese colleagues (including Kentaro Ishizu from NICT, Japan), will evaluate reliable 6G networking solutions for mobile applications in rescue robotics scenarios. The focus will be on expanding the Multi-X approach developed within the 6GEM framework, in cooperation with 6G-life startups, to enhance mesh networking solutions. A large integration and demo workshop will showcase the developed solutions in authentic and large-scale test fields of the German Rescue Robotics Center (DRZ).

Poster presentation (GJWS5-GP-TUIL1)

Data-driven Channel Modelling for ICAS

Marc Miranda (Technische Universität Ilmenau)

Integrated communication and sensing (ICAS) promises to be key technology in beyond-5G and 6G networks for automotive applications. We present our activities in multi-link radio channel characterization for sensing in Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) environments, based on relevant channel sounding measurement campaigns. The objectives are: to study and publish datasets useful for multi-path propagation analysis, validation of geometry-based stochastic channel models (GBSCMs) and development of ray-based reflectivity approaches. By capturing time-varying, dual-polarimetric dual-link MIMO channel impulse responses (CIRs) and position data with real-time kinematic (RTK) precision, we make available realistic representations of channel behavior in the FR1 band in complex vehicular scenarios. Preliminary results show that ray-based simulations are beneficial for estimating reflected power from objects/targets and capturing dynamic channel characteristics, laying the groundwork for extensions to standard 3GPP channel models.

Poster presentation (GJWS5-GP-TUIL2)

Radio Channel Characterization for ICAS (Channel4ICAS) – Joint German-Japanese Research Project

Christian Schneider (Technische Universität Ilmenau)

This work presents a joint German-Japanese research effort focused on radio channel characterization for Integrated Communications and Sensing (ICAS). Serving as an extension to the BMBF-funded 6G-ICAS4Mobility project, the effort aims to study the aspects of sensing and security in automotive communications. Key objectives include acquiring and analyzing high-resolution multi-link MIMO channel measurements in various frequency bands, validating state-of-the-art ray-tracing tools, and developing concepts for the extension of 3GPP channel models for use in simulations. Furthermore, channel analysis and modeling results are used to study optimal waveform design, physical layer security methods and to evaluate ICAS resource allocation as well as parameter estimation algorithms. The project aims for a holistic understanding of radio channels for ICAS, supporting demands in next-generation vehicular networks and strengthening German-Japanese research activities.

Poster presentation (GJWS5-GP-UDE1)

Photonic Technologies for IEEE 802.15.3d THz Communications

Andreas Söhr, University Duisburg-Essen Germany

The poster summarizes recent achievements in photonic technologies for THz communications combatible to IEEE 802.15.3d 8 hannelization. Besides high-power MUTC photodiodes and Kerr microring oscillators for 6G THz transmitter the poster also demonstrates achievements in 200 Gbit/s THz communications over long distances. Compatibility of the developed systems to IEEE 802.15.3d channelization is also demonstrated.

Poster presentation (GJWS5-GP-UDE2)

Joint UDE-NICT research collaboration on THz communications within 6GEM

Jonas Tebart (University Duisburg-Essen), Takahiro Kaji (NICT, Advanced ICT Research Institute), Shuya Iwamatsu (University Duisburg-Essen), Andreas Stöhr (University Duisburg-Essen)

The 6th mobile generation targets at enabling new use cases such as holographic communication, terahertz communication or joint communication and sensing (JCS) requiring much wider wireless bandwidths than today's mobile generations can offer. The opening of the terahertz frequency range with its available huge operational bandwidth is widely considered as physical layer solution for this challenge. Consequently, international regulatory and standardization bodies are currently opening specific terahertz bands for future mobile communications.

The University of Duisburg-Essen and the National Institute of Information and Communications Technology are combining their technological and experimental skills for the development of photonic-assisted front-ends for full-duplex high data-rate wireless communications in the THz range targeting a wireless fiber to fiber bridge. The technologies planned for the implementation of this project are presented in this poster.

Poster presentation (GJWS5-GP-WZL)

Enhancement of Mobile Robotic Adaptivity with Cloud/Edge-Computing and 5G CloudRAN Architecture

Guillaume Tréheux (Laboratory for Machine Tools and Production Engineering)

Flexible assembly systems in dynamic environments pose significant challenges, including computational limitations in tasks like localization, navigation, perception, and reverse kinematics, along with ensuring scalability for multiple robots at minimal cost. This research aims to develop a scalable cloud/edge-computing infrastructure leveraging 5G/6G RAN within the 5G-Industry Campus Europe to enhance robotic adaptivity in Lean Manufacturing Assembly Systems (LMAS). The focus includes defining network Key Performance Indicators (KPIs) for Ultra-Reliable Low Latency Communications (URLLC) in industrial settings and creating a digital twin of the production environment using NVIDIA Isaac Sim. These efforts are geared toward optimizing robotic performance, improving flexibility, and ensuring cost-effective scalability in advanced manufacturing environments.

Poster presentation (GJWS5-GP-DENS1)

6G-ICAS4Mobility : Experimental Results

Robert Müller (DENSO AUTOMOTIVE Deutschland GmbH)

The German 6G-platform project 6G-ICAS4Mobility studies Integrated Communications and sensing (ICAS). The focus is on communication-centric sensing and multi-site radar fusion for mobile devices, using V2X sidelink. 6G-ICAS4Mobility provides measurements, simulations and hardware platforms for device-side ICAS in road vehicles and for drones.

The poster provides a high-level summary of six main achievements in hardware implementation and measurement campaigns. Selected detailed results will be given in four dedicated posters.

Poster presentation (GJWS5-GP-DENS2)

mmWave ICAS Channel Analysis at 28 GHz for Street Intersection Scenario

Weihan Xu, DENSO AUTOMOTIVE Deutschland GmbH

This work presents a millimeter-wave (mmWave) Integrated Communication and Sensing (ICAS) channel analysis at 28GHz, focusing on the dynamic effects of Vulnerable Road Users (VRUs) in a crowded street intersection scenario. ICAS has emerged as a potential new feature in 6G, offering the possibility of unlocking new markets using 3GPP technology. Additionally, advanced sensing capabilities of 6G technology can help address the growing hardware demands of ultrafast mmWave communications. Furthermore, standardized ICAS architectures can support RADAR interference challenges in automotive environments. To understand the challenges of ICAS system in dynamic environments, ray tracing simulations are conducted at 28 GHz, to obtain the stochastic channel parameters. The dynamic evolution of the channel is further analyzed for the potential sensing purposes such as in-vehicle sensor fusion and bi-static sensing for hidden object detection. The results provide insights for the development and testing of 6G ICAS systems for automotive use cases.

Poster presentation (GJWS5-GP-ERIC)

Reliability enhancements for mmW communication using IEEE 802.1CB

Junaid Ansari (Ericsson), Pierre Kehl (Fraunhofer IPT)

An empirical study on the use of IEEE 802.1CB with mmW communication has been conducted in a real production environment. Wireless communication shows packet delay variations caused by packet retransmissions, processing delays, protocol stack signaling, alignment delays with respect to the packet transmit opportunity, etc. mmW transmissions may suffer from blockage and penetration losses, which are undesirable in industrial deployments. In this poster, the use of IEEE 802.1CB protocol (also known as Frame Replication and Elimination for Reliability) for mmW reliability enhancements will be described. IEEE 802.1CB has two main functions: replication and elimination. IEEE 802.1CB protocol sends frames after replication on several disjoint paths. The elimination function deletes any redundant frames received. The experimental results indicate that IEEE 802.1CB scheme can reduce packet delay variations in wireless communication and make mmW transmissions robust.

Poster presentation (GJWS5-GP-RAS1)

6G-ADLANTIK: Photonics for harnessing the terahertz frequency range for 6G communication

Taro Eichler (Rohde & Schwarz)

The 6G-ADLANTIK project advances the development of sixth-generation (6G) mobile communication by utilizing electro-optic integration to access the terahertz (THz) frequency range. This approach addresses the growing demand for higher data rates and lower latency, unlocking new opportunities in industry, medical technology, and everyday applications. The project focuses on creating THz signal sources and detectors capable of covering nearly the entire 6G frequency spectrum. Key innovations include stabilized lasers, optical frequency combs, and advanced waveguide structures, which are integrated into high-performance transmission and reception units. Electro-optic integration enables precise, high-quality THz signals critical for 6G systems. Beyond communication, these components have applications in sensing and imaging technologies. Additionally, the project develops THz measurement tools for characterizing and optimizing 6G systems. By fostering technological sovereignty, 6G-ADLANTIK strengthens Germany's and Europe's position in advanced communication technologies while benefiting multiple sectors with innovative THz capabilities.

Poster presentation (GJWS5-GP-RAS2)

6G-LICRIS: Liquid Crystal based Reconfigurable Intelligent Sufaces

Taro Eichler (Rohde & Schwarz)

The upcoming 6G mobile communication standard will enable new applications and increased device connectivity. High-frequency ranges allow for greater data transmission bandwidth but face challenges like energy losses and signal blockages caused by obstacles such as buildings, which reduce network coverage compared to lower frequencies. To address these issues, either the number of active antennas can be increased, or radio wave propagation can be optimized. A promising solution involves reconfigurable surfaces, which can dynamically adjust their properties to direct 6G signals effectively. These surfaces, often mounted on walls, reduce the need for active antennas and are more energy-efficient.

The 6G-LICRIS project develops such reconfigurable surfaces using liquid crystal materials, which are better suited for high frequencies than semiconductors. The technology is tested in mobile networks and integrated into real-world scenarios to improve network coverage and adapt dynamically to changing needs. This innovation also strengthens Europe's technological leadership in advanced communication systems.

Both poster and demonstration (GJWS5-GB-FHHI)

Real-time Demonstration of International Optical Network Testbed Data Sharing with Data Sovereign Features

Yusuke Hirota1, Sugang Xu1, Angela Mitrovska2, Yuki Yoshida1, Pooyan Safari2, Behnam Shariati2, Johannes K. Fischer2, Ronald Freund2, Hideaki Furukawa1, Kouichi Akahane1, and Yoshinari Awaji1 (1:NICT, 2:HHI)

In the 6G/B5G era, optical network testbeds are taking on a new role in delivering big data, such as telemetry data, which is crucial for training and validating Artificial Intelligence (AI) and Machine Learning (ML)-assisted network functions. Nevertheless, assembling a comprehensive dataset for the emerging disaggregated, multi-vendor environments, is too demanding for a single testbed. This situation highlights the need for collaboration among various network testbeds in the data domain. To this end, establishing a data governance framework for exchanging and sharing invaluable testbed data across organizations, particularly those from different counters, is indispensable. Here we demonstrate a real-time, international testbed data sharing between NICT and HHI testbeds with data sovereignty based on International Data Spaces Reference Architecture Model (IDS-RAM).

Both poster and demonstration (GJWS5-GB-RWTH)

Prediction and Visualization of Ultra-High-Speed mmWave/THz Ultra-Spots based on Reinforcement Learning Powered by Extended Reality and Space-Time Synchronization

Phuc Duc Nguyen (NICT), Keitarou Kondou (NICT), Daniel Zakamulin (RWTH Aachen), Meliksah Canoglu (RWTH Aachen), Haris Gačanin (RWTH Aachen), Yozo Shoji (NICT)

The challenge of predicting the location of ultra-high-speed communication coverage using mmWave/THz waves (also known as ultra-spot) is increasingly prominent in beyond-5G, especially in communication between unmanned aerial vehicles (UAVs) and other UAVs, ground stations, or unmanned ground vehicles (UGVs), where mobilities are constantly moving at different speeds and environments are changing. In this study, we will introduce a proposed ultra-spot prediction method, adaptive flight path modification based on reinforcement learning, as well as the application of extended reality for ultra-spot visualization. Additionally, this research will analyze the effectiveness of high-precision space-time synchronization techniques to enhance the accuracy of ultra-spot location prediction, as well as the potential of this technique in beam steering and path planning applications.

Demonstration display (GJWS5-GD-NOKI)

6G Mobility Metaverse

Rastin Pries, Nokia, Marco Hoffmann, Nokia

The joined demo "6G Mobility Metaverse" from Nokia, Bosch, Mercedes, and Vodafone focuses on visualizing two 6G topics, namely real-time digital twinning of large-scale environments as well as in-vehicle subnetworks. Any change in the physical setup (smart city) will be reflected in real-time in the digital twin by merging sensory information from various sources. Real-world incidents detected in the digital twin are immediately fed back to the physical world. The demo also nicely visualizes how to adjust the view on the digital twin based on the user needs.

In-vehicle subnetworks are good means to connect the large number of sensors inside vehicles wirelessly. This demo showcases the challenges of in-vehicle subnetworks.