



## CONASENSE2022 Programme – EU-IoT/EFPP Hackathon Programme

### Registration – mandatory but FREE of charges:

<https://www.eventbrite.com/e/conasense2022-6g-communications-services-and-sustainability-tickets-344386237507>

### Where:

Munich Highlight Towers, IBM Watson Research Center, Mies-van-der-Rohe-Straße 6, 80807 Munich, Germany, and hybrid mode:

- CONASENSE Symposium: Yorktown South (21<sup>st</sup> floor)
- Hackathon: Large Boardroom (20<sup>th</sup> floor)

***When you arrive:*** two of our fortiss students, Dushyant Dave and Kamal Arumugam will be on the groundfloor to assist you at the registration booth.

### Hybrid Mode Coordinates:

- CONASENSE symposium: <https://fortiss.mywebex.com.com/join/room1>
- EU-IoT/EFPP Hackathon Highlight Towers, 20<sup>th</sup> floor, IBM Watson Research Center, Board room and Hybrid mode (Webex)
  - Fortiss Webex room1, Fortiss Webex room 1, <https://fortiss.mywebex.com.com/join/room1>
  - Discord, general link <https://discord.gg/qYpaA7rJ> (channel links directly sent to mentors and teams)
  - Slack, <http://eu-iot-hackathon.slack.com>
    - Invitation URL: [https://join.slack.com/t/eu-iot-hackathon/shared\\_invite/zt-12l6hgmk1-gyoj3nOrGSglL8meWERlw](https://join.slack.com/t/eu-iot-hackathon/shared_invite/zt-12l6hgmk1-gyoj3nOrGSglL8meWERlw)



Day 1, June 27<sup>th</sup> 2022, 9:00 CET – 18:00 CET

Time (CET)	Sessions	
8:30-9:30	Registration period – Highlight towers, groundfloor	
9:00-09:30	<b>Welcoming Session</b> <ul style="list-style-type: none"> <li>CONASENSE welcome, Rute Sofia, Ramjee Prasad</li> <li>IBM Welcome, Felizitas Müller, IBM</li> <li>fortiss Welcome, Harald Rueß, fortiss</li> </ul>	
09:30-10:30	<b>Keynote Session – 21<sup>st</sup> floor, room Yorktown South</b> Chair: Paulo Rufino , Aarhus University <ul style="list-style-type: none"> <li><a href="#">IBM Innovation Studio Munich</a>, Felizitas Müller, IBM</li> <li>Florian Küster, Unternehmer TUM Makerspace</li> <li><a href="#">The EU platform for IoT and Edge must be open source!</a>, Gael Blondelle, Eclipse (remote)</li> <li><a href="#">AI based sensing for IoT Building Applications</a>, Avik Santra, Infineon</li> </ul>	
10:30-11:00	Coffee-break - 21 <sup>st</sup> floor, Yorktown South	
11:00-12:00	<b>Hackathon session 1</b> 20 <sup>th</sup> floor, Large Board room	<b>11:00-12:00 Technical session - Full paper session 1 (20m plus 10m)</b> Chair: Manel Khelifi, fortiss <ul style="list-style-type: none"> <li><a href="#">GDOP Optimised LEO Constellation for Positioning</a>, Harshal More, Mauro de Sanctis, Ernestina Cianca, Cosimo Stallo</li> <li><a href="#">Achievable Bandwidth of Reconfigurable Intelligent Surfaces (RIS) Concepts Towards 6G Communications</a>, Werner Mohr</li> </ul>
12:00-13:00	<b>Hackathon session 1 (cont)</b>	<b>Invited Talks Track: 6G Wireless Challenges (15m plus 5m)</b> Chair: Paulo Rufino, Aarhus University <ul style="list-style-type: none"> <li><a href="#">Cybersecurity in the Era of Next Generation Wireless Networks</a>, Milica Pejanović-Djurišić, University of Montenegro</li> <li><a href="#">Green OFDM Transmission: An optimal Signal Design Approach</a>, Hoomayoun Nikookar, Defence Academy, Netherlands</li> </ul>
13:00-14:30	Lunch Break – 21 <sup>st</sup> floor, Yorktown South	
14:30-16.15	<b>Hackathon Session 2</b> 14:30-15:30 – mentor get together	<b>Project Presentation Session: Next Generation IoT Projects- Yorktown South</b> Chair: Victor Banos, fortiss <ul style="list-style-type: none"> <li><a href="#">ASSIST-IoT</a>, Ignacio Lacalle Ubela, Universidad Politecnica di Valencia (remote)</li> <li><a href="#">IntelloT</a>, Arne Bröring, Siemens AG (remote)</li> <li><a href="#">iGENIOUS</a>, Giacomo Bernini and Erin Seder, Nextworks (remote)</li> <li><a href="#">TERMINET: nexT gEneRation sMart INterconnectEd IoT</a>, Panagiotis Sariagiannidis, University Western Macedonia (remote)</li> </ul>



Time (CET)	Sessions	
		<ul style="list-style-type: none"> <li>• <a href="#">VEDL-IoT</a>, Jens Hagemeyer, University of Bielefeld</li> <li>• <a href="#">IOT-NGIN</a>, Jonathan Klimt, RWTH, Aachen</li> <li>• <a href="#">EFPE</a>, Usman Wajid, Information Catalyst</li> </ul>
16:15-16:30	Coffee-break	
16:30-18:00	Hackathon Session 3	<p>16:30-18:00 Invited Talks Track (15m plus 5 for questions): Business Models and Use-cases for 6G Chair: Rute C. Sofia, fortiss</p> <ul style="list-style-type: none"> <li>• <a href="#">Challenges in the design of a holographic telepresence system – the current outcomes from the implementation of a use case scenario</a>, Vladimir Poulkov, Technical University of Sofia, Bulgaria</li> <li>• <a href="#">6G - An Ecosystem for Technology and Market Opportunities</a>, Martjin Kuipers, University Lusiada/ INESC-INOV, Portugal</li> <li>• <a href="#">Green Business Model 6G Services: A new perspective with Internet of Things connected Green Business Models empowered with Artificial Intelligence</a>, Per Valter, Aarhus University</li> <li>• <a href="#">Green Business Models and Use-cases for 6G</a>, Peter Lindgren, vice-president CGC, Aarhus University, Denmark</li> </ul>
18:00-18:30	Hackathon Mentors' get-together	
19:30-21:00	Social Dinner (registration required until 23 <sup>rd</sup> June, circa 35-40 Euros) – register via <a href="https://forms.gle/2sUaAsakUzuvK6cU8">https://forms.gle/2sUaAsakUzuvK6cU8</a>	

Day 2, June 28<sup>th</sup> 2022 , 09:30 CET – 18:00 CET

Time (CET)	Tracks	
09:30-10:30	Hackathon session 4	<p><b>Technical session - Full paper session 2 ((20m plus 10m) Chair: Manel Khelifi, fortiss</b></p> <ul style="list-style-type: none"> <li>Catarinha Castanheira, Rita Almeida, Duarte Marques, Guilherme Firmino, Luis Elvas, Joao C. Ferreira, <a href="#">How tourists move in a city.</a></li> <li>Susmita Paul, <a href="#">Intrusion Detection System in IoT to Prevent Cyber-Attacks in Organization</a></li> </ul>
10:30-11:00	Coffee-break	
11:00-13:00	Hackathon Session 5	<p><b>Short paper session (20m plus 10m)</b> Chair: Albená Mihovska, Aarhus University</p> <ul style="list-style-type: none"> <li>Savita Sthawarmarth, Eric Renault, <a href="#">Stateless Paradigm for Resiliency in Beyond 5G Networks</a></li> <li>Nidhi, Bahram Khan, Albená Mihovska, Ramjee Prasad, Vladimir Poulkov, Fernando J Velez. <a href="#">Dynamic Resource Block Allocation in Network Slicing</a></li> </ul>
		<b>Break (12:00-13:00)</b>
13:00-14:30	Lunch Break	
14:30-15:30	<p><b>Invited Talks Track 2: IoT Cooperation Opportunities towards Brazil (15m plus 5m)</b> Chair: Paulo Rufino, Aarhus University</p> <ul style="list-style-type: none"> <li><a href="#">Information Technology courses in large scale to supply national demands</a>, Rodolfo Azevedo, President of UNIVESP, Brazil</li> <li>Sergio Paulo Gaulindo, President of Brasscom, Brazil</li> <li><a href="#">IoT in Brazil understanding challenges and opportunities</a>, Paulo José Spaccaquerche, President of ABINC (Brazilian Association of IoT)</li> </ul>	
15:30-16:00	Coffee-break	
16:00-17:00	Hackathon pitching	<p><b>Invited Talks Track 3: Advanced Visions Towards 6G</b> Chair: Rute C. Sofia, fortiss</p> <ul style="list-style-type: none"> <li><a href="#">Machine Learning Enables Radio Resource Utilization of uRLLC</a>, Kwan-Cheng Chen, University of Florida</li> <li><a href="#">Reaching out to billions of client devices: Challenges and opportunities in very dense wireless networks</a>, Jean-Paul Linnarzt, Signify, Philips Lighting, Netherlands</li> <li><a href="#">Polyphase Channelizers in Modern Communication Systems</a>, Fred Harris, University of San Diego</li> </ul>

CONASENSE 2022

# 6G communications, services and sustainability



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17:00-17:30	Hackathon Juri meeting	Break
17:30-18:00	Awards Session, Closure and announcement of next event	



## Abstracts and Bios

### Welcoming Session



Ramjee Prasad, Fellow IEEE, IET, IETE, and WWRF, is a Professor of Future Technologies for Business Ecosystem Innovation (FT4BI) in the Department of Business Development and Technology Aarhus University, Herning, Denmark. He is the Founder President of the CTIF Global Capsule (CGC). He is also the Founder Chairman of the Global ICT Standardization Forum for India, established in 2009. He has been honoured by the University of Rome "Tor Vergata", Italy as a Distinguished Professor of the Department of Clinical Sciences and Translational Medicine on March 15, 2016. He is an Honorary Professor of the University of Cape Town, South Africa, and the University of KwaZulu-Natal, South Africa. He has received the Ridderkorset of Dannebrogordenen (Knight of the Dannebrog) in 2010 from the Danish Queen for the internationalization of top-class telecommunication research and education. He has received several international awards such as IEEE Communications Society Wireless Communications Technical Committee Recognition Award in 2003 for making a contribution in the field of "Personal, Wireless and Mobile Systems and Networks", Telenor's Research Award in 2005 for impressive merits, both academic and organizational within the field of wireless and personal communication, 2014 IEEE AESS Outstanding Organizational Leadership Award for: "Organizational Leadership in developing and globalizing the CTIF (Center for TeleInfrastruktur) Research Network", and so on. He has been the Project Coordinator of several EC projects, namely, MAGNET, MAGNET Beyond, eWALL. He has published more than 50 books, 1000 plus journal and conference publications, more than 15 patents, over 140 Ph.D. Graduates and a larger number of Masters (over 250). Several of his students are today worldwide telecommunication leaders themselves.



**Rute C. Sofia** (PhD 2004) is the Industrial IoT Head at fortiss - research institute of the Free State of Bavaria for software intensive services and systems in Munich, Germany. She is also an Invited Associate Professor of University Lusófona de Humanidades e Tecnologias, and an Associate Researcher at ISTAR, Instituto Universitário de Lisboa. Rute's research background has been developed on industrial and on academic context, and she has co-founded COPELABS (2012-2019, Lisbon, Portugal), research unit which she also steered between 2013-2017. and where she was a Senior Researcher until 2019. She has co-founded Senception Lda (2013), a start-up focused on personal communication platforms. Her current research interests are: network architectures and protocols; IoT; edge computing; in-network computation; network mining. Rute holds over 60 peer-reviewed publications in her fields of expertise, and 9 patents.

She is an ACM Senior member and an IEEE Senior Member, and an ACM Europe Councillor. She is also an N2Women Awards Co-chair. Before COPELABS/ULHT, she was a senior researcher at INESC TEC (07-10, Porto, Portugal), where she steered the "Internet Architectures and Networking" area of UTM, team dedicated to wireless/cellular networking architectures and to user-centric networking paradigms. She was (04-07, Munich, Germany) a senior research scientist in Siemens AG and Nokia-Siemens Networks GmbH, focusing on aspects such as: fixed-mobile convergence; carrier-grade Ethernet; QoS; IPv6 interoperability. Rute holds a BEng in Informatics Engineering by Universidade de Coimbra (1995); M.Sc. (1999) and Ph.D. (2004) in Informatics by Universidade de Lisboa. During her PhD studies, she was a visiting scholar (2000-2003) at Northwestern University (ICAIR) and at University of Pennsylvania.



**Felizitas Müller:** After studying business administration at the University of Applied Sciences in Constance, Felizitas, started her professional career in Strategic Sales at IBM Technology Support Services. In addition to her work at IBM, she completed a Master's degree in Strategic Sales Management at the ESB in Reutlingen. Since 2018, she is working as a project manager within the IBM Sustainability Software Business Unit responsible for software implementation projects. Since 2021, she is leading the "Center for AI" (research center for artificial intelligence between fortiss and IBM) from IBM-side.

***Introduction to fortiss, Harald Rueß, Scientific Manager, fortiss***



After studying mathematics in Ulm, Germany, and computer science in San Diego, California, Harald Rueß earned a doctorate from the University of Ulm. He worked at SRI International in Menlo Park, California between 1995 and 2005, first as an international fellow, then since 1998 as a staff researcher in SRI's computer science lab, including stints as a visiting professor in Mannheim in 2001 and longer research assignments in Cambridge in 1999 and Manchester in 2005. His research interests encompass the fields of dependable program manager in the automotive and aerospace industries in southern Germany between 2006 and 2008. Harald Rueß has been scientific managing director at fortiss - the research institute of the Free State of Bavaria for software-intensive systems and services – since 2009.

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**Keynote Speeches – 27.06.2022, 9:30-10:30**

**9:30-9:45 IBM Innovation Studio Munich, Felizitas Müller, IBM**



**Bio:** After studying business administration at the University of Applied Sciences in Constance, Felizitas, started her professional career in Strategic Sales at IBM Technology Support Services. In addition to her work at IBM, she completed a Master's degree in Strategic Sales Management at the ESB in Reutlingen. Since 2018, she is working as a project manager within the IBM Sustainability Software Business Unit responsible for software implementation projects. Since 2021, she is leading the "Center for AI" (research center for artificial intelligence between fortiss and IBM) from IBM-side.

**9:45-10:00 , Florian Küster, UnternehmerTUM MakerSpace**

**10:00-10:15 The EU platform for IoT and Edge must be open source! , Gaël Blondelle, Eclipse Foundation**

**Abstract:** This talk will cover why Europe needs a widely adopted open source IoT and Edge platform. Of course, interoperability and scalability come to mind, but beyond that, digital sovereignty should also be a strong incentive. And finally, this is also an opportunity to show the EU leadership and to better disseminate our research efforts to industry players.



**Gaël Blondelle** joined the Eclipse Foundation in 2013 where he is now Managing Director of Eclipse Foundation Europe GmbH and VP, Ecosystem Development, of the Eclipse Foundation. Gaël joined the Eclipse Foundation with the desire to help organizations to work in open source as the best way to implement open innovation and open collaboration. Gaël has been involved in open source for more than 18 years in various roles, including as an entrepreneur, as a business developer, and as a manager of a large European research project aiming to create an open source ecosystem for industrial players.

### 10:15-10:30 AI based sensing for IOT Building Applications, Avik Santra, Infineon

**Abstract** - Sensing technologies play an important role in realizing smart, energy-efficient and sustainable buildings. Sensors of different modalities are part of building infrastructures, like lighting, HVAC and surveillance, that are increasingly becoming connected. Data from such multi-modal IoT sensors can be used to realize new and improved building applications using advanced signal processing and machine learning. In this talk, we will cover topics, such as IoT building applications like lighting/HVAC controls, location-based services, and describe AI architectures for sensor data processing.



**Avik Santra** received his M.S. in Signal Processing (Hons) from Indian Institute of Science, Bangalore and Ph.D. in Electronics, Electrical and Informatics (summa cum laude) from FAU University of Erlangen. He is currently heading the advanced AI team developing signal processing and machine learning algorithms for industrial and consumer radars and depth sensors at Infineon, Neubiberg. Earlier in his career, he has worked as system engineer for LTE/4G modem at Broadcom Communications, and also has worked as research engineer developing cognitive radars at Airbus. He is co-author of the book titled 'Deep Learning Applications of Short-Range radars', published by Artech House and has filed more than 70 patents and published over 50 papers. He is a Senior Member of IEEE.

Artech House and has filed more than 70 patents and published over 50 papers. He is a Senior Member of IEEE.

### Technical Session – Full Papers – 27.06.2022, 11:00-12:00

#### 11:00-11:30 Harshal More, Mauro de Sanctis, Ernestina Cianca, Cosimo Stallo, *GDOP Optimised LEO Constellation for Positioning*

**Abstract:** This paper presents the design of a dedicated LEO constellation optimized using a Genetic Algorithm (GA). The optimization aims to minimize the Geometric Dilution of Precision (GDOP). The paper demonstrates that the designed constellation provides good Geometrical Navigation Accuracy (GNAC) and global availability. The proposed constellation is a combination of sub-Walker constellations (hybrid) that can provide 100 % global coverage, with at least 5 visible satellites at given epoch. Using the proposed constellation, the position accuracy in a static and dynamic user scenario has been assessed.

#### 11:30-12:00 Werner Mohr, *Achievable Bandwidth of Reconfigurable Intelligent Surfaces (RIS) Concepts Towards 6G Communications*

**Abstract:** In the research community the concept of Reconfigurable Intelligent Surfaces (RIS) is currently discussed in the context of post-Shannon activities. It is the objective of RIS to improve the radio channel environment by specific adjustable reflecting surfaces to maximize the received power and thereby the radio channel capacity. This paper is





investigating the achievable bandwidth of the RIS approach from a system and signal theoretical perspective and under realistic propagation conditions as well as the sensitivity with respect to displacements of the mobile station. In addition, the overall achievable channel capacity is compared with a wideband system for the same transmit power. Based on these investigations, potential means or increasing the effective bandwidth are derived as well as conclusions on the applicability of the RIS concepts for wideband systems like LTE, 5G and 6G.



**Werner Mohr** was graduated from the University of Hannover, Germany, with the Master Degree in electrical engineering in 1981 and with the Ph.D. degree in 1987. Dr. Werner Mohr joined Siemens AG, Mobile Network Division in Munich, Germany in 1991. He was involved in several EU funded projects and ETSI standardization groups on UMTS and systems beyond 3G. Werner Mohr coordinated several EU and Eureka Celtic funded projects on 3G (FRAMES project), LTE and IMT-Advanced radio interface (WINNER I, II and WINNER+ projects), which developed the basic concepts for future radio standards. Since April 2007 he was with Nokia Solutions and Networks (now Nokia) in Munich Germany, where he was Head of Research Alliances. In addition, he was chairperson of the NetWorld2020 European Technology Platform until December 2016. Werner Mohr was Chair of the Board of the 5G Infrastructure Association in 5G PPP of the EU Commission from its launch until December 2016. He was chair of the "Wireless World Research Forum – WWRF" from its launch in August 2001 up to December 2003. He was member of the board of ITG in VDE from 2006 to 2014. He is co-author of a book on "Third Generation Mobile Communication Systems" a book on "Radio Technologies and Concepts for IMT-Advanced" and a book "Mobile and Wireless Communications for IMT-Advanced and Beyond". In December 2016 Werner Mohr received the IEEE Communications Society Award for Public Service in the Field of Telecommunications and in November 2018 he received the VDE ITG Fellowship 2018. In May 2019 Werner Mohr received the WWRF Fellowship. In March 2021 he retired from Nokia and is now active as consultant.

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## Invited Talk Session: 6G Wireless Challenges – 27.06.2022, 12:00-13:00

*Chair: Paulo Rufino, Aarhus University*

**12:00-12:20 Cybersecurity in the Era of Next Generation Wireless Networks**, Milica Pejanović-Djurišić, University of Montenegro



**Milica Pejanović-Djurišić** is full professor in Telecommunications and Wireless Communications at the Faculty of Electrical Engineering, University of Montenegro, founder and director of its Research Centre for ICT. Prof. Pejanović-Djurišić has been cooperating with numerous universities, research centers, international and think tank organizations worldwide as a visiting researcher and lecturer. In her research work she is focused on various aspects of wireless communications and networks, where she has achieved notable results that were published in several hundred scientific papers in international journals and international conferences, scientific and professional papers in domestic journals and conferences, as well as in several books and other publications.

**12:20-12:40 Green OFDM Transmission: An optimal Signal Design Approach**, Hoomayoun Nikookar, Defence Academy, Netherlands



**Abstract:** In this talk a green Binary Phase Shift Keying (BPSK) modulated Orthogonal Frequency Division Multiplexing (OFDM) transmission is addressed by designing an optimal signal for the minimum average transmit power taking into account the characteristic of the transmit antenna. The optimal waveform is obtained by applying the Calculus of Variations and for the best performance in the BPSK data detection. The optimal waveform is compared with the conventional rectangular and linear ramp waveforms. Results show the transmission greenness of the proposed technique in shaping the signal.



**Hodayoun Nikookar** received his Ph.D. in Electrical Engineering from Delft University of Technology in 1995. He is an Associate Professor at the Faculty of Military Sciences of the Netherlands Defence Academy. Dr Nikookar has published 150 papers in the peer reviewed international technical journals and conferences, 15 book chapters and is author of two books: Introduction to Ultra-Wideband for Wireless Communications, Springer, 2009 and Wavelet Radio: Adaptive and Reconfigurable Wireless Systems based on Wavelets , Cambridge University Press, 2013.

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## Project Presentation Sessions – 27.06.2022, 14:30-15:30

### 14:30-14:45 ASSIST-IoT, Ignacio Lacalle Ubela, Universidad Politecnica di Valencia (remote)

**Abstract:** ASSIST-IoT is designing and developing an innovative reference architecture, envisioned as a decentralized ecosystem, where intelligence is distributed among nodes by implementing AI/ML close to data generation and actuation, and hyperconnecting nodes, in the edge-cloud continuum, over softwarized smart network. This is supported by several pillars: (i) innovative IoT architecture, to adapt to the NGI paradigm, including intelligence, security and privacy by design; (ii) moving from semantic interoperability to semantically-enabled cross-platform, cross-domain data transactions, within decentralized governance; (iii) development and integration of innovative devices, supporting context-aware computing; (iv) introduction of self-\* mechanisms, supporting self-awareness and (semi-)autonomous behaviours across IoT deployments, and (v) Tactile Internet support for latency applications, like AR/VR/MR, and human-centric interaction with IoT components. Finally, to validate research results, and developed solutions, and to ensure their wide applicability, extended pilot deployments with strong end-user participation are taking place in: (i) port automation; (ii) smart safety of workers, and (iii) cohesive vehicle monitoring and diagnostics, bringing about domain-agnostic aspect of the approach. In this talk, we will showcase the main relevant aspects of the project vis-a-vis Next Generation IoT features, will outline the demonstrator pilots and will provide information about our Open Call for funding to individual entrepreneurs like you!



**Mr. Ignacio Lacalle** (male) is a researcher working at the Universitat Politècnica de València (UPV), a public University at the South-East of Spain. Ignacio is a Telecommunications Engineer (2014) from UPV and is currently working on his PhD. The expertise of Ignacio is mainly rooted on Internet of Things field, having participated in 6 research projects related to interoperability, added value services, data processing and manageability, among others. Ignacio has performed various roles in those projects (ranging from Developer to Community Manager and Project Manager). In addition, most of those projects were focused on applying IoT-related innovations, in particular, to the field of maritime ports, one of the preferred

verticals of the research group.

#### **14:45-15:00 IntelloIoT: Intelligent IoT Environments, Arne Bröring, Siemens AG**

**Abstract:** Traditional IoT setups are cloud-centric and typically focused around a centralized IoT platform to which data is uploaded for further processing. Next generation IoT applications are incorporating technologies such as artificial intelligence, augmented reality, and distributed ledgers to realize semi-autonomous behaviour of vehicles, guidance for human users, and machine-to-machine interactions in a trustworthy manner. Such applications require more dynamic IoT environments, which can operate locally without the necessity to communicate with the Cloud. In this talk, we describe three use cases of next generation IoT applications and highlight associated challenges for future research. Based on this, we present the IntelloIoT framework that comprises the required components to address the identified challenges.

**Arne Bröring** is a senior researcher at Siemens' corporate research labs in Munich (DE) since 2014. Previously, he has worked for the Environmental Systems Research Institute (ESRI) in Zurich (CH), the 52°North initiative (DE), the University of Münster (DE), and received his PhD in 2012 from the University of Twente (NL). His research interests lay in the area of pervasive systems and particularly the internet of things, semantic web technologies, the sensor web, participatory sensing, as well as mobile and location-based services. He has been the Scientific and Technical Coordinator of the project IntelloIoT (<http://intelliott.eu>), as well as BIG IoT, and contributed to numerous other international innovation and research projects. His research has contributed to over 90 publications in refereed journals, conferences, and workshops resulting in an H-Index of 28.

#### **15:00-15:15 iGENIOUS: Next-Generation IoT Solutions for the Universal Supply Chain , Erin Seder, Nextworks (remote)**

**Abstract:** iGENIOUS (Next-GENeration IoT sOLutions for the Universal Supply chain, <https://ingenious-iot.eu/web/>) aims to build an holistic architecture for the next-generation supply chain by exploiting the wealth of data that the Internet of Things (IoT) can provide. In practice, iGENIOUS tackles the digitalisation of supply chain management and aims at optimizing the various logistics processes involved, including sourcing, procurement, conversion, production, and management operations.

Relevant use cases start right in the factories, where automated robots increase efficiency by working fully autonomously or by assisting human workers. To innovate logistics, IoT sensors shall monitor the safety-critical parts of land-based transport vehicles, thereby enabling longer maintenance intervals to reduce costs and ensuring reliable detection of



defects that could otherwise lead to accidents. By integrating network technologies ranging from local-area wireless networks all the way up to satellites, the project aims to enable comprehensive tracking of assets in shipping containers across land and sea. iNGENIOUS also seeks to develop tools for optimising container loading and unloading in ports, as well as to exploit 5G networks to remotely control vehicles in situations, where humans would be in danger or exposed to adverse environmental conditions.

IoT data is centric in iNGENIOUS, where an interoperability layer, made by the integration of a data virtualization platform with several Distributed Ledger technologies enable the coexistence of heterogeneous Machine-to-Machine IoT platforms on the one hand for data collection and distribution, and AI/ML techniques on the other for data processing and service optimization.



**Bio:** Dr. Seder graduated with a PhD in Physics from the University of Connecticut in 2013, followed by postdoctoral work at Jefferson National Lab (USA) and CERN (Switzerland). Her recent research activities have been focused in the fields of IoT and AI/ML in Industry 4.0. Dr. Seder has been active in Horizon 2020 projects including 5G-TRANSFORMER, COREALIS, 5G-EVE, EFPF, 5GZORRO, iNGENIOUS, and HEXA-X. She is currently in the R&D division at Nextworks Srl in the role of system and software engineer.

#### **15:15-15:30 TERMINET: nexT gEneRation sMart INterconnectEd IoT', Panagiotis Sariagiannidis, University Western Macedonia**

**Abstract:** The vision of TERMINET is to provide a flexible, open, and decentralised next generation IoT reference architecture based on cutting-edge technologies such as software-defined networking, multiple-access edge computing, and virtualisation for new real-time capable solutions. This goal will be achieved by enabling secure and privacy-preserving IoT services, user-aware solutions, semi-autonomous devices, and self-aware mechanisms, frameworks, and schemes, supported by distributed AI and new intelligent IoT devices within a virtualized edge-platform-cloud environment. TERMINET envisages six realistic, compelling, and complementary use cases in IoT domains such as energy, smart buildings, smart farming, healthcare, and manufacturing.



**Prof. Panagiotis Sariagiannidis** is the Director of the ITHACA lab (<https://ithaca.ece.uowm.gr/>), co-founder of the 1<sup>st</sup> spin-off of the University of Western Macedonia: MetaMind Innovations P.C. (<https://metamind.gr>), and Associate Professor in the Department of Electrical and Computer Engineering in the University of Western Macedonia, Kozani, Greece. He received the B.Sc. and Ph.D. degrees in computer science from the Aristotle University of Thessaloniki, Thessaloniki, Greece, in 2001 and 2007, respectively. He has published over 250 papers in international journals, conferences and book chapters, including IEEE Communications Surveys and Tutorials, IEEE Transactions on Communications, IEEE Internet of Things, IEEE Transactions on Broadcasting, IEEE Systems Journal, IEEE Wireless Communications Magazine, IEEE Open Journal of the Communications Society, IEEE/OSA Journal of Lightwave Technology, IEEE Transactions on Industrial Informatics, IEEE Access, and Computer Networks. He has been involved in several national, European and international projects. He is currently the project coordinator of three H2020 projects, namely a) H2020-DS-SC7-2017 (DS-07-2017), SPEAR: Secure and PrivatE smArt gRid, b) H2020-LC-SC3-EE-2020-1 (LC-SC3-EC-4-2020), EVIDENT: bEhavioral Insights and Effective eNergy policy acTions, and c) H2020-ICT-2020-1 (ICT-56-2020), TERMINET: nexT gEneRation sMart



INTERconnectEd IoT, while he coordinates the Operational Program MARS: sMART fARming with dRoneS (Competitiveness, Entrepreneurship, and Innovation) and the Erasmus+ KA2 ARRANGE-ICT: SmartROOT: Smart faRming innOVatiOn Training. He also serves as a principal investigator in the H2020-SU-DS-2018 (SU-DS04-2018), SDN-microSENSE: SDN-microgrid reSiliEnt Electrical eNErgy SystEm and in three Erasmus+ KA2: a) ARRANGE-ICT: pARtneRship foR AddressiNG mEGatrends in ICT, b) JAUNTY: Joint undergAduate coURses for smart eNErgy management sYstems, and c) STRONG: advanced firST ResPONDers training (Cooperation for Innovation and the Exchange of Good Practices). His research interests include telecommunication networks, internet of things and network security. He is an IEEE member and participates in the Editorial Boards of various journals, including International Journal of Communication Systems and EURASIP Journal on Wireless Communications and Networking.



**Anna Triantafyllou** was born in Ioannina, Greece. She received the Diploma degree (5 years) from the Dept. of Informatics and Telecommunications Eng., University of Western Macedonia, Greece, in 2017. She received a Graduation Excellence Award from the Technical Chamber of Greece in 2018. She is a Ph.D. student in the Dept of Electrical and Computer Engineering, University of Western Macedonia, Greece. Her main research interests are in the area of internet of things, communication protocols, and LoRaWAN. Up until now, she has published 11 papers in international journals and conferences, including Wireless communications and mobile computing, MDPI Information, Computer Networks and IEEE Open Journal of the Communications Society. Recently she received the award of “Best Communication Systems Paper” in the 9<sup>th</sup> International Conference on Modern Circuits and Systems Technologies (MOCASST) on Electronics and Communications 2020. Ms Triantafyllou is also a Research Associate in national and European funded research projects in the same University. More specifically, she was involved in the Operational Program DIAS: Drone Innovation in saffron Agriculture Surveillance (Competitiveness, Entrepreneurship, and Innovation). Currently she participates in the following research projects: the H2020-SU-DS-2018 (SU-DS04-2018-2020), SDN-microSENSE: SDN-microgrid reSiliEnt Electrical eNErgy SystEm, the H2020-ICT-2018-20 (ICT-56-2020) TERMINET: nexT gEneRation sMART INterconnectEd IoT and the H2020-LC-SC3-2018-2019-2020 (LC-SC3-EC-4-2020) EVIDENT: bEhaVioral Insgihts and Effective eNErgy policy aCTions.

### 15:30-15:45 VEDLIoT - Very Efficient Deep Learning in IoT, Jens Hagemeyer, Bielefeld University

**Abstract:** The VEDLIoT project targets the development of energy-efficient Deep Learning for distributed AIoT applications. A holistic approach is used to optimize algorithms while also dealing with safety and security challenges. The approach is based on a modular and scalable cognitive IoT hardware platform. Using modular microserver technology enables the user to configure the hardware to satisfy a wide range of applications.

VEDLIoT offers a complete design flow for Next-Generation IoT devices required for collaboratively solving complex Deep Learning applications across distributed systems. The methods are tested on various use-cases ranging from Smart Home to Automotive and Industrial IoT appliances.

**Jens Hagemeyer** is research associate at Bielefeld University, within the group Cognitronics and Sensor Systems, as part of the technical faculty.



His research interests are in the area of heterogeneous and reconfigurable computing, applied to various applications in the area of cloud and edge computing. He is also co-founder of ParaXent GmbH, a spin-off established in 2018 which targets the development and efficient utilization of heterogeneous hardware accelerators. With his team, he is continuously involved in several international research projects and acts as coordinator of the H2020 project VEDLIoT, dealing with the integration of IoT and deep learning.

#### 15:45-16:00 IOT-NGIN Project Presentation, Jonathan Klimt, RWTH, Aachen

**Abstract:** This talk shall provide an overview on the ICT-56 IoT-NGIN project.



**Jonathan Klimt**, M.Sc. has studied Electrical Engineering at the the Technical University Munich (TUM) and the RWTH-Aachen with a focus on computer engineering and embedded systems. He is currently working as a researcher at the Institute for Automation of Complex Power Systems at RWTH-Aachen and is researching on Unikernels, Cloud and High-Performance Computing, Embedded Systems and Programming Languages. In the IoT-NGIN project, he is pushing the use of Unikernels in the cloud and edge-clouds further, enhancing performance and security in the IoT backend landscape.

#### 16:00-16:15 EFPF, Usman Wajid, Information Catalyst

**EFPF** is an EC H2020 funded innovation project that aims to establish a federated digital platform for connected smart factories. The federated platform developed in the project interlinks different stakeholders of the digital manufacturing domain and enables users to utilise innovative functionalities, experiment with disruptive approaches and develop custom Industry4.0 solutions to maximise connectivity, interoperability and efficiency across the supply chains. At the core of EFPF platform is an interoperability mechanism called 'Data Spine' that provides open interfaces to support the integration of distributed systems and platforms with their toolset and services. Through the Data Spine based connectivity and interoperability, the EFPF platform aims to realise and support a connected and smart ecosystem of the future. To support the ecosystem development, the project has already provided 2.5million Euros as cascade funding to 20 experiments that will validate EFPF solutions in different industrial scenarios or add new functionalities in the EFPF federation. Moreover, the EFPF platform is now open for access and experimentation. For further details, please consult the project website: <https://www.efpf.org/> or drop a line to: [info@ef-foundation.com](mailto:info@ef-foundation.com)



**Dr Usman WAJID** is a Technical Director at Information Catalyst (ICE), an innovative ICT SME operating in the domains of Software, Data, and Services with specialism in Process Engineering and Data Analytics.

Usman is increasingly interested in the development and promotion of innovative solutions - with modern views on data capabilities in business transformation - bringing together cutting-edge research and innovation from Industry4.0, IoT, Big Data and AI disciplines into user centric solutions. At ICE, he is also responsible for initiating and leading research & innovation projects in diverse industrial sectors such as manufacturing, eHealth, Big Data and Cybersecurity. Usman's successful collaborations with research and industrial partners have resulted in a number of European funded projects (such as EFPF) in the areas of digital manufacturing,



ehealth and big data analytics. With proven experience of managing digital transformation projects and solution development life-cycle in multiple domains, Usman actively collaborates with research, industry and standardisation bodies to develop innovation roadmaps and align individual agendas with research and innovation frameworks.

[usman.wajid@informationcatalyst.com](mailto:usman.wajid@informationcatalyst.com) // <https://tinyurl.com/usmanwajid>

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## Invited Talks Track: Business Models and Use-cases for 6G – 27.06.2022, 16:30-18:30

### **16:30-16:50 Challenges in the design of a holographic telepresence system – the current outcomes from the implementation of a use case scenario, Vladimir Poulkov, Technical University of Sofia, Bulgaria**

**Abstract:** With the emergence of 6G systems, a whole new range of novel use cases, services and key value and performance indicators, come into play. Examples are the remote interactions between human beings that become more and more part of our everyday living. The current methods are becoming obsolete, as new forms of interactions are being developed leading to a true immersion into a distant environment. Based on the current-state-of the art of holographic telepresence systems some general trends for their future development are identified. The talk focuses on the vision for the research and design for human-centered immersive communications and points out some important performance indicators. As a practical example the challenges, current status, and outcomes from the development of a specific use case for an advanced holographic telepresence system in the framework of the “HOLOTWIN” project, funded by the ministry of Science and Education of Bulgaria, will be considered.



Professor Vladimir Poulkov has received the M.Sc. and Ph.D. degrees from the Technical University of Sofia (TUS), Sofia, Bulgaria. He has more than 30 years of teaching, research, and industrial experience in the field of telecommunications. He has successfully managed numerous industrial, engineering, R&D and educational projects. He has been Dean of the Faculty of the Telecommunications at TUS and Vice Chairman of the General Assembly of the European Telecommunications Standardization Institute (ETSI). Currently he is Head of the Tele infrastructure R&D Laboratory at TUS and Chairman of the Cluster for Digital

Transformation and Innovation, Bulgaria. He is Fellow of the European Alliance for Innovation; Senior IEEE Member. He has authored many scientific publications and is tutoring BSc, MSc, and PhD courses in the field of Information Transmission Theory and Wireless Access Networks.

### **16:50-17:10 6G - An Ecosystem for Technology and Market Opportunities, Martjin Kuipers, Lusíada University/INOV-INESC, Portugal**

**Abstract:** According to National Geographic, an ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. 6G is an ecosystem where technologies, networks, operators and users work together to form a global interconnected network of systems. No longer will there be a particular feature, such as reduced latency, increased data rates, etc, that will drive the systems. Instead, the ecosystem will house different creatures at the same time. New technologies can be quickly deployed and new markets can be targeted without huge investments in updating the entire network core. 6G is going to be exciting for academics, businesses and foremost, end-users.



**Berend Willem Martijn Kuipers** received a B.Sc. from the Rijswijk University of Technology, the Netherlands, in the area of computer science in 1996. In 1999, he received his M.Sc. in the area of telecommunications from the Delft University of Technology in the Netherlands. He received his Ph.D. in the area of telecommunications from Aalborg University, Denmark in 2005. During his Ph.D. he has developed a novel multicarrier access scheme for 4G systems. Currently he is employed by INOV-INESC Inovação in Lisbon, where is involved in the application of artificial intelligence algorithms for data analysis, such as clustering algorithms, seasonal ARIMA forecasting and machine learning. He has supervised more than 30 M.Sc. students and was involved with courses on telecommunications and computer networks, artificial intelligence and data structures. He has taken part in National and European projects, like Monitor-BT, E-Balance, TRILLION, ROCSAFE, FASTER e PERSONA and has publications in the area of channel modelling, access techniques and IP networking.

He is also professor and coordinator at the bachelor's degree in Computer Science and Engineering at the Lusíada University of Lisbon, where he is responsible for the courses on artificial intelligence, data structures and computer networking.

**17:10-17:30 Green Business Model 6G Services: A new perspective with Internet of Things connected Green Business Models empowered with Artificial Intelligence, Per Valter, Aarhus University**

**Abstract:** In an increasingly more interconnected world, 5G networks have delivered sufficient results on dimensions such as connectivity, speed, latency, and reliability for most corporations' applications and services.

It's time to investigate how 6G Services could create additional value for corporations and society. This presentation explores the potential value of Green Business Model 6G Services, where Green Business Models are connected with Internet of Things and empowered with Artificial Intelligence.



**Per Valter** is Associate Professor of innovation and green business development. Where his main research field areas are Innovation, Green Business Development, Digitization of Business Models and Entrepreneurship. He has successfully been founding several startup companies and grown them to exit's stage and was awarded "Børsen Gazelle" in 2013, 2014, 2019, 2020 for creating and leading one among the fastest growing companies in Denmark, in addition to these business achievements he is a Graduate in Computer Science and holds an Executive MBA - Master in Management of Technology and an MSc in Business and Management Research at Henley University of Reading and a Ph.D. degree in Social Sciences and Business from Aarhus University. He is an experienced teacher on bachelor and master level in addition to supervising.

His research interests are Innovation, Green Business Development, Digitization of Business Models and Entrepreneurship.

**17:50-18:10 Green Business Models and Use-cases for 6G, Peter Lindgren, vice-president CGC, Aarhus University,**





## Denmark

**Abstract:** In the last few years businesses have been motivated and pushed by governments and global society on innovating and developing Green Business Models. However, Reconfiguring, designing and developing green business models to become efficient and valuing Green Business Models have shown to be much more complex than expected due to several barriers and challenges called Green Walls. It also includes balancing monetary and non monetary value formulas of business models. Not just for the single business – but for businesses in their entire value network. Green Business Models and Green business Model Innovation calls therefore for new and more advanced business model security approaches, technologies and understanding. Previous business model innovation practice and systems cannot offer these solutions – but business models combined with 6G and wide-area wireless technologies give hope to business and societies that this finally can be solved.



**Peter Lindgren** holds a full Professorship in Multi business model and Technology innovation at Aarhus University, Denmark – Business development and technology innovation and is Vice President of CTIF Global Capsule (CGC) [www.ctifglobalcapsule.org](http://www.ctifglobalcapsule.org). He is founder of the Multi Business Model Innovation Approach. He is Director of CTIF Global Capsule/MBIT Research Center at Aarhus University – Business Development and Technology and is member of Research Committee at Aarhus University – BSS. He is cofounder of five start-up businesses amongst others - [www.thebeebusiness.com](http://www.thebeebusiness.com) , [www.thedigibusiness.com](http://www.thedigibusiness.com), [www.vdmbee.com](http://www.vdmbee.com) .



## Day 2 Programme

Technical session - Full paper session 2 – 28.06.2022, 09.30-10.30 CET

Chair: Manel Khelifi, fortiss

**09:30-10:00 Catarina Castanheira, Rita Almeida, Duarte Marques, Guilherme Firmino, Luis Elvas, Joao C. Ferreira, *How tourists move in a city.***

**Abstract:** Little is known about the spatial behaviour of urban visitors, even though travellers create a massive amount of data (Big Data) when they visit cities. Using their behaviours, these data sources may be utilised to monitor their existence.

Using Big Data, this article aims to analyze the digital footprint of urban visitors. Unlike others that rely on mobile device operators in Lisbon, This article establishes a partnership with Lisbon Municipality. We developed a Python approach to clean and prepare visualisation dashboards to understand tourists' movement in a city.

**10:00-10.30 Susmita Paul, *Intrusion Detection System in IoT to Prevent Cyber-Attacks in Organization***

**Abstract:** Internet of things (IoT) devices are connected objects which are able to collect and exchange data. IoT offers many opportunities to make day-to-day life more fulfilling but is impacted by many security challenges. IoT is fast gaining traction in a wide range of industries, including health care, automotive and logistics. The Internet of Things (IoT) ecosystem has grown in importance as a method of ensuring the security and stability of both information and connection. This paper is based on the analysis of intrusion Detection Systems that is used in organizations and how they can be improved. An IDS is used to detect and remove malicious packets before it enters the network. It is a technique to detect the attack source when cryptography is broken and it also monitors the system activities or network traffic to detect policy violations. The objective of this research paper is to do a bibliometric analysis and improve the efficiency and security of organizations and human life. An IoT-based environment is used to enable the integration and realization of smart objects in smart industry, Smart health, smart homes and smart buildings. An Intrusion Detection System (IDS) is a technique to detect malicious activities in an IoT network.

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Short paper session – 28.06.2022, 11:00-12:00

Chair: Albena Mihovska, Aarhus University

**11:00-11:30 Savita Sthawarmarth, Eric Renault, *Stateless Paradigm for Resiliency in Beyond 5G Networks***

**Abstract:** An unprecedented surge in communication capabilities to things, in general, is challenging the traditional internet service providers. Telecommunication operators played a major role in connecting people to the internet and are now compelled to accommodate communicating things with traffic demands that are diverse and unpredictable in nature. To that end, sofwarization and virtualization of network entities have extensively helped to achieve a high degree of flexibility and scalability. Complementing this, separating the computing from the storage as a second degree of decoupling is required to make network functions highly resilient. Our work introduces the stateless network function paradigm by proposing a Quasi-local model which is a fetch and cache model in order to achieve resiliency. We justify the proposed model with the state analysis, design, and derivation of state metrics. Furthermore, we assess various network



architectures suitable for future stateless network functions to maintain the End-to-End delay budget of diverse telecom use cases.

### **11:30-12:00 Nidhi, Bahram Khan, Albena Mihovska, Ramjee Prasad, Vladimir Poulkov, Fernando J Velez Dynamic Resource Block Allocation in Network Slicing**

**Abstract:** Network slicing is crucial in 5G and its evolution concerning user-centric services. By allocating independent resources, like link bandwidth, computing/processing capabilities and spectrum, to address users' requests, slicing serves the end-to-end verticals or services. gNodeB (gNB) allocates the bandwidth resources to transmit/receive data to User Equipments (UEs). Resources Blocks (RBs) are the smallest resource entities assigned to a single user. In 5G New Radio (NR), the time-domain resource allocation defines the allocated symbols (OFDM symbols), while the frequency-domain allocation illustrates the RBs (sub-carriers) allocation to the UE. RB comprehends 12 sub-carriers in the frequency domain with a flexible RB bandwidth, unlike LTE-A. It is critical to provide enhanced services to different users. There have been several works on challenges to enable a multi-tenant and service RAN while providing isolation to the slices. This work proposes a detailed approach for creating slices based on the demanded services, resource virtualization and isolation. The focus is on resource sharing algorithms at the Slice Orchestrator (SO) level. These virtual network slices support a wide range of services and applications categorized into the Enhanced Mobile Broadband, Ultra-Reliable and Low-Latency Communications and Massive Machine-Type Communications megatrends. The paper also provides an overview of standardization activities and evolving requirements to support use cases and services like Holographic Telepresence, Automotives, among other.

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### [Invited Talks Track 2: IoT Cooperation Opportunities towards Brazil, 28.06.2022, 14:30-15:30](#)

### **14:30-14:50 Information Technology courses in large scale to supply national demands, Rodolfo Azevedo, President of UNIVESP, Brazil**

**Abstract:** According to official statistics, Brazil lacks more than 40k new IT professionals every year. From this number, 26k new jobs are created in São Paulo. In this presentation, we will show UNIVESP's approach to provide bachelor's degree to thousands of students around the state through distance learning. Currently, we have 14k computing students, and we plan to reach 20k by the end of 2022, when we will start graduating in large scale. We will also show how we organized the curriculum of 3 computing courses that share a common core and how we have been partnering with companies to bring the students to market.



**Bio:** Rodolfo Azevedo is President of the São Paulo Virtual University (UNIVESP) since 2019 and full professor at University of Campinas (UNICAMP). His main research interests are in Computer Architecture and Technology for Teaching where he advised more than 40 MsC and PhD students and received 4 best papers in conferences. He was member of the Brazilian Computing Society Council, and Director of the Institute of Computing at Unicamp from 2017 to 2019. He is member of IEEE, ACM and SBC.



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**14:30-14:50 Sergio Paulo Gaulindo, President of Brasscom, Brazil**



**Sergio Paulo Gallindo**, CEO of Brasscom, Companies' Association of Information and Communication Technology (ICT) and Digital Technologies, since 2014, works in conception and fostering public policy aimed at competitiveness, digital transformation, education, and innovation.

Sergio Paulo is Lawyer and Engineer; Master's in Political and Economic Law by Mackenzie Presbyterian University; M.Sc. in Computer Science by The University of Texas at Austin, under a Fulbright scholarship; Bachelor's in Law by USP, University of

São Paulo; Bachelor's in Electronic Engineering by UFRJ, Federal University of Rio de Janeiro; and lecturer of Tax and Digital Economy in the Tax Management MBA at USP/ESALQ.

Member of the Management Committee of ICP-Brasil, under Brazilian Presidency; member of several advisory boards in the Ministry of Science, Technology and Innovation; member of the Advisory Board of the Social Opportunity Institute – IOS; member of the Certification Board of Vanzolini Foundation; former associated with the Harvard Business School Angels of Brazil; former member of The Economic and Social Development Council to the President of Brazil. Country Manager of BT (British Telecom) Brazil from 2009 to 2014 and Vice-President of Nortel Brazil.

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**15:10-15:30 IoT in Brazil understanding challenges and opportunities, Paulo José Spaccaquerche, President of ABINC (Brazilian Association of IoT)**



**Paulo Jose Spacca** is currently the President of ABINC, the Brazilian Association of IoT. He has more than 40 years of professional experience working closely with leading technology companies such as IBM and SAP, as well as banks and retail companies. He is responsible for the implementation in Brazil of American companies such as Sybase, Netscape, Peoplesoft, Quest and others. Excellent relationship with the main executives of national and multinational companies, mainly in the Finance, Public Services, Media, and Government sectors. He was also a professor at IBM for the sales courses.

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**Invited Talks Track 3: Advanced Visions Towards 6G, 28.06.2022, 16:00-17:00**

**16:00-16:20 , Machine Learning Enables Radio Resource Utilization of uRLLC, Kwan-Cheng Chen, University of South Florida, USA**

**Abstract:** Proactive open-loop communication in the virtual-cell network architecture emerges as a compelling approach to accomplish minimal end-to-end latency communication. To achieve ultra-reliability, predictive radio resource utilization is required without feedback control mechanism. In this talk, we introduce machine learning to facilitate predictive radio resource utilization by smartly taking advantage of delayed information, and effectively accomplish proactive communication. The tradeoff between reliability and density of access points is also identified to guide the uRLLC system



design



Kwang-Cheng Chen has been a Professor at the Department of Electrical Engineering, University of South Florida, since 2016. From 1987 to 2016, Dr. Chen worked with SSE, Communications Satellite Corp., IBM Thomas J. Watson Research Center, National Tsing Hua University, HP Labs., and National Taiwan University in mobile communications and networks. He visited TU Delft (1998), Aalborg University (2008), Sungkyunkwan University (2013), and Massachusetts Institute of Technology (2012-2013, 2015-2016). He founded a wireless IC design company in 2001, which was acquired by Mediatek Inc. in 2004. He has been actively involved in the organization of various IEEE conferences and serving editorships with a few IEEE journals (most recently as a series editor on Data Science and AI for Communications in the IEEE Communications Magazine), together with various IEEE volunteer services to the IEEE, Communications Society, Vehicular Technology Society, and Signal Processing Society, such as founding the Technical Committee on Social Networks in the IEEE Communications Society. Dr. Chen also has contributed essential technology to various international standards, namely IEEE 802 wireless LANs, Bluetooth, LTE and LTE-A, 5G-NR, and ITU-T FG ML5G. He has authored and co-authored over 300 IEEE publications, 4 books published by Wiley and River (most recently, Artificial Intelligence in Wireless Robotics, 2019), and more than 23 granted US patents. Dr. Chen is an IEEE Fellow and has received several awards including 2011 IEEE COMSOC WTC Recognition Award, 2014 IEEE Jack Neubauer Memorial Award, 2014 IEEE COMSOC AP Outstanding Paper Award. Dr. Chen's current research interests include wireless networks, quantum communications and computing, cybersecurity, artificial intelligence and machine learning, IoT/CPS, and social networks.

**16:20-16:40 Reaching out to billions of client devices: Challenges and opportunities in very dense wireless networks, Jean-Paul Linnartz, Signify, Philips Lighting**

**Abstract:** To carry the predicted amounts of traffic from more users, more devices, each generating more bit/s than today, future generations of wireless networks need to be very dense (bit/s/m<sup>2</sup>) with access points at many locations. The (installation of the) infrastructure to support this can become a major cost factor in the economics of connectivity provision. But the value generated by such network goes beyond pure communication.

The physical layer of an advanced communication infrastructure lends itself well to functions, features and services beyond transporting bits. The estimation of the wireless channel response gives side information about the time of flight between the transmitter and receiver but also the excess distance of reflections give information about objects and human that are in the propagation environment. Similarly, at the network layer, insights about activities in the environment can be deduced.

The use of a variety of radio and optical wavelength to leads to interesting propositions. But the convergence of communication, sensing and positioning not only happening at the lower layers. At an infrastructure level, the presence of power and a high-speed data connection are critically important. The lighting infrastructure is rapidly expanding. With more than 100 Million of digitally cloud-connected light points, it forms (one of) the largest Internet of Things installations.



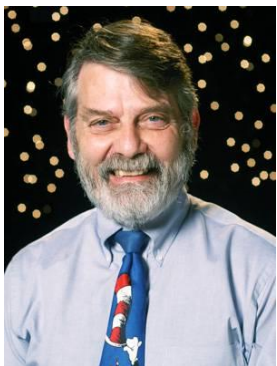
**Jean-Paul Linnartz** (Fellow, IEEE) currently is a Research Fellow with Signify (Philips Lighting) Research, and a Part-time Professor with TU Eindhoven, addressing Personalized Human Centric Lighting and optical wireless communication. His inventions led to more than 75 granted patent families and have been a basis for three ventures. From 1992 to 1995, he was an Assistant Professor with the University of California, Berkeley, CA, USA. In 1994, he was an Associate Professor with TU Delft. From 1988 to 1991, he was an Assistant



Professor with the TU Delft. He was Senior Director with Philips Research, Eindhoven, The Netherlands, where he headed Security, Connectivity, and IC Design Research Groups.

### 16:40-17:00 Polyphase Channelizers in Modern Communication Systems, Fred Harris, University of San Diego

**Abstract:** We learn to design filters and how to apply their use in the sampled data domain that satisfy their often-repeated constraint; Linear Time Invariant (LTI)! The body of tools with which we are armed in LTI is remarkable: transfer functions, impulse response, superposition, reciprocity, commutability, and so on. One's intuition and understanding about sampled data filters fail us when we change the playing field to Linear Time Varying (LTV). All our tools vanish! In this presentation we will explain how an LTI filter is changed to an LTV filter and the three reasons we choose to do this. They are to reduce cost, to improve performance, and have fun being creative. We take our audience on a trip through Alice's looking glass where things seem to operate backwards and accomplish what appears to be applied magic. We learn how to form an M-path polyphase analysis filter bank and its dual, an M-path polyphase synthesis filter bank. These are amazing processing engines that perform their processing tasks by using spectral aliasing, caused by a sample rate change, to move spectral bands between baseband and selected center frequencies and then separate these aliases by their distinct phase profiles. Remarkably, they accomplish this with a single prototype filter and an inverse FFT that performs channelization of all the filters in the filter bank. Strangely, the same filter is centered at multiple center frequencies simultaneously. Even more remarkable is the capabilities offered by a cascade of the analysis and synthesis filter banks. How about channelizers with multiple simultaneous bandwidths and arbitrary center frequencies. Would an order of magnitude reduction in processing work load be of interest to you? This presentation is low on math and high in comprehension.



Professor harris is at the University of California San Diego where he teaches and conducts research on Digital Signal Processing and Communication Systems. He holds 40 patents on digital receiver and DSP technology and lectures throughout the world on DSP applications. He consults for organizations requiring high performance, cost effective DSP solutions.

He has written some 285 journal and conference papers, the most well-known being his) 1978 paper "On the use of Windows for Harmonic Analysis with the Discrete Fourier Transform" (9400 citations). He is the author of the book **Multirate Signal Processing for Communication Systems**, coauthor with Bernie Sklar of **Digital Communications** and has contributed to several other DSP books. His special areas include Polyphase Filter Banks, Physical Layer Modem design, Synchronizing Digital Modems

and Spectral Estimation

He was the Technical and General Chair respectively of the 1990 and 1991 Asilomar Conference on Signals, Systems, and Computers, was Technical Chair of the 2003 Software Defined Radio Conference, of the WPMC-2006 Wireless Personal Multimedia Conference, of the DSP-2009, DSP-2013 Conferences and of the SDR-WinnComm 2015 Conference. He became a Fellow of the IEEE in 2003, cited for contributions of DSP to communications systems. In 2006 he received the Software Defined Radio Forum's "Industry Achievement Award". He received the DSP-2018 conference's commemorative plaque with the citation: *We wish to recognize and pay tribute to fred harris for his pioneering contributions to digital signal processing algorithmic design and implementation, and his visionary and distinguished service to the Signal Processing Community.*

The spelling of his name with all lower case letters is a source of distress for typists and spell checkers. A child at heart, he collects toy trains, old slide-rules, and gyroscopes.



## Venue Information

The CONASENSE2022 symposium takes place in the Highlight Towers, IBM Watson Research Center 21<sup>st</sup> floor, room Yorktown south.

The co-located Hackathon takes place on the 20<sup>th</sup> floor, Large Board room.

Coffee-breaks, Lunch breaks, and keynote sessions occur on IBM Watson Center, 21<sup>st</sup> floor.

Registration is available on the first and second day, groundfloor, from 9 to 9.30 CET.



## Venue address:

- Munich Highlight Towers
- Mies-van-der-Rohe-Straße 6, 80807 München

## How to Reach

### From the Airport:

Take the Lufthansa Airport Bus (for passengers of all airlines) from Munich Airport to the first stop Schwabing Nord (Nordfriedhof). Travel time is approx. 25 minutes. The walk from there to the Munich Highlight Towers is approximately 10 minutes

- **Further information:** [www.airportbus-muenchen.de](http://www.airportbus-muenchen.de)



## Train/Metro

From Odeonsplatz take the U6 (towards Münchner Freiheit / Garching-Forschungszentrum) to the Nordfriedhof station. Travel time is approx. 7 minutes. Take the northern exit towards Schenkendorfstraße / AOK / Orthodox Church.

- **Further informationen:** [www.mvv-muenchen.de](http://www.mvv-muenchen.de)

## Car

From the Mittlerer Ring (Schenkendorfstraße or Isarring) follow the Ungererstraße (B11) out of town towards Landshut. Turn left into Fröttmaninger Straße and left again into Guerickestraße. There are usually parking spaces available at the end of the street.

From the A9 coming from Nuremberg: go to the end of the motorway (München-Schwabing), then onto the Mittlerer Ring (West). Take the next left into Ungererstraße, then follow as above.

## Hotels in Walking Distance - Suggestions

### Ibis Munich City North

- Ungererstrasse 139
- 80805 Munich
- <http://www.accorhotels.com/gb/hotel-0996-ibis-munich-city-north/index.shtml>

### Munich Marriott Hotel

- Berliner Strasse 93
- 80805 Munich
- <http://www.marriott.com/hotels/travel/mucno-munich-marriott-hotel/>

### Pullman Munich

- Theodor-Dombart-Strasse 4
- 80805 Munich
- <http://www.pullman-hotel-muenchen.de/en/>
- Walking distance to fortiss: 10 minutes





## INNSIDE Munich

- Mies-van-der-Rohe-Strasse 10
- 80807 Munich
- <http://www.melia.com/en/hotels/germany/munich/ininside-munich-parkstadt-schwabing/index.html>
- Walking distance to fortiss: 10 minutes