6G Plattform

Berlin 6G Conference 2024

Technical Sessions

Stand: 17.06.2024

6G Plattform

Agenda

Termin	Plenarsaal C 01	Raum A 08	Raum A 03 – A 04	Raum A 05	Raum A 06
Tue-AM1	09:15 Opening and EUREKA Session				
Tue-AM2	EUREKA & CELTIC Session				
Tue-PM1	EU and Intern. 6G Activities	Integrated Communication and Sensing [O. Blume, U. Barth]		Innovation Management [L. Underberg]	Security for 6G and Beyond [I. Bjelakovic, H. Boche, et al.]
Tue-PM2	EU and Intern. 6G Activities	3D Networks [A. Dekorsy, D. Wübben]		Sub-THz Channel Measurements and Modeling for 6G and Beyond [M. Peter]	Resilience in Wireless Communication Networks *[E. Jorswieck, F. Dressler]*
Tue-PM3	Start-Up Program [S. Stanczak]				
Wed-AM1	Plenary key note Session [G.Fettweis]				
Wed-AM2	Joint Communication and Sensing [F. Dressler, N. Franchi]	Towards Ubiquitous Coverage with 6G [G. Yammine]	JAP / GER Workshop	Sensing Technologies for Health in 6G Networks [S. Stanczak]	Energy Savings in Future Mobile Networks [T. von der Grün, T. Windisch]
Wed-PM1	Industry Panel: Open 5G Campus Networks – Drivers for 6G?	6G and Healthcare [T. Neumuth, C. Lipps]	Technologies and Circuits for Sub-THz Communication and Sensing	Large Scale Experimentation Facilities [G. Carle]	Reconfigurable Intelligent Surfaces: Theory, Optimization, and Experiments

Stand: 17.06.2024

	[T. Magedanz + N. Franchi]		[C. Carta, I. Ndip]		[A. Sezgin, R. Schober]
Wed-PM2	Towards Open 6G Research Infrastructures and Toolkits (Open6GRIT) International Session [T. Magedanz]	Trustworthiness [S. Köpsell, N. Franchi]	Architektur [G. Kunzmann]	From XL to cell-free MIMO: next-generation multi-antenna technologies [E. Jorswieck, L. Miretti]	Quantum Communications [H.Boche, F. Fitzek]
Thu-AM1	Beyond Metal: The future of Robotics Powered by 6G [S. Stanczak]	Control Plane Aspects of 6G Technology [A. Drummond]	Reconfigurable Intelligent Surfaces: Theory, Optimization, and Experiments [A. Sezgin, R. Schober]	Optische Zugangs- und Gebäudenetze für 6G [V. Jungnickel]	
Thu-AM2	Future Research Topics [S. ten Brink, S. Stanczak]	Wireless Access Protocols for 6G [A. Munari]	Quantum Technologies for 6G and Beyond [I. Bjelakovic, M. Geitz et al.]	Optical Transport Evolution Towards 6G [C. Schubert, J. Fischer]	SGP / GER Hybrid Workshop
Thu-PM1		Antennas [W. Keusgen, C. Oikonomopoulos]	Electromagnetic Exposure in 5G and Beyond Networks [M. Pauli]	Next Generation Wireless Networks and the Role of Machine Learning [R. Luis Garrido Cavalcante]	Highly-Efficient PAs for 5/6G [F. Gerfers, A. Hagelauer]

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Tue-PM1, A 08

Session Title: ICAS in Cellular Infrastructure and Sidelink

Session Chair: Dr. Oliver Blume (Bosch)
Ulrich Barth (Nokia Bell Labs)

CV

Oliver is a Dipl.-Phys. and holds a PhD of TU Hamburg in Electrical Engineering. He is with Bosch as a 5G/6G expert for V2X, connected and assisted driving, with a focus on ICAS. He is working in internal and collaborative research projects and is coordinating the project 6G-ICAS4Mobility for distributed Integrated Communication and Sensing (ICAS) in 6G Sidelink.

From 1997-2021 he was in the Radio Access department in Nokia Bell Labs and Nokia Standardisation. He contributed to many projects, e.g., 5GNetmobil, Tacnet4.0, SEKOM, GreenTouch, EARTH.

Ulrich is a Dipl.-Ing. And works for Nokia Bell Labs in the position of Technology Engagement Director. In this role he coordinates technology scouting, partnerships, and technology transfers. He senses the different partner interests in collaborations, align them to a common denominator and fosters the joint success. In parallel Ulrich is the Location Leader for Nokia Bell Labs Stuttgart. He represents Nokia Bell Labs in the industry and university context.

Background

One of the most prominent new concepts in 6G will be Integrated Communication and Sensing (ICAS). 3GPP systems already provide localization of connected devices. ICAS extends the successful cellular communication system to a platform for radar-like sensing of non-connected objects like vehicles, drones or VRUs.

Many uses cases have been proposed by European and BMBF 6G projects and by 3GPP SA1. ICAS sensing may leverage FR1 and FR2 bands. It may use Uplink or Downlink channels of cellular infrastructure or sidelink channels between vehicles. This will result in different system architectures, different sensing performance, different services and business models. The two industrial projects Komsens-6G and 6G-ICAS4Mobility are addressing ICAS in different approaches in a complementing work split. The keynote from 6G-RIC will further provide the academic view on ICAS.

The session aims for a status update about the system architectures, measurement campaigns, modelling and PoCs of the two projects. We will discuss synergies and opportunities for collaboration. This includes next steps on the projects' roadmaps, alignment of contributions to the 6G-Platform whitepapers and possible joint dissemination (as a follow-up of the combined booth at the 6G event 2024 in Berlin).

The session will be open to all participants of the 6G event, including members of other 6G projects which have aspects of ICAS in their scope. However, due to time limitation, we will not be able to allow further project presentations.

Agenda

- Key Note: Slawomir Stanczak (HHI), “The 6G-RIC view on ICAS for network as a sensor”, (20 min)
- System architecture and PoCs of KOMSENS-6G, (25 min)
- System architecture and PoCs of 6G-ICAS4Mobility, (25 min)
- Discussion between projects: Synergies and Collaboration Opportunities, (20 min)

Tue-PM1, A 03 – A 04

Session Title: Innovation Management and StartUp Connect

Session Chair: Dr.-Ing. Lisa Underberg

CV

Lisa Underberg received M.Sc. in Electrical Engineering in 2013 and her Ph.D. focusing on wireless communication systems for factory automation in 2019 from TU Dortmund University, Dortmund, Germany. She is currently with the Institute for Automation and Communication (ifak), Magdeburg, Germany, where she heads the "Wireless Automation" group. Her research interests include wireless communication networks, applications in process and factory automation and critical infrastructure and other Industry 4.0-related topics. She chairs 5G-ACIA's working group "Industrial 5G in Practice", participates in industrial radio-related groups of ZVEI, VDI and VDE and is part of the Automation Congress' and WFCS program committee.

Background

The session led by the WG Innovation Management within the 6G Platform. The working group functions as a connector and recogniser for innovations across the field of 6G Plattform and also providing start-up support from a scientific and technical perspective. In addition to this, incubators were created as part of the 6G programme, which offer an attractive financial structure for start-ups and also form a powerful start-up and innovation ecosystem with the WG Innovations Management.

Agenda

The event will start with an overview of the WG Innovation Management within the 6G Plattform, highlights its role for innovations in the 6G technology. Following this, representatives from each startup 6G-incubator (xG-Incubator, 6GEM Cubator, Launch Hub42 and SSC Kaiserslautern) will present their respective impulses, highlighting their approaches and contributions to fostering innovation in the field. This will set the stage for a panel discussion on "how to start up," where experts will share insights, strategies, and best practices for up-and-coming entrepreneurs.

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Tue-PM1, A 06

Session Title: Security for 6G and Beyond

Session Chair: Dr. Igor Bjelakovic
Prof. Dr.-Ing. Holger Boche
Dr. Stefan Katzenbeisser

CV

Igor Bjelakovic received the Dr.rer.nat degree in Mathematics and Dipl. Phys. degree in Theoretical/Mathematical Physics from TU Berlin in 2004 and 2001, respectively. He is senior researcher with Fraunhofer Heinrich-Hertz-Institute and a lecturer at TU Berlin. Previously, he held appointments with TU München and TU Berlin, Departments of Mathematics and Electrical Engineering. He was a member of the researcher group General Information Transfer and Combinatorics at the Universität Bielefeld led by Rudolf Ahlswede, and a member of Institute for Mathematics (Mittag-Leffler-Institut) of the Royal Swedish Academy of Science (Djursholm, Stockholm). His research interests are in the areas of quantum communications, physical layer security, information theory, statistical signal processing, high-dimensional probability and statistics and their applications in communications, machine learning, and distributed computation of functions in multi user networks.

Holger Boche received the Dipl.-Ing. degree in electrical engineering, Graduate degree in mathematics, and the Dr.-Ing. Degree in electrical engineering from the Technische Universität Dresden, Dresden, Germany, in 1990, 1992, and 1994, respectively, and the Dr. rer. nat. degree in pure mathematics from the Technische Universität Berlin, Berlin, Germany, in 1998. From 1994 to 1997 he did postgraduate studies at the Friedrich-Schiller Universität Jena. In 1997, he joined the Heinrich-Hertz-Institut (HHI) für Nachrichtentechnik Berlin, Berlin. From 2002 to 2010, he was a Full Professor in mobile communication networks with the Institute for Communications Systems, Technische Universität Berlin. In 2003, he became the Director of the Fraunhofer German-Sino Laboratory for Mobile Communications, Berlin, and in 2004, he became the Director of the Fraunhofer Institute for Telecommunications (HHI), Berlin, Germany. Since October 2010, he has been with the Institute of Theoretical Information Technology and a Full Professor with the Technische Universität München.

Stefan Katzenbeisser received his Ph.D. degree in Computer Science at TU Wien. Following his habilitation in Computer Science at TU München (2009), he was a professor at the Technical University of Darmstadt from 2012 until 2019. Since 2019, he has been a full professor at the Faculty of Computer Science and Mathematics at the University of Passau, Germany. His current research interests include embedded security, privacy, and cryptographic protocol design.

Background

The aim of the planned session is to present the latest approaches, results, and overview of activities within the 6G hubs in the field of security research for 6G networks and to intensify cross-hub discussion and cooperation.

The target topics (non-exclusive list):

1. System level security aspects
2. Post-quantum cryptography approaches and potential use-cases within 6G landscape
3. Privacy and confidentiality for integrated communication and sensing
4. Intelligent reflecting surfaces in the service of security
5. Security concepts for novel communication schemes, e.g., post-Shannon communications, in-network-computing, over-the-air computation, distributed consensus protocols etc.
6. Physical layer approaches to security
7. Integration of physical layer security in future communication systems
8. Side channel attacks
9. Resilience against attacks with quantum hardware
10. Quantum physical layer security
11. ML/AI in the service of security
12. Security of ML/AI based protocols deployed in future wireless networks
13. Other security related topics are welcome as well

Agenda

The session consists of a series of invited talks with contributions from the 6G-hubs, related BMBF projects, and companies providing security solutions.

Planned contributions:

1. Physical Layer Based Security Solutions (PHYSEC GmbH, BMBF-UltraSec project, TBC)
2. Quantum Private Queries (Thorsten Strufe (KIT), Open6GHub)
3. Privacy and Confidentiality for Multi-Party Over-the-Air Computation (6G-RIC, TBD)
4. IRS-assisted Secure Communication (6G-RIC, TBD)
5. Contributions by 6G-life
6. Contributions by 6GEM (TBC)

6G Plattform

Tue-PM2, A 08

Session Title: 3D Networks

Session Chair: Prof. Dr.-Ing. Armin Dekorsy
Dr.-Ing. Dirk Wübben

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6G Plattform

Tue-PM2, A 05

Session Title: Sub-THz Channel Measurements and Modeling for 6G and Beyond

Session Chair: Dr.-Ing. Michael Peter

CV

Michael Peter received the Dipl.-Ing. degree (M.S.) in electrical engineering and information technology from the University of Karlsruhe, Germany, in 2004, and the Dr.-Ing. (Ph.D.) degree in electrical engineering, telecommunications, from the Technische Universität Berlin, Germany, in 2018.

He joined the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, Berlin, Germany in 2005. In 2019, he became co-leader of the Millimeter-Wave Research Group and took over as head in 2021. His research interests include millimeter-wave and THz communications with focus on channel measurements and modeling, physical layer design and simulation, and performance analysis. He is author and co-author of more than 80 peer-reviewed scientific papers.

With his group he is heavily involved in the German "6G Research and Innovation Cluster" (6G-RIC) coordinated by HHI and several related research projects such es 6G-LICRIS, 6G-ADLANTIK and 6G-ICAS4Mobility funded by the Federal Ministry of Education and Research (BMBF).

Background

The exploitation of the sub-THz frequency range for future mobile radio systems is attracting great interest in the context of 6G research and development. Systems in the range from 80 GHz to 300 GHz with transmission bandwidths of several GHz promise very high data rates and ultra-high network capacity through dense deployment. The combination of short wavelength and very high bandwidth is also attractive for sensing applications such as high-precision positioning and localization. The benefits can be further enhanced by joint design and full integration of communication and sensing functionalities in the same system (Integrated Communication and Sensing, ICAS), targeting novel services in manufacturing, agriculture, entertainment, security and health.

Agenda

1. Dr. Michael Peter (Fraunhofer HHI), Characteristics of the sub-THz radio channel – insights from measurement-based analyses for various scenarios (6G-RIC, 6G-ADLANTIK)
2. Alexander Ebert (Fraunhofer IIS / Technische Universität Ilmenau), Characterization of propagation in an industrial scenario from sub-6 GHz to 300 GHz” (6G-RIC)
3. Lucas Cândido Ribeiro (Technische Universität Braunschweig), Small scale propagation characterization at 300 GHz in an industrial environment (6G-RIC)
4. Dr. Taro Eichler (Rohde & Schwarz), Probing the time evolution of the sub-THz radio channel for communication and sensing (6G-ADLANTIK)
5. Prof. Thomas Kaiser (Universität Duisburg-Essen), Time-varying THz indoor channel measurements and simulations for 6G testing with micrometer accuracy (6GEM)

6G Plattform

Tue-PM2, A 06

Session Title: Resilience in Wireless Communication Networks

Session Chair: Prof. Dr.-Ing. Eduard Jorswieck
Prof. Dr.-Ing. Falko Dressler

CV

Eduard Jorswieck is managing director of the Institute of Communications Technology and the head of the Chair for Communications Systems and Full Professor at TU Braunschweig, Brunswick, Germany. Eduard's main research interests are in the broad area of communications. He has published more than 175 journal papers, 15 book chapters, 1 book, 4 monographs, and some 325 conference papers on these topics. Dr. Jorswieck is IEEE Fellow. He is PI in the national 6G projects 6G-RIC, MassIMO, RePro and in the EU project 6G-SENSES.

Falko Dressler is full professor and Chair for Telecommunication Networks at the School of Electrical Engineering and Computer Science, TU Berlin. Dr. Dressler has been associate editor-in-chief for IEEE Trans. on Network Science and Engineering, IEEE Trans. on Mobile Computing and Elsevier Computer Communications. He has been chairing conferences such as IEEE INFOCOM, ACM MobiSys, ACM MobiHoc, IEEE VNC, IEEE GLOBECOM. Dr. Dressler is an IEEE Fellow as well as an ACM Distinguished Member. He is a member of the German National Academy of Science and Engineering (acatech). He is PI of the 6G-Platform and the 6G-RIC projects as well as spokesperson of the DFG SPP Resilient Worlds.

Background

Resilience is needed as the core property of the network infrastructure, from the Internet to the internet of things (IoT), from connected cars to complex cyber-physical systems (CPS). Resilience is a primary research objective for the coming years in the entire research community. This observation has led to the establishment of the DFG focus research program Resilient Worlds to work on fundamental challenges while several industry projects within the BMBF call “Resilienz – Widerstandsfähige digitale Systeme” study specific use cases and scenarios for resilient communication systems and networks.

Agenda

Special Session with 6 invited speakers:

1. Aydin Sezgin (RUB)
2. Norman Franchi (FAU)
3. Frank Hofmann (Bosch)
4. Matthias Hollick (TU Darmstadt)
5. Riccardo Bassoli (TU Dresden)

6G Plattform

Wed-AM2, C 01

Session Title: Joint Communication and Sensing

Session Chair: Prof. Dr.-Ing. Falko Dressler
Prof. Dr.-Ing. Norman Franchi

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Wed-AM2, A 08

Session Title: Towards Ubiquitous Coverage with 6G

Session Chair: Dr. -Ing. George Yammine

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Agenda

- Alexander Hofmann [Fraunhofer IIS]: NTN Aspects
- Marius Corici [Fraunhofer FOKUS]: Understanding the importance of nomadic networks for ubiquitous coverage in 6G networks
- Norbert Franke [Fraunhofer IIS]: Positioning in Cell-Free Massive MIMO Systems
- Matthias Meyer [TECTWIN]: Next-Generation Network Deployment and Services

6G Plattform

Wed-AM2, A 05

Session Title: Sensing Technologies for Health in 6G Networks

Session Chair: Prof. Dr.-Ing. habil. Slawomir Stanczak

CV

Slawomir Stanczak is Professor of Network Information Theory at the Technical University of Berlin and Head of the Wireless Communications and Networks Department at the Fraunhofer Heinrich Hertz Institute (HHI). Prof. Stanczak is co-author of two books and more than 200 peer-reviewed journal and conference papers in the areas of information theory, wireless communications, signal processing, and machine learning. Prof. Stanczak received research grants from the German Research Foundation and the Best Paper Award from the German Society for Telecommunications in 2014. He was an associate editor of the IEEE Transactions on Signal Processing from 2012 to 2015, editor of the IEEE Journal on Selected Areas in Communications for the special issue "Machine Learning in Communications and Networks" from 2020 to 2022, and chair of the ITU-T Focus Group on Machine Learning for Future Networks including 5G from 2017 to 2020. Since 2020 Prof. Stanczak is chairman of the 5G Berlin association and since 2021 he is coordinator of the 6G-RIC (Research & Innovation Cluster) and CampusOS projects.

Background

In modern medicine, radar and sensor technologies are playing an increasingly important role in improving diagnostic procedures, patient monitoring and developing innovative healthcare applications. These technologies enable the precise capture and analysis of biological signals, opening new possibilities for early disease detection, personalized treatments and more effective healthcare management.

Basic research in 6G aims to integrate such mechanisms into the communication infrastructure. In particular, the use of the subTHz spectrum is an important focus. Thanks to advances in semiconductor technology, technical development is possible in both the areas of sensors and communication, which is already evident in commercial systems.

Intensive work is currently being done on using these frequencies for sub-THz sensing and integrating them with communication (Integrated Communication and Sensing, ICAS). The combination of very high frequencies and bandwidths in particular results in several potential applications in the medical field, such as the contactless recording of vital parameters, the detection of substances/liquids/gases, the determination of movement patterns using imaging methods and the recording of physical/mental stress.

One of the challenges is the identification of suitable mechanisms of action and applications, which require a high degree of interdisciplinarity, both in terms of complex technology and clinical interpretability. This session will provide a comprehensive overview of the current state of research and discuss possible applications in an interdisciplinary manner with medical professionals (Charité), researchers (6G-RIC, KOMMSENS-6G), startups (StartUpConnect / xG-Incubator) and industry.

Agenda

1. Dr. Stefan Wesemann (Nokia Bell Labs), SubTHz sensing for health applications: opportunities & challenges (KOMSENS-6G)
2. Dr. Benedict Scheiner (Sykno GmbH), Unlocking health insights: cutting-edge radar technology for vital sign and heart sound detection (xG-Incubator)
3. Nastassia Vysotskaya (Infineon AG), Transforming cardiovascular health: a transformer-based approach to continuous, non-invasive blood pressure estimation via radar sensing (6G-Health)
4. Dr. Johannes Dommel (Fraunhofer HHI), Insights from experimental measurements in the subTHz regime (6G-RIC)

6G Plattform

Wed-AM2, A 06

Session Title: Energy Savings in Future Mobile Networks

Session Chair: Thomas von der Grün
Thomas Windisch

CV

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6G Plattform

Wed-PM1, C 01

Session Title: Industry Panel: Open 5G Campus Networks – Drivers for 6G?

Session Chair: Prof. Dr.-Ing. Thomas Magedanz
Prof. Dr.-Ing. Norman Franchi

CV

Mr. Takehiro Nakamura joined NTT Laboratories in 1990. He is now Chief Standardization Officer in NTT DOCOMO, Inc. Mr. Nakamura has been engaged in R&D and the standardization activities for advanced radio and network technologies of W-CDMA, HSPA, LTE/LTE-Advanced, 5G and 6G, and engaged in strengthening inter-industry collaboration. He has been contributing to standardization activities in ARIB, ITU and 3GPP since 1997, including as vice chair and chair of 3GPP TSG-RAN from 2005 to 2013. Currently, he plays important roles to promote and accelerate 5G and 6G in Japan and globally as the Acting Chairman of Strategy & Planning Committee and the leader of Millimeter wave Promotion Ad Hoc of 5G Mobile Communications Promotion Forum(5GMF), the leader of Cellular System Task Group of ITS Info-communications Forum, the leader of White Paper Subcommittee in Beyond 5G Promotion Consortium in Japan and the Board member of 5G-ACIA.

Dr. Muslim Elkotob is a Senior Executive and lead design and business development authority in Vodafone Business. He drives innovation and standardizes architectures in Autonomics, Slicing and Security in 5G+ and IoT. He is an IPv6-Forum Fellow and chairman/delegate in SDOs including ETSI, TMForum, ITU-T and IEEE. He has a career background of 20+ years with vendors, service providers and R&D.

Tilo Heckmann did his Diplomingenieur in Elektrotechnik at Universität Karlsruhe in 1993. He started his professional work with an IBM Subsidiary in IT domain with focus on UNIX operating systems and High-Speed data networks and their monitoring and management. Tilo was entering 1997 the company which finally became Telefónica Germany in network technology department.

Various expert and management positions in network technology domain pushing forward cutting-edge technology, products, and services into production network. During his time, he put his focus on introducing of GPRS, UMTS and 5G into core networks and he was responsible for the development of data messaging, location, and roaming services. Since more than 10 years he is in the role of a technology strategist - scouting, evaluating, and incubating new technologies and services upfront the daily business. He is looking on a long track record of striking strategical long term collaboration contracts with various partners of Telefonica. Now, he is going to pave the way for NTN and 6G technologies and services for Telefonica.

Dr. Andreas Mueller is a renowned expert at the forefront of connectivity research and 5G/6G innovation. As the leader of Bosch's strategic 6G activities across diverse business units and sites, he spearheads holistic transformative endeavors aligned with business imperatives. With his profound expertise in communication technologies for the IoT, Andreas also serves as the Chief Expert in this field. Moreover, he has held the position of General Chair of 5G-ACIA, the globally leading organization driving and shaping Industrial 5G, since its establishment in 2018. Andreas' pivotal contributions also include coordinating and advancing Bosch's Industrial 5G undertakings over the last couple of years, focusing on key areas such as private networks, Open RAN, AI/ML, and edge computing. Equipped with a robust background in telecommunications and vertical industry applications, Andreas is uniquely positioned to drive the transformative 5G/6G-enabled revolution across various sectors.

Joachim Sachs has more than 25 years of experience in mobile telecommunication from 2G to 6G. He is a senior expert at Ericsson Research and coordinates research on 5G and 6G mobile networks for Industrial IoT and vertical use cases, including cross-industry research collaborations.

Joachim studied electrical and electronics engineering at RWTH Aachen University, ENSEEIHT Toulouse, NTNU Trondheim and University of Strathclyde Glasgow. He received Ph.D. and diploma degrees from Technical University Berlin and RWTH Aachen University, respectively. In 2009 he was a visiting scholar at Stanford University. Joachim was awarded as Ericsson Inventor of the Year and received the Research Award of the Vodafone Foundation for Scientific Research. He is co-chair of the Technical Committee on Communication Networks and Systems of the German VDE Information Technology Society and a VDE ITG Fellow. Joachim holds numerous patents and has published 3 books, 2 book chapters and around 90 papers in international journals and conferences. He is a regular invited speaker and co-organizer of workshops, panels, sessions and journal special issues.

Slawomir Stanczak is Professor of Network Information Theory at the Technical University of Berlin and Head of the Wireless Communications and Networks Department at the Fraunhofer Heinrich Hertz Institute (HHI). Prof. Stanczak is co-author of two books and more than 200 peer-reviewed journal and conference papers in the areas of information theory, wireless communications, signal processing, and machine learning. Prof. Stanczak received research grants from the German Research Foundation and the Best Paper Award from the German Society for Telecommunications in 2014. He was an associate editor of the IEEE Transactions on Signal Processing from 2012 to 2015, editor of the IEEE Journal on Selected Areas in Communications for the special issue "Machine Learning in Communications and Networks" from 2020 to 2022, and chair of the ITU-T Focus Group on Machine Learning for Future Networks including 5G from 2017 to 2020. Since 2020 Prof. Stanczak is chairman of the 5G Berlin association and since 2021 he is coordinator of the 6G-RIC (Research & Innovation Cluster) and CampusOS projects.

Background

There is no doubt, that in many countries customized Non-public / Private / Campus Networks are currently being considered to be a solution to leapfrog commercial public 5G deployments in order to meet specific requirements of enterprises. We can witness that thanks to different business and operation models, in which operators, third parties, or the enterprises themself are planning, deploying and operating these networks. Looking at current research and innovation projects in this context, we can recognize a lot of the targeted 6G innovation areas being addressed, such as the research on higher spectrum RAN, satellite integration, dynamic spectrum usage, new positioning and sensing capabilities, network automation and deep integration of AI/ML, open network architectures and new eco system developments, etc.

In this panel we want to obtain an overview, how industry stakeholders are considering the role of Open 5G Campus Networks and their role in the evolution towards 6G.

Speaker

- Takehiro, Nakamura, DoCoMo, Japan
- Muslim Elkotop, Vodafone, Germany
- Tilo Heckmann, Telefonica, Germany
- Andreas Mueller, Bosch, Germany
- Joachim Sachs, Ericsson, Germany
- Slawomir Stanczak, HHI, Germany

6G Plattform

Wed-PM1, A 08

Session Title: 6G and Healthcare

Session Chair: Thomas Neumuth
Christoph Lipps

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6G Plattform

Wed-PM1, A03 – A 04

Session Title: Technologies and Circuits for Sub-THz Communication and Sensing

Session Chair: Prof. Dr. Corrado Carta
Prof. Dr. Ivan Ndip

CV

Corrado Carta received the Ph.D. degree from the Swiss Federal Institute of Technology (ETH) Zürich, Switzerland, in 2006. From July 2000 to February 2006, he was with the Microwave Electronics Group, ETH Zürich, where his main research interests include silicon-based radio frequency integrated circuit (RFIC) design for microwave wireless communications. From April 2006 to May 2008, he was with the High-Speed Electronics Group, Department of Electrical and Computer

Engineering, University of California at Santa Barbara, CA, USA, where his research work focused on the design of siliconbased integrated circuits for very large mm-wave phased arrays. In June 2008, he joined Sonos Inc., Santa Barbara, CA, USA, where he led the RF Engineering and Compliance Team, involved in the development and characterization of the wireless interface of new and existing products. In March 2010, he joined the Chair of Circuit Design and Network Theory, Technische Universität Dresden, Germany, where he led the mm-Wave IC Design Group and Beyond Moore Electronics, till August 2021. He is currently a Professor with the Integrated Broadband and High-Frequency Circuits Chair, Technische Universität Berlin, and also heads the Circuit Design Department, IHP Microelectronics GmbH, Frankfurt (Oder), Germany.

Ivan Ndip is a full Professor at the Brandenburg University of Technology Cottbus-Senftenberg (BTU), Germany. He has also been with Fraunhofer IZM for over 22 years, where he currently leads the Department of RF & Smart Sensor Systems. Prof. Ndip drives 5G and 6G research at Fraunhofer IZM. He has authored and co-authored over 230 scientific publications in peer-reviewed journals and conference proceedings. He has also taught Professional Development Courses to hundreds of engineers/scientists worldwide. He is a recipient of numerous Best Paper Awards, and the Tiburtius Prize, awarded yearly for outstanding Ph.D. dissertations in the State of Berlin. He is also a recipient of the Fraunhofer IZM Research Award, and the John A. Wagnon Technical Achievement Award from the International Microelectronics Assembly and Packaging Society (IMAPS). He holds more than 35 German, European and US patents. Prof. Ndip received the Dipl.-Ing. (M.Sc.) and Dr.Ing. (Ph.D.) degrees in electrical engineering from the Technische Universität Berlin. He also received the Dr.-Ing. habil. degree in electrical engineering from the Brandenburg University of Technology. He served as Director in the Executive Board of IMAPS from 2016 to 2020. He is a Life Member and Fellow of IMAPS as well as Senior Member of IEEE.

Background

The channel bandwidth has significant impact on the performance of wireless systems. The larger the bandwidth, the higher the throughput of wireless communication systems, and the higher the range resolution of radar systems. Due to the enormous bandwidth available in the sub-THz bands, these bands are currently being explored for the development of future 6G communication systems, sub-THz radar sensors as well as joint communication and sensing systems. However, the development of sub-THz systems is quite challenging, partly because of very high propagation losses in the sub-THz bands, which have severe impact on signal-to-noise ratio and throughput. To overcome these challenges, novel design techniques must be implemented at the chip, package and module levels. In this session, experts from industry and academia in Germany will present their latest results in the development of hardware systems for sub-THz wireless applications. The focus will be on SiGe BICMOS technologies, novel transceiver circuits as well as on advanced RF packages and integrated antennas for 6G, sub-THz radar sensing as well as on joint-communication and sensing applications. A fully-functional testbed for sensing in the sub-THz band will also be presented with a dedicated talk and setup for a live demonstration at the event venue. The results presented in this session originate from R&D projects funded by the German Federal Ministry of Education & Research (BMBF): 6G-RIC, Open 6G Hub, ESSENCE-6GM, 6GEM, CampuSens, MassIMO, AI4CSM, 6G-TERAKOM

Talks

1. Advanced RF Packages, Integrated Antennas and Reflectarrays for 6G and Sub-THz Radar Sensing Applications
    - Speaker: Robert Stöcker, Fraunhofer IZM, BTU Cottbus-Senftenberg
    - Additional contributors: Uwe Maaß, Thi Huyen Le, Ivan Ndip
    - Funding: 6GKom, 6G-TERAKOM, 6G-RIC, TKOS
2. SiGe BiCMOS Integrated Transceivers and Module Integration for Resilient Communication at D-band
    - Speaker: Corrado Carta, IHP GmbH
    - Additional contributors: Andrea Malignaggi, Batuhan Sütbas, Karthik KrishneGowda
    - Funding: 6G-RIC, Open 6G Hub, ESSENCE-6GM
3. Integrating Communication and Sensing: 6G and Radar Circuits in the D-Band
    - Speaker: Jan Schöpfel
    - Additional contributors: Tobias T. Braun, and Nils Pohl, Ruhr-Universität Bochum
    - Funding: 6GEM
4. SiGe BiCMOS Technology and Circuits for mm-Wave Applications
    - Speaker: Hans-Dieter Wohlmuth, Infineon
    - Funding: CampuSens, MassIMO, AI4CSM, ESSENCE, 6G-TERAKOM
5. 200Gbit/s Wireless Point-to-Point Transmission over 50m at 300GHz
    - Speaker: Sebastian Randel, Karlsruhe Institute of Technology (KIT), Germany
    - Additional contributors: Dittmer, D. Fang, Y. Chen, H. Peng, A. Bhutani, C. Koos
    - Funding: Open6GHub, 6GEM
6. D-Band Sensing Testbed: Advancing Ultra-Broadband Near-Realtime Capabilities
    - Speaker: Ramez Askar, Fraunhofer HHI
    - Additional contributors: Sven Wittig
    - Funding: 6G-RIC

6G Plattform

Wed-PM1, A 05

Session Title: Large Scale Experimentation Facilities

Session Chair: Prof. Dr.-Ing. Georg Carle

CVs

Georg Carle is professor at the Technical University of Munich since 2008, holding the Chair of Network Architectures and Services. He studied at University of Stuttgart, Brunel University, London, and Ecole Nationale Superieure des Telecommunications, Paris. He did his Ph.D. in Computer Science at University of Karlsruhe, and worked as postdoctoral scientist at Institut Eurecom, Sophia Antipolis, France, at the Fraunhofer Institute for Open Communication Systems, Berlin, and as professor at the University of Tübingen. He has been working on methods and tools for reproducible network research for more than two decades, e.g. as co-organizer of the 2003 workshop MoMeTools in conjunction with ACM SIGCOMM. He is scientific institution representative in the Interim Supervisory Board of the Scientific Large-scale Infrastructure for Computing/Communication Experimental Studies (SLICES-RI) European Research Infrastructure.

Serge Fdida is Professor at Sorbonne University (until 12/2017: UPMC) since 1995. His research interests are related to the future Internet as well as the design of federated testbeds to support experimentally driven research. He has been leading many research projects in High Performance Networking in France and Europe, notably pioneering the European activity on federated Internet testbeds. He lead Equipex FIT, a large-scale testbed on the Future Internet of Things, now part of the SLICES Research Infrastructure. He was instrumental in the effort of the networked systems testbed community to make SLICES entering the ESFRI (European Strategy Forum on Research Infrastructures) Roadmap in 2021. He has been coordinating several European projects.

Hakima Chaouchi is Professor at Institut Mines-Telecom following the completion of her PhD in 2004 from University of Paris VI in France and King's College of London in the UK. She develops leading research in wireless and mobile communication, Internet of Things, Big Data, and network security. She was appointed to manage the Doctoral Training Centre in Paris (DTC), implementing the European Institute of Innovation and Technology (EIT) ICT Labs' vision of building leadership in innovation in Europe and providing innovation support at doctoral level in a strong connection to the industry. The Doctoral Training Centre is supported by Nokia, Orange, Thales, EDF and others. Since 2018, she is Scientific Advisor on ICT Research and Innovation Strategy of the French Ministry of High Education and Research.

Sebastian Gallenmüller received his Ph.D. in 2021 from the Technical University of Munich. He works as senior scientist and habilitation candidate at the at the Chair of Network Architectures and Services, TUM Department of Computer Engineering. His main research interests are programmable packet processing systems and testbeds for network experiments with a focus on performance analysis and modeling of packet processing systems. As part of his work for SLICES is one of the developers of a framework that ensures the creation of reproducible network experiments.

Background

Experimental research on networked systems requires a suitable research infrastructure to perform experiments. For many years, the dominating approach of research groups was to create a specific experimental setup tailored to the needs of specific experiments, e.g., in the context of a PhD thesis. The community is well aware of the obvious shortcomings of this approach. One shortcoming is that while the time and effort to set up the needed infrastructure is high, the fact that the setups are created independently not only means unnecessary duplication of work, but also heterogeneity, with details frequently not documented in publications, that may lead to difficulties reproducing experiments of other scientists.

The networked systems community built large testbed research infrastructures, which contribute to overcome such challenges, and which provide valuable resources for experimental research of networked systems. However, there appears to be a gap between what the community that operates research infrastructures provides as services, and what scientists performing cutting edge experimental research actually need.

The SLICES Research Infrastructure aims to bridge this gap by providing high quality experimentation services with emerging technologies around the area of digital sciences (5G/6G, NFV, IoT and Cloud Computing), in an Internet-scale setup. SLICES aspires to foster the community of researchers around this ecosystem, create and strengthen necessary links with relevant industrial stakeholders for the exploitation of the infrastructure, advance existing methods for research reproducibility and experiment repeatability, and design and deploy the necessary solutions for providing SLICES with an easy to access scheme for users from different disciplines. A set of detailed research activities has been designed to materialize these efforts in tools for providing transnational (remote and physical) access to the facility, as well as virtual access to the data produced over the facilities. The respective networking activities of the project aspire in fostering the community around these infrastructures, as well as open up to new disciplines and industrial stakeholders.

Agenda

- Georg Carle (TUM)
- Serge Fdida (Sorbonne University)
- Hakima Chaouchi (Institut Mines-Telecom)
- Sebastian Gallenmüller (TUM)
- Panel Discussion: Industrial vs. Academic Viewpoints on Large Scale Research Infrastructures for Computing/Communication Experiments

6G Plattform

Wed-PM1, A 06

Session Title: Reconfigurable Intelligent Surfaces: Theory, Optimization, and Experiments

Session Chair: Prof. Dr.-Ing Aydin Sezgin
Prof. Dr.-Ing. Robert Schober

CV

Aydin Sezgin received the Dr. Ing. (Ph.D.) degree in electrical engineering from TU Berlin, in 2005. From 2001 to 2006, he was with the Heinrich-Hertz-Institut, Berlin. From 2006 to 2008, he held a postdoctoral position, and was also a lecturer with the Information Systems Laboratory, Department of Electrical Engineering, Stanford University, Stanford, CA, USA. From 2008 to 2009,

he held a postdoctoral position with the Department of Electrical Engineering and Computer Science, University of California, Irvine, CA, USA. From 2009 to 2011, he was the Head of the Emmy-Noether-Research Group on Wireless Networks, Ulm University. In 2011, he joined TU Darmstadt, Germany, as a professor. He is currently a professor with the Ruhr University Bochum, Germany. He has published several book chapters, more than 70 journals and 200 conference papers in these topics. Aydin is a winner of the ITG-Sponsorship Award, in 2006. He was a first recipient of the prestigious Emmy-Noether Grant by the German Research Foundation in communication engineering, in 2009. He has coauthored papers that received the Best Poster Award at the IEEE Communication Theory Workshop, in 2011, the Best Paper Award at ICCSPA, in 2015, at ICC, in 2019, and at ISAP, in 2023.

Robert Schober received his Dipl.-Ing. and Dr.-Ing. degrees from Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) in 1997 and 2000, respectively. He was a postdoctoral fellow at the University of Toronto, Canada, in 2001. From 2002 to 2011 he was a Professor and Canada Research Chair at the University of British Columbia (UBC), Vancouver, Canada. Since January 2012 he has been an Alexander-von-Humboldt-Professor and the Chair for Digital Communication at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany. His research interests fall into the broad areas of Communication Theory, Wireless Communications, and Statistical Signal Processing.

Robert received several awards for his work including the 2007 Wilhelm Friedrich Bessel Research Award of the Alexander von Humboldt Foundation, the 2008 Charles McDowell Award for Excellence in Research from UBC, a 2011 Alexander von Humboldt Professorship, a 2012 NSERC E.W.R. Stacie Fellowship, and the 2017 Wireless Communication Technical Committee Recognition Award. In addition, he has received several best paper awards for his research and is listed as a 2017 and 2018 Highly Cited Researcher by the Web of Science. Robert is a Fellow of the Canadian Academy of Engineering, a Fellow of the Engineering Institute of Canada, and a Fellow of the IEEE.

From 2012 to 2015, he served as Editor-in-Chief of the IEEE Transactions on Communications. From 2016 to 2018, he has been the Chair of the Steering Committee of the IEEE Transactions on Molecular, Biological and Multiscale Communication. Currently, he serves on the Editorial Board of the Proceedings of the IEEE. Furthermore, he is a Member at Large of the Board of Governors, the Director of Journals, and a Distinguished Lecturer of the IEEE Communications Society.

6G Plattform

Background

The session aims to offer the audience a comprehensive overview of the potential advantages associated with reconfigurable intelligent surfaces (RIS) in the context of 6G technology. Key topics to be explored during the session include an in-depth examination of the operational principles underlying the expanding array of RIS variations, their respective models, and their integration and interaction with radio access concepts. Additionally, the session will delve into critical considerations such as efficient channel estimation, resilience, and physical layer security.

Particular emphasis will be placed on exploring the applications of RIS within the framework of next-generation wireless networks, including but not limited to massive MIMO, cell-free operation, and Cloud-RAN. The objective is to shed light on the manifold ways RIS can significantly impact and enhance the functionality of these evolving communication paradigms.

Furthermore, the session is designed to address the requisite mathematical tools essential for studying RIS applications. This encompasses a broad spectrum of techniques, ranging from information and communication theoretic modeling and analysis to convex, global, and machine-learning-based optimization methods. By delving into these mathematical foundations, the session aims to provide a deeper understanding of the theoretical underpinnings that govern the efficacy of RIS in diverse communication scenarios.

In addition to theoretical discussions, the session will feature in part vides of practical demonstrations showcasing proof-of-concept RIS experiments across various use cases. These demonstrations serve as tangible examples, offering insights into the real-world applicability and potential of RIS technology. Through this dual approach of theoretical exploration and practical demonstrations, the session seeks to provide a holistic and enriching learning experience for participants keen on understanding the transformative role of reconfigurable intelligent surfaces in the realm of 6G.

Agenda

Session Part I, 4 Talks, (60 minutes)

- Eduard Jorswieck (6G-RIC)
- Wolfgang Utschick (6G-Life)
- Vahid Jamali (Open6GHub)
- Taro Eichler (stc) (6G-LICRIS)

Session Part II, 4 Talks (60 min)

- Michael Peter (6G-LICRIS, 6G-RIC)
- Robert Stöcker (6G-RIC, Fraunhofer IZM)
- Alejandro Jiménez Sáez (Open6GHub)
- Markus Heinrichs (TH Köln)

6G Plattform

Wed-PM2, C 01

Session Title: International Panel “Open 6G for all - Towards Open 6G Research Infrastructures and Toolkits (Open6GRIT))”

Session Chair: Prof. Dr.-Ing. Thomas Magedanz, Fraunhofer FOKUS / TU Berlin

CV

Thomas Magedanz (PhD) has been professor at the Technische Universität Berlin, Germany, leading the chair for next generation networks (www.av.tu-berlin.de) since 2004. In addition, since 2003 he has been Director of the Business Unit Software-based Networks (NGNI) at the Fraunhofer Institute for Open Communication Systems FOKUS (www.fokus.fraunhofer.de/go/ngni) in Berlin. For 35 years Prof. Magedanz has been a globally recognized ICT expert, working in the convergence field of telecommunications, Internet and information technologies understanding both the technology domains and the international market demands. His interest is in software-based networks for different vertical industries, with a strong focus on building public and non-public campus networks. He became famous over the last two decades for the development of open software toolkits for building vendor independent open testbeds for next generation mobile networks, such as OpenIMSCore, OpenEPC, OpenBaton, and Open5GCore. His current interest is in the evolution from 5G to 6G and the development of the Open 6G Core. For more details of his current work look here: www.6G-ready.org and www.open6Gnet.org

Dr. K. Chalkiotis has joined Deutsche Telekom Group Technology in 2013 as Vice President in Mobile Access. He moved from Cosmote Greece (subsidiary of Deutsche Telekom Group) where he initially joined in 2002.

His primary function was to define the strategy, architecture, innovation and blueprints for Mobile Access Networks in Deutsche Telekom Group. As of the beginning of 2016 he was also responsible for the architecture of the fixed networks within Deutsche Telekom Group Technology. Since 2018 he took over the responsibility of Access & Home Networks in DT group defining the strategy, architecture and innovation for access and home Networks in Deutsche Telekom Group. From 2020 - 2022 he was leading the 5G solutions which pushed the 5G deployment with the introduction of Dynamic Spectrum Sharing, (DSS), 5GC and Network Slicing. From 2022 up to September 2023 he was leading the Non terrestrial Networks and 6G Tribes.

Currently he is leading the Access Technologies & Spectrum Tribe and he is heading the 6G activities overall in DTAG Group. He is also Alternate Board Member for Deutsche Telekom in NGMN (Next Generation Mobile Networks) and member of the Board of 6G IA. He holds a B.Sc. in Physics, a B.Sc. at Electrical Engineering and Computing and also he holds a Ph.D. in Electrical

Maria Guta is Senior 5G/6G SatCom Solutions Architect in the 5G/6G Non-Terrestrial Networks Programme Office of the Directorate of Connectivity and Secure Communications5G/6G in the European Space Agency, Space for 5G | ESA CSC

Prepares and implements initiatives for design, development and pre-commercial deployment of 5G/6G NTN solutions; fostering co-creation/co-experimentation of satellite, terrestrial verticals industries. Interfaces with external stakeholders – space, terrestrial and vertical associations, national NTN initiatives, and EU-SNS-JU to develop common understanding for 5G/6G NTN. She leads the ESA 3GPP NTN standardisation working group and other related actions. She has more than 20 years of experience in field, in previous positions, was with Eutelsat in the Systems Studies Division and the Space Engineering SpA in the Telecom Programmes Division.

Akihiro Nakao received B.S. (1991) in Physics, M.E. (1994) in Information Engineering from the University of Tokyo. He was at IBM Yamato Laboratory, Tokyo Research Laboratory, and IBM Texas Austin from 1994 till 2005. He received M.S. (2001) and Ph.D. (2005) in Computer Science from Princeton University. He taught as an associate professor (2005-2014) and as a professor (2014-2021) in Applied Computer Science, at Interfaculty Initiative in Information Studies, Graduate School of Interdisciplinary Information Studies, the University of Tokyo. He has served as Vice Dean of the University of Tokyo's Interfaculty Initiative in Information Studies (2019-2021). In April 2021, he has moved to School of Engineering, the University of Tokyo (2021-present). Since April 2023, he has been serving as Head of Department of System Innovations, School of Engineering. He was appointed as an adviser to the President of the University of Tokyo (2019-2020) and has been a special adviser to the President of the University of Tokyo (2020-present). He is serving as Director, Collaborative Research Institute for NGCI,（Next-Generation Cyber Infrastructure), the University of Tokyo (2021-present). He has been appointed as the first guest professor at the University of Oulu and its Faculty of Information Technology and Electrical Engineering (ITEE) in September 2023. For social services, he has been playing several important roles in Japanese government and also at research societies. He has also been appointed Chairman of the 5G Mobile Network Promotion Forum (5GMF) Network Architecture Committee by Japanese government. He has been appointed as Chairman of 5G/Beyond 5G committee, Space ICT Promotion Initiative Forum, International Committee, and Beyond 5G Promotion Consortium as well (2020-present). From 2020 to present, he is a chair and advisor of IEICE technical committee on network systems (NS) as well as a chair of IEICE technical committee on cross-field research association of super-intelligent networking (RISING). He has been elected to become the president of Communication Society, IEICE, in 2024.

Serge Fdida is a Professor with Sorbonne Université since 1995. His research interests are related to the future internet technology and architecture. He has been leading many research projects in Europe, notably pioneering the activity on federated Internet testbeds. He established PlanetLab Europe in 2007 and the OneLab and FIT facilities. He was one of the initiators of the ACM Conext conference, general chair of ACM Mobicom 2015, IEEE Infocom 2019 and in 2021 and started the NetworkingChannel online program. Serge Fdida has also developed a strong experience related to innovation and industry transfer, – he was the co-founder of the Qosmos and Hopcast companies, – one of the active contributors to the creation of the Cap Digital cluster in Paris and President of EIT Health France. He is currently coordinating SLICES, the first large-scale scientific instrument in Digital Sciences, supported by the EU ESFRI framework. Serge Fdida received his PhD from Université Pierre & Marie Curie (UPMC), Paris in 1984. He received his Habilitation in 1989. Assistant Professor UPMC (1983-1987). Associate Professor UPMC (1988-1991). Professor Université Paris Descartes (1991-1995). Sabbatical at IBM Raleigh in 1995. Professor Sorbonne Université. Adviser ITC Department CNRS (2000-2005). Vice-President European affairs of UPMC (2014-2018). VP International Development of Sorbonne Université (2018-2021).

Anastasius Gavras (male) has more than 30 years of professional experience in academic and industry research. He is a programme manager at Eurescom in Germany and his work focuses on next generation networks, security and research infrastructures. His current interests are large scale testbeds for experimentation with 6G and Next Generation Internet technologies and systems among others in the context of the Smart Network and Services (SNS) programme. He is interested in innovation on top of advanced infrastructures and how such infrastructures can be used to demonstrate the value of new technologies for business and society. He is vice chair of the steering board and member of the technology board of the SNS Initiative and is actively involved in several work groups (e.g., 6G Architecture, Vision, Test, Measurement and KPIs Validation). He is author or co-author of several papers and articles in the area. He is member of the editorial board of the

Eurescom mess@ge magazine and has authored several articles for the magazine, typically with a techno-socio-economic dimension.

Abhimanyu (Manu) Gosain is a Senior Director for Institute of Wireless Internet of Things at Northeastern University, co-Chair for the FCC 6G Technology Advisory Council and Senior Advisor for NTIA ITS and DoD OUSD R&E FutureG. He is in charge of setting strategic goals and the research agenda for a $100M public-private partnership for the NSF Platforms for Advanced Wireless Research (PAWR) program and $25M DARPA Colosseum program. He serves as a Board Member for the OpenAirInterface Software Alliance, Founding member for Magma Core Foundation, Academic research council representative for O-RAN Alliance, Technology Roadmap group member for NextG Alliance and co-chair on organizing committee and program committees for 6GSymposium, EuCNC,IEEE InfoCom and ACM WinTech. His numerous professional publications and experience exemplify use-inspired basic research in the field of networking technologies such as 5G,6G, AI/ML, edge computing and Internet of Things. He is an IEEE Senior Member. He received his M.S. degree from Tufts University and M.B.A. from Boston University with High Honors.

Tony Q.S. Quek received the B.E. and M.E. degrees in Electrical and Electronics Engineering from Tokyo Institute of Technology, respectively. At Massachusetts Institute of Technology, he earned the Ph.D. in Electrical Engineering and Computer Science. Currently, he is the Cheng Tsang Man Chair Professor with Singapore University of Technology and Design (SUTD) and ST Engineering Distinguished Professor. He also serves as the Head of ISTD Pillar, Director for Future Communications R&D Programme, Sector Lead for SUTD AI Program, and the Deputy Director of SUTD-ZJU IDEA. His current research topics include wireless communications and networking, 6G, network intelligence, non-terrestrial networks, and open radio access network.

Dr. Quek has been actively involved in organizing and chairing sessions and has served as a TPC member in numerous international conferences. He is currently serving as an Area Editor for the IEEE Transactions on Wireless Communications. He was an Executive Editorial Committee Member of the IEEE Transactions on Wireless Communications, an Editor of the IEEE Transactions on Communications, and an Editor of the IEEE Wireless Communications Letters.

Dr. Quek received the 2008 Philip Yeo Prize for Outstanding Achievement in Research, the 2012 IEEE William R. Bennett Prize, the 2016 IEEE Signal Processing Society Young Author Best Paper Award, the 2017 CTTC Early Achievement Award, the 2017 IEEE ComSoc AP Outstanding Paper Award, the 2020 IEEE Communications Society Young Author Best Paper Award, the 2020 IEEE Stephen O. Rice Prize, the 2020 Nokia Visiting Professorship, and the the 2022 IEEE Signal Processing Society Best Paper Award. He is a Fellow of IEEE and a Fellow of the Academy of Engineering Singapore.

Panelists

- Aki Nakao, Tokyo University, Japan
- Kostas Chalkiotis, Deutsche Telekom, Germany
- Maria, Guta, European Space Agency, The Netherlands
- Serge Fdida, Sorbonne University, France
- Anita Dohler, NGMN Alliance
- Anastasius Gavras, EURESCOM, Germany
- Tony Quek, SUDT, Singapore
- Abhimnayu Gosain, Northeast University, USA

6G Plattform

Wed-PM2, A 08

Session Title: Trustworthiness

Session Chair: Stefan Köpsell
Prof. Dr.-Ing. Norman Franchi

CV

tba

Background

tba

Agenda

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Wed-PM2, A 03 – A 04

Session Title: Panel discussion: Paving the way to 6G architecture – do we need a revolution?

Session Chair: Dr. Gerald Kunzmann

CV

Gerald Kunzmann is a Principal Network Architect at NOKIA Strategy & Technology and has a leadership position in Nokia's internal 6G research & standardization program. Gerald is a major contributor to bi-lateral 6G collaborations and funded 6G research projects and leads the Architecture & System Design working group in the German 6G platform as well as a corresponding work package in the German 6G lighthouse project 6G-ANNA.

Gerald has more than 15 years of experience in telecommunications industry and academia including his PhD degree, which he received from the Technische Universität München (TUM). Gerald had been working in NTT DOCOMO Eurolabs in Munich, where he was responsible for various European ICT research projects, university collaborations, and open source projects on topics such as information-centric networking, Quality-of-Experience (QoE), network management, and Network Functions Virtualization (NFV). Between 2015 and 2020, he was acting as a delegate in ETSI ISG NFV. Gerald had also been acting as a delegate to 3GPP WGs SA1 and SA2 with focus on machine-type communication, network automation, artificial intelligence, and machine learning. Moreover, Gerald is (co-)author of numerous patents and scientific publications in the mentioned areas

Background

As multi-faceted as the term network architecture is, so are the 6G architectures envisioned in various 6G Platform projects: some of them looking into the functional architecture, others into implementation architectures, and yet others at deployment architectures.

In this session, we want to take a closer look at the 6G vision and related requirements on the 6G architecture stemming from the heterogeneity of various expected 6G use cases, specific deployments needs and expected new services.

We would like to learn from and discuss with the panelists related assumptions and expectations towards the 6G functional architecture. We also aim at confronting these assumptions with the realities we face in 6G high tech industry, e.g., in the form of spectrum availability, ongoing pre-standard discussions, 6G timeline, AI-based services, key learnings from 5G, and maturity of the baseline technologies.

Naturally, 6G and its architecture will be an evolution from earlier generations; however, the transition to a new generation is also an opportunity to introduce revolutionary changes. We'd like to discuss with the panelists which areas are expected to fundamentally change as compared to 5G, required by changes on the technology side, new monetization opportunities, or -maybe most important- a reduction of total cost of ownership. Important topics like sustainability, AI, open-source developments and new technologies such as quantum security will also be discussed in the context of the role they play in a future architecture.

Agenda

tba

6G Plattform

Wed-PM2, A 05

Session Title: From XL to cell-free MIMO: next-generation multi antenna technologies

Session Chair: Prof. Dr.-Ing. Eduard Jorswieck
Dr. Lorenzo Miretti

CV

Eduard Jorswieck is managing director of the Institute of Communications Technology and the head of the Chair for Communications Systems and Full Professor at TU Braunschweig, Brunswick, Germany. Eduard's main research interests are in the broad area of communications. He has published more than 180 journal papers, 16 book chapters, 1 book, 4 monographs, and some 325 conference papers on these topics. Dr. Jorswieck is IEEE Fellow. He is PI in the national 6G projects 6G-RIC, MassIMO, RePro and in the EU project 6G-SENSES.

Lorenzo Miretti received the B.Sc. and M.Sc. degrees in Telecommunication Engineering from Politecnico di Torino in 2015 and 2018, respectively, and the Ph.D. degree in wireless communications from EURECOM and Sorbonne Universite in 2021.He is currently a postdoctoral researcher with the Technical University of Berlin and the Fraunhofer Heinrich Hertz Institute. Within the 6G-RIC, 6G-ANNA, and MassIMO projects, he investigates novel solutions for next generation wireless networks, such as cell-free massive MIMO and sub-THz mobile access networks.

Background

The advent of extremely large-scale antenna systems, achieved by increasing the number of antennas at the base station (XL MIMO) or through coordinated joint processing of geographically distributed antenna systems (e.g., cell-free massive MIMO), holds great promise for enhancing the capabilities of next-generation wireless networks. However, to deliver the envisioned gains in practice, several technical challenges need to be addressed. For instance, of particular interest are the design of scalable and efficient hardware components, baseband processing techniques, network architectures, as well as radio resource management protocols. This special session aims to bring together experts from both industry and academia, involved in German 6G research programs, to discuss the opportunities and challenges of these next generation MIMO systems.

Agenda

- Prof. Giuseppe Caire, TUB (6G-RIC)
- Prof. Aydin Sezgin, RUB (6GEM, 6G-ANNA)
- Prof. Wolfgang Utschick, TUM (6G-Life)
- Dr. Miguel Lopez, Ericsson (6G-ANNA)
- Dr. Lorenzo Miretti, HHI (6G-RIC, 6G-ANNA, MassIMO)
- Paulo Oliveira, Infineon (MassIMO)

6G Plattform

Wed-PM2, A 06

Session Title: Quantum Communications

Session Chair: Prof. Dr.- Holger Boche
Prof. Dr. Frank Fitzek

CV

tba

Background

tba

Agenda

tba

6G Plattform

Thu-AM1, C 01

Session Title: Beyond Metal: The Future of Robotics Powered by 6G

Session Chair: Prof. Dr.-Ing. Slawomir Stanczak

CV

Slawomir Stanczak is Professor of Network Information Theory at the Technical University of Berlin and Head of the Wireless Communications and Networks Department at the Fraunhofer Heinrich Hertz Institute (HHI). Prof. Stanczak is co-author of two books and more than 200 peer-reviewed journal and conference papers in the areas of information theory, wireless communications, signal processing, and machine learning. Prof. Stanczak received research grants from the German Research Foundation and the Best Paper Award from the German Society for Telecommunications in 2014. He was an associate editor of the IEEE Transactions on Signal Processing from 2012 to 2015, editor of the IEEE Journal on Selected Areas in Communications for the special issue "Machine Learning in Communications and Networks" from 2020 to 2022, and chair of the ITU-T Focus Group on Machine Learning for Future Networks including 5G from 2017 to 2020. Since 2020 Prof. Stanczak is chairman of the 5G Berlin association and since 2021 he is coordinator of the 6G-RIC (Research & Innovation Cluster) and CampusOS projects.

Background

5G technology is expected to have a significant impact on the field of robotics, offering new capabilities in communication, control, and data processing. These capabilities can enable a wide range of applications across multiple sectors, including manufacturing, healthcare, agriculture, and service industries. One of the most significant impacts of 5G is its ability to enable real-time control of robots. There is no doubt that 6G will provide even lower latency and more reliable connections at higher data rates than 5G. Yet, these improvements alone may not be sufficient for the future applications of 6G in connected control and robotics, particularly in scenarios involving swarms of collaborative robots.

The goal of this session is to discuss the fascinating world of networked robotics, focusing on the critical requirements, technological advances, and significant applications emerging from this dynamic field. Our discussion will extend to identifying and leveraging synergies and opportunities for collaboration, not only within the 6G hubs but also between these hubs and the industry.

The session is intended to be inclusive and will welcome all attendees of the 6G event. The session will serve as a platform to discuss the future directions of networked robotics and the potential for new technologies and methodologies to shape the field.

Agenda

1. Dr. Frank Hofmann (Bosch), Requirements from the world of networked robotics (20mins)
2. Prof. Frank Fitzek (6G-life), Robotics and Communications (20 mins)
3. Prof. Christian Wietfeld (6GEM), Highly reliable networking for 6G-enabled immersive robot control (20 mins)
4. Prof. Jörg Raisch (6G-RIC), Over-The-Air Consensus for Collision Avoidance and Formation Control in Multi-Robot Systems (20 mins)
5. Panel discussion: Stefanie Speidel (6G-life), further panelists (tbd) (40mins)

6G Plattform

Thu-AM1, A 08

Session Title: Control Plane Aspects of 6G Technology

Session Chair: Prof. Dr. André Drummond

CV

André C. Drummond received a B.S. degree in computer engineering from the Pontifical Catholic University of Campinas in 2002 and an M.Sc. and Ph.D. in computer science from the State University of Campinas, Brazil, in 2005 and 2011, respectively. He is an Associate Professor with the Department of Computer Science, University of Brasilia, Brazil. He is on a three-year leave working as a senior researcher at the Technische Universität Braunschweig in the group of Prof. Admela Jukan. His research interests include computer networks and traffic engineering for 6G networks.

Prof. Drummond coordinates key activities in the TIA 6 Autonomous, Convergent Networks working group in the 6G Research and Innovation Cluster(6G-RIC)project.

Background

One of the most prominent use cases for 6G is the mobile networks for Industry 4.0, which are networks with enhanced characteristics to provide optimized and customized services. Thus, a new spectrum exploitation opportunity arises for mmWave and sub-THz-frequency bands. When we move from the traditional sub-6GHz frequency range, we lose the radio omnidirectional capability and pass to a directional beam regime to enhance signal strength and establish communication. As a UE moves, it is necessary to maintain the alignment between its beam and the BS beam, thus requiring fast-tracking on the mobility. Furthermore, due to the physical characteristics of high-frequency beams, they can be easily absorbed by obstacles, thus being susceptible to line of sight (LoS) blocking, which will require multi-connectivity solutions or the restoration of the communication by the application of Reconfigurable Intelligent Surface (RIS). Looking from an architectural point of view, the mobile network was not designed for high-capacity data applications, but for low-rate voice services, Moreover, the location of the UE significantly impacts the quality of

transmission. To tackle this problem, towards 6G, the cell-free network architecture was proposed, willing to reach uniformly high data rates everywhere. These new high-frequency regimes and novel

architectures challenge the RAN's control plane design by demanding control loops that must be executed in real-time. Therefore, it is necessary to place computational power on the nodes that will execute RAN virtual functions, thus allocating it to the edge of the RAN. Moreover, an efficient telemetry data-gathering process is required to feed the RAN functions with the relevant data in a timely and granular fashion. This session gathers a selection of research topics related to the control plane aspects of 6G technologies.

Agenda

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6G Plattform

Thu-AM1, A 03 – A 04

Session Title: Reconfigurable Intelligent Surfaces: Theory, Optimization, and Experiments - Panel

Session Chair: Prof. Dr.-Ing Aydin Sezgin
Prof. Dr.-Ing. Robert Schober

CV

Aydin Sezgin received the Dr. Ing. (Ph.D.) degree in electrical engineering from TU Berlin, in 2005. From 2001 to 2006, he was with the Heinrich-Hertz-Institut, Berlin. From 2006 to 2008, he held a postdoctoral position, and was also a lecturer with the Information Systems Laboratory, Department of Electrical Engineering, Stanford University, Stanford, CA, USA. From 2008 to 2009,

he held a postdoctoral position with the Department of Electrical Engineering and Computer Science, University of California, Irvine, CA, USA. From 2009 to 2011, he was the Head of the Emmy-Noether-Research Group on Wireless Networks, Ulm University. In 2011, he joined TU Darmstadt, Germany, as a professor. He is currently a professor with the Ruhr University Bochum, Germany. He has published several book chapters, more than 70 journals and 200 conference papers in these topics. Aydin is a winner of the ITG-Sponsorship Award, in 2006. He was a first recipient of the prestigious Emmy-Noether Grant by the German Research Foundation in communication engineering, in 2009. He has coauthored papers that received the Best Poster Award at the IEEE Communication Theory Workshop, in 2011, the Best Paper Award at ICCSPA, in 2015, at ICC, in 2019, and at ISAP, in 2023.

Robert Schober received his Dipl.-Ing. and Dr.-Ing. degrees from Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU) in 1997 and 2000, respectively. He was a postdoctoral fellow at the University of Toronto, Canada, in 2001. From 2002 to 2011 he was a Professor and Canada Research Chair at the University of British Columbia (UBC), Vancouver, Canada. Since January 2012 he has been an Alexander-von-Humboldt-Professor and the Chair for Digital Communication at Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany. His research interests fall into the broad areas of Communication Theory, Wireless Communications, and Statistical Signal Processing.

Robert received several awards for his work including the 2007 Wilhelm Friedrich Bessel Research Award of the Alexander von Humboldt Foundation, the 2008 Charles McDowell Award for Excellence in Research from UBC, a 2011 Alexander von Humboldt Professorship, a 2012 NSERC E.W.R. Stacie Fellowship, and the 2017 Wireless Communication Technical Committee Recognition Award. In addition, he has received several best paper awards for his research and is listed as a 2017 and 2018 Highly Cited Researcher by the Web of Science. Robert is a Fellow of the Canadian Academy of Engineering, a Fellow of the Engineering Institute of Canada, and a Fellow of the IEEE.

From 2012 to 2015, he served as Editor-in-Chief of the IEEE Transactions on Communications. From 2016 to 2018, he has been the Chair of the Steering Committee of the IEEE Transactions on Molecular, Biological and Multiscale Communication. Currently, he serves on the Editorial Board of the Proceedings of the IEEE. Furthermore, he is a Member at Large of the Board of Governors, the Director of Journals, and a Distinguished Lecturer of the IEEE Communications Society.

Background

The session aims to offer the audience a comprehensive overview of the potential advantages associated with reconfigurable intelligent surfaces (RIS) in the context of 6G technology. Key topics to be explored during the session include an in-depth examination of the operational principles underlying the expanding array of RIS variations, their respective models, and their integration and interaction with radio access concepts. Additionally, the session will delve into critical considerations such as efficient channel estimation, resilience, and physical layer security.

Particular emphasis will be placed on exploring the applications of RIS within the framework of next-generation wireless networks, including but not limited to massive MIMO, cell-free operation, and Cloud-RAN. The objective is to shed light on the manifold ways RIS can significantly impact and enhance the functionality of these evolving communication paradigms.

Furthermore, the session is designed to address the requisite mathematical tools essential for studying RIS applications. This encompasses a broad spectrum of techniques, ranging from information and communication theoretic modeling and analysis to convex, global, and machine-learning-based optimization methods. By delving into these mathematical foundations, the session aims to provide a deeper understanding of the theoretical underpinnings that govern the efficacy of RIS in diverse communication scenarios.

In addition to theoretical discussions, the session will feature in part vides of practical demonstrations showcasing proof-of-concept RIS experiments across various use cases. These demonstrations serve as tangible examples, offering insights into the real-world applicability and potential of RIS technology. Through this dual approach of theoretical exploration and practical demonstrations, the session seeks to provide a holistic and enriching learning experience for participants keen on understanding the transformative role of reconfigurable intelligent surfaces in the realm of 6G.

Agenda

Panel: (60 minutes), moderator: Aydin Sezgin (6GEM)

- Robert Schober (6G-RIC)
- Thomas Zwick (Open6GHub)
- Andreas Mueller (6G-ANNA, Bosch)
- Michael Meyer (6G-ANNA, Ericsson)
- Vincenzo Sciancalepore (NEC)
- Wilhelm Keusgen ((6G-RIC, 6G-LICRIS)
- tba, IMST

Thu-AM1, A 05

Session Title: Optische Zugangs- und Gebäudenetze für 6G

Session Chair: Volker Jungnickel

CV

Volker Jungnickel (M) received PhD and habilitation in Physics and Communications Engineering in 1995 and 2015, respectively. He joined Fraunhofer HHI in 1997, working on optical wireless communications, multiple antennas in mobile networks and fixed optical access networks. Volker teaches and supervises thesis at TU Berlin, where he was appointed as extraordinary professor in 2021. Volker serves in optical wireless standards e.g. as chair of IEEE Std 802.15.13-2023 and as technical editor of IEEE Std 802.11bb-2023.

Background

The growth of data rates in mobile communications has been mostly realized by network densification. While 4G and its evolution to 5G required optical fiber links to every base station, 6G needs fibers to every building, and even inside it, to deploy more and more wireless base stations, finally in every room (fibre-to-the-room, FttR).

5G campus networks are designed for big industry, but acceptance in small and medium enterprises, and end users is poor, because of high cost of equipment, deployment and maintenance. To provide solutions also in this market, 6G will be complemented by low-cost access and in-building solutions, such as 50G-PON for FttH and FttR, Ethernet, PLC and Coax to get into every room and wireless technologies such as Wi-Fi, mm-wave and LiFi. These technologies will be enhanced to allow higher reliability, lower latencies and less energy per bit, and increasingly meet main KPIs also required for 6G.

The workshop will cover the increasingly important in-building network segment for 6G and address still controversial questions via panels, e.g. what technology developments allow higher QoS inside buildings and can be scaled to high volumes that enable lower cost for deployment and operation. This includes, e.g. how to use existing technologies and scaling performance and costs to realize FttR and how improve the QoS of Wi-Fi while keeping the cost at a reasonable level.

Agenda

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6G Plattform

Thu-AM2, C 01

Session Title: Future Research Topics

Session Chair: Prof. Dr. Stephan ten Brink
Prof. Dr. Slawomir Stanczak

CV

Stephan ten Brink has been a faculty member at the University of Stuttgart, Germany, since July 2013, where he is head of the Institute of Telecommunications. From 1995 to 1997 and 2000 to 2003, Dr. ten Brink was with Bell Laboratories in Holmdel, New Jersey, conducting research on multiple antenna systems. From July 2003 to March 2010, he was with Realtek Semiconductor Corp., Irvine, California, as Director of the wireless ASIC department, developing WLAN and UWB single chip MAC/PHY CMOS solutions. In April 2010 he returned to Bell Laboratories as Department Head of the Wireless Physical Layer Research Department in Stuttgart, Germany. Dr. ten Brink is a recipient and co-recipient of several awards, including the Vodafone Innovation Award, the IEEE Stephen O. Rice Paper Prize, the IEEE Communications Society Leonard G. Abraham Prize for contributions to channel coding and signal detection for multiple-antenna systems. He is best known for his work on iterative decoding (EXIT charts) and MIMO communications (soft sphere detection, massive MIMO).

Slawomir Stanczak is Professor of Network Information Theory at the Technical University of Berlin and Head of the Wireless Communications and Networks Department at the Fraunhofer Heinrich Hertz Institute (HHI). Prof. Stanczak is co-author of two books and more than 200 peer-reviewed journal and conference papers in the areas of information theory, wireless communications, signal processing, and machine learning. Prof. Stanczak received research grants from the German Research Foundation and the Best Paper Award from the German Society for Telecommunications in 2014. He was an associate editor of the IEEE Transactions on Signal Processing from 2012 to 2015, editor of the IEEE Journal on Selected Areas in Communications for the special issue "Machine Learning in Communications and Networks" from 2020 to 2022, and chair of the ITU-T Focus Group on Machine Learning for Future Networks including 5G from 2017 to 2020. Since 2020 Prof. Stanczak is chairman of the 5G Berlin association and since 2021 he is coordinator of the 6G-RIC (Research & Innovation Cluster) and CampusOS projects.

Background

Mobile wireless communications has always been a driver of communications technology at large, ranging from physical aspects such as waveform design, channel modeling, hardware platforms and modem algorithms to higher layer topics such as networking, reliability and security. As we are arriving at the 6th generation networks, the natural question arises: Where do we go from here? What is „left“ for the 6G++ generations of wireless communications? This session will push well-known experts in the field onto a panel, discussing about future research topics and communications technologies to come.

Agenda

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6G Plattform

Thu-AM2, A 08

Session Title: Wireless Access Protocols for 6G

Session Chair: Dr. Andrea Munari

CV

Andrea Munari received Ph.D. in telecommunications engineering from the University of Padova, Italy, in 2010. From 2007 to 2010, he was with IBM Research, Zürich, Switzerland, and in 2011, he joined the Corporation Research and Development Division of Qualcomm Inc., San Diego, CA, USA. He is currently with the Institute of Communications and Navigation, German Aerospace Center. From 2014 to 2018, he

was a Senior Researcher and a Lecturer with the Institute of Networked Systems, RWTH Aachen University. His main research interests include, among others, the design and modeling of medium access techniques, with special attention to Internet of Things applications. He received the 2018 ACM MobiCom Workshop on Millimeter Wave Networks and Sensing Systems Best Paper Award, and the IEEE Globecom 2020 Communications Theory Symposium Best Paper Award. He served on the Technical Program Committee at several IEEE International Conferences and as the Co-Chair of the IEEE ICC'14, ICC'15, and ICC'16 Workshop on Massive Uncoordinated Access Protocols, of the Special Session on Small Data Networks at IEEE PIMRC 2018, and as the Co-Chair of the IEEE VTC-Fall 2019 Workshop on Small Data Networks. He serves as an Associate Editor for IEEE COMMUNICATIONS LETTERS.

Background

While there have been significant research efforts to address different aspects of Internet-of-Things (IoT) and Machine-Type-Communications (MTC) in current cellular standards, the vision of extreme IoT/MTC connectivity required for these diverse applications is yet to be realized. There is also the need to consider E2E aspects as part of the design, i.e., the entire protocol stack from the physical layer to the application layer. This Session will focus on novel wireless access techniques for 6G connectivity, including PHY, MAC-Layer and Higher Layer / Cross-Layer aspects. In addition, the session will address aspects of "semantic communication", with focus on resource-efficient "goal-oriented" communication solutions that unify aspects of data acquisition, communication and control (targeting, e.g., application scenarios in networked robotics).

Agenda

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6G Plattform

Thu-AM2, A 03 – A 04

Session Title: Quantum Technologies for 6G and Beyond

Session Chair: Igor Bjelakovic (TU Berlin, Fraunhofer HHI, 6G-RIC)
Marc Geitz (T-Labs)
Janis Nötzel (TU München, 6G-life)
Henrike Wissing (Fraunhofer HHI, 6G-RIC, SQuaD)

CV

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Background

Quantum technologies are increasingly playing a role in the planning and design of communication systems. Examples of this include quantum computing, quantum optical communication systems and quantum sensing, to name but a few. Much of the research is located in the physics community.

The aim of this session is to bring together different communities and stimulate an exchange across disciplinary boundaries.

The goals of the session are as follows:

- Identify points of interconnection between current developments in quantum communication and research related to the 6th generation of mobile networks, including methods beyond traditional wireless communication.
- Showcase potential use cases of quantum communication technologies that are considered relevant from the perspective of industry. e.g., network operators.
- Impact of the rapid development of quantum technologies on security research in the field of future 6G networks.
- Feasibility of large-scale deployment of quantum technologies in commercial future networks

Agenda

1. Quantum Communication Technologies: Overview of Research Activities and Challenges (Nicolas Spethmann (PTB, SQuaD), Christoph Becher (Uni Saarland, SQuaD) are involved and will provide a suitable speaker)
2. A Quantum Perspective on Security Research for Communication Systems (Tobias Hemmert (BSI))
3. Quantum Technology at Deutsche Telekom (T-Labs (Oliver Holschke (T-Labs), speaker tentative and to be confirmed)
4. Time Synchronization in Quantum Networks (6G-life, Riccardo Bassoli TBC)
5. Quantum Hardware Aware Security for 6G Networks (6G-RIC, Igor Bjelakovic)
6. Design of Joint Detection Receivers (6G-life, Janis Nötzel)
7. Programmable Quantum Optical Chips (QuiX Quantum (NL), TBC)

6G Plattform

Thu-AM2, A 05

Session Title: Optical Transport Evolution Towards 6G

Session Chair: Dr. rer. nat. Colja Schubert
Dr.-Ing. Johannes Fischer

CV

Colja Schubert received the Dipl.-Phys. and Dr. rer. nat. degrees in physics from Technische Universität Berlin, Berlin, Germany, in 1998 and 2004, respectively. He was an Exchange Student with Strathclyde University, Glasgow, U.K., from 1996 to 1997. During the Dipl. Thesis, from 1997 to 1998, he was with the Max-Born-Institute for Nonlinear Optics and Short Pulse Spectroscopy, Berlin. Since 2000, he has been a member of the Scientific Staff with the Fraunhofer Institute for Telecommunications, Heinrich-Hertz-Institute, Berlin. His research interests include high-speed transmission systems and all-optical signal processing. He is currently heading the Submarine and Core Systems Group, Photonic Networks and Systems Department, and is also serving as the Deputy Department Head. He is a member of the German Physical Society.

Dr. Johannes K. Fischer heads the Digital Signal Processing Group in the Department of Photonic Networks and Systems of Fraunhofer HHI. He authored or coauthored more than 150 publications. His research interests are advanced modulation formats, digital signal processing for coherent systems and real-time implementation of digital signal processing algorithms. He is a Senior Member of the IEEE and a member of the VDE, where he serves in the Expert Group KT 3.1 “Modelling of Photonic Components and Systems” of the ITG. He has served as Technical Subcommittee member for various conferences (e.g. OFC, OECC, CLEO Europe), as Program Chair of OFC 2024 and as guest editor of the Journal of Lightwave Technology.

Background

With the unprecedented level of connectivity and communication capabilities expected in future 6G networks, the evolution of optical access and transport technologies will play a pivotal role in shaping the forthcoming era of next generation wireless networks. This workshop aims to explore the complexities of this transformative phase by delving into the challenges and opportunities it presents.

The background and motivation for this session are rooted in the understanding that 6G promises to start a new era of connectivity marked by unprecedented data rates (100x higher than 5G), minimal transmission latency (1/5x lower than 5G), and a large plethora of different applications ranging from augmented and virtual reality (AR/VR) to massive Internet of Everything (IoE) deployments. To realize the full potential of 6G, a robust and advanced underlying optical transport infrastructure is essential and indispensable. This fact emphasizes the critical role of the optical X-haul network, which will serve as the backbone supporting the high bandwidth requirements and stringent performance demands of 6G. Considering that the transition to 6G entails a paradigm shift in optical transport networks, this workshop will address the evolving landscape, from the physical layer to the network layer. Areas such as state-of-the-art optical access technologies, advanced modulation formats for optical transport, neuromorphic and reservoir computing for optical signal processing, optical wireless communications, and autonomous control and management of optical networks, are only a few highly encouraged topics.

By bringing experts, researchers, academia and industry professionals together, the workshop aims to foster a collaborative environment, where through insightful discussions and shared knowledge,

the participants will have the opportunity to contribute to the collective understanding of the challenges and possibilities of the optical transport evolution towards 6G.

Agenda

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6G Plattform

Thu-PM1, A 08

Session Title: Antennas and frontends for Beyond 5G and 6G applications

Session Chair: Prof. Dr. Wilhelm Keusgen
Dr. Christos Oikonomopoulos

CV

Prof. Dr. Wilhelm Keusgen received the Dipl.-Ing. (M.S.E.E.) and Dr.-Ing. (Ph.D.E.E.) degrees from the RWTH Aachen University, Aachen, Germany, in 1999 and 2005, respectively. From 1999 to 2004, he was with the Institute of High Frequency Technology, RWTH Aachen University, where he worked on the reciprocity of multiple antenna systems. From 2004 to 2021 he was heading a research group for millimeter-waves and advanced transceiver technologies at the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, located in Berlin, Germany. Since 2021 he is a full professor at Technical University Berlin and heading the chair for Microwave Systems. His main research areas are millimeter wave and THz communications for 5G and beyond.

Dr. Christos Oikonomopoulos received his diploma (Dipl.-Ing.) and his doctoral (Dr.-Ing.) degrees in electrical engineering in RWTH Aachen in 2003 and 2010 respectively. Since 2009 he works at IMST GmbH in the department of Antennas and EM-Modelling. His interests are as well in the fields of antenna design for V2X, drones, mmWave and sub-THz applications as in the radar systems and in the radio channel modelling. Currently he is project manager in numerous industry and public funded projects. He is the project coordinator in the 6G-SNS project iSEE-6G.

Background

Looking into all aspects of a radio communication environment, the antenna topic plays always a significant role in the radio link performance and the quality of service (QoS). Their development as technological enablers for energy-efficient operation of cell-free mmWave networks in ICT and/or aerial platforms is of great importance. An additional important aspect in future 6G applications, which should be taken into consideration is, e.g. the development of intelligent antennas, the beam alignment and tracking between ground and drone communication units etc.

One of the most prominent new concepts in 6G will be Integrated Communication and Sensing (ICAS). 3GPP systems already provide localization of connected devices. ICAS extends the successful cellular communication system to a platform for radar-like sensing of non-connected objects like vehicles, drones or VRUs.

There are numerous use cases that will deploy different intelligent antenna arrays with beamforming capabilities in the mmWave and Sub-THz frequency bands. The antenna development is a core parameter of both European and national funded projects like the 6G-RIC, the iSEE-6G, the KOMSENS-6G and the 6G Terakom. Different beamforming approaches, different waveforms, different frontends are investigated within the available project timeline

The session aims for a status update about these different antenna topics and peripheral system approaches. Concepts and already existing demonstrators, that are deployed to architectures, measurement campaigns, modelling and PoCs of the two projects. We will discuss synergies and opportunities for collaboration. This includes next steps on the projects' roadmaps, alignment of contributions to the 6G-Platform whitepapers and possible joint dissemination (as a follow-up of the combined booth at the 6G event 2024 in Berlin).

The session will be open to all participants of the 6G event, including members of other 6G projects which have aspects of antenna arrays in their scope. However, due to time limitation, we will not be able to allow further project presentations.

Agenda

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6G Plattform

Thu-PM1, A 03 – A 04

Session Title: Electromagnetic Exposure in 5G and Beyond Networks

Session Chair: Dr.-Ing. Mario Pauli
Amina Fellan

CV

Mario Pauli is a Senior Researcher and a permanent Lecturer with the Institute of Radio Frequency Engineering and Electronics (IHE), Karlsruhe Institute of Technology (KIT). He has served as a Lecturer for radar and smart antennas of the Carl Cranz Series for Scientific Education. He is currently a Co-Founder and the Managing Director of PKTEC GmbH, Karlsruhe, and a Co-Founder of Wellenzahl Radar- und Sensortechnik GmbH & Company KG, Karlsruhe. His current research interests include radar and sensor systems, RCS measurements, antennas, wave propagation, and millimeter-wave packaging.

Background

In an era dominated by rapid technological advancements, understanding the implications of EMF exposure resulting from new technologies is paramount. This session aims to unravel the intricacies of EMF exposure in 5G and beyond networks, providing participants with essential knowledge and insights on EMF exposure assessment considerations.

Agenda

- Tam Ta (RWTH Aachen): „Challenges for Human Exposure Assessment in 5G and impacts on 6G” (15 min)
- Thorsten Kayser (PKTEC GmbH): "Calculation of Protection Areas of Cellular Radio Stations using Wattwächter" (15 min)
- Josef Opitz (BNetzA): to be announced (15 min)
- Panel Discussion (30 min)

6G Plattform

Thu-PM1, A 05

Session Title: Next Generation Wireless Networks and the Role of Machine Learning

Session Chair: Dr. Renato Luis Garrido Cavalcante

CV

Renato Luis Garrido Cavalcante received the Electronics Engineering degree from the Instituto Tecnologico de Aeronautica, Sao Jose dos Campos, Brazil, in 2002, and the M.E. and Ph.D. degrees in communications and integrated systems from the Tokyo Institute of Technology, Tokyo, Japan, in 2006 and 2008, respectively. He is currently a Group Leader with the Fraunhofer Institute for Telecommunications, Heinrich Hertz Institute, Berlin, Germany. He held appointments as a Research Fellow with the University of Southampton, U.K., and as a Research Associate with the University of Edinburgh, Edinburgh, U.K.

Dr. Cavalcante was the recipient of the Excellent Paper Award from the Institute of Electronics, Information and Communication Engineers in 2006 and the IEEE Signal Processing Society (Japan Chapter) Student Paper Award in 2008. He is currently an Associate Editor for the IEEE Transactions on Signal Processing, and he served as a publication chair for the IEEE International Workshop on Signal Processing Advances in Wireless Communications in 2013 and as a tutorial chair for the International Symposium on Wireless Communication Systems in 2021. He also served as an organizer of the invited session on Applications of Machine Learning and Compressive Sensing in Communications at the 21th International ITG Workshop on Smart Antennas.

Background

Machine learning (ML) tools, particularly those rooted in deep learning techniques, have been attracting increasing attention in the wireless domain owing to their notable success in tackling challenges in computer vision and speech recognition tasks. The substantial availability of data and computational power has played a pivotal role in the triumph of ML in these conventional domains. However, extending these tools to communication systems, especially at the lower layers of the communication stack, presents challenges owing to the highly dynamic nature of the wireless environment. Furthermore, in wireless systems, data may be spread across a large network consisting of heterogenous hardware with vastly different computational and communication power. This intricacy poses substantial challenges when determining the optimal locations for training algorithms and for devising effective strategies for data collection, and this matter has been in activate consideration in standardization bodies for 6G networks.

Against this background, we propose an session with invited talks from distinguished experts from both academia and industry. The objective is to delve into cutting-edge developments pertaining to the application of machine learning in the context of 6G and the subsequent generations of wireless networks. Participants will examine and share insights regarding the transformative role that machine learning plays in shaping the future of wireless communication technologies.

Agenda

- "Enhancing 6G Receiver Performance: Comparative Analysis of AI-Based and Conventional Post-Distortion Techniques for Power Amplifiers", Ali El Husseini (Ericsson)
- (title to be decided), Francesco Rossetto (Rhode & Schwarz)
- "Fixed-point methods and model-driven AI for 6G PHY optimization", Jochen Fink (Fraunhofer HHI)

6G Plattform

Thu-PM1, A 06

Session Title: Highly-Efficient PAs for 5/6G

Session Chair: Prof. Friedel Gerfers
Prof. Amelie Hagelauer

CV

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Background

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Agenda

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