CONASENSE2022 Invited Talks – 6G Business Models, Use-cases and Sustainability

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1.   INTRODUCTION

The session of invited talks focused on 6G business models, use-cases and design aspects relevant to achieve sustainability.

Milica Pejanović-Djurišić, University of Montenegro, addressed cybersecurity challenges in 6G, taking into consideration the CONASENSE interdisciplinary approach, and the boundaries created in terms of regulation, data privacy, and security policies towards AI, heterogeneous wireless networks, etc.

Hoomayoun Nikookar, Defence Academy, Netherlands addressed green radio communication design for OFDM systems, explaining how such design can be formulated as an optimization problem.

Vladimir Poulkov, University of Sofia, Bulgaria, provided a use-case for the design and implementation of a holographic system.

Martjin Kuipers, Lusíada University/INOV-INESC, Portugal, addressed the need to rethink the 6G business models having as key technological aspect virtualization and as such, to re-think the 6G value-chain.

Per Valter, Aarhus University,

Peter Lindgren, CGC, Aarhus University, closed the session with a presentation on Green Business Models, in particular alerting to the need to integrate novel and more advanced business model security approaches, technologies and understanding. The talk brought the vision to the power of business models combined with 6G and wide-area wireless technologies in bringing societal benefits.

2.   CYBERSECURITY IN THE ERA OF NEXT GENERATION WIRELESS NETWORKS, MILICA PEJANOVIĆ-DJURIŠIĆ, UNIVERSITY OF MONTENEGRO

Presentation

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.

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 trade-off 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 involving 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.

3. GREEN OFDM TRANSMISSION: AN OPTIMAL SIGNAL DESIGN APPROACH, HOOMAYOUN NIKOOKAR, DEFENCE ACADEMY, NETHERLANDS

Presentation

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.

Homayoun 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.

4. 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

Presentation

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 an 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.

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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.

5.   6G - AN ECOSYSTEM FOR TECHNOLOGY AND MARKET OPPORTUNITIES (PDF), MARTJIN KUIPERS,UNIVERSITY LUSIADA/ INESC-INOV, PORTUGAL

Presentation

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 datarates, 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 targetted 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.

6. 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 c 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 serval 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 experience teacher on bachelor and master level in addition to supervising.

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

7.   GREEN BUSINESS MODELS AND USE-CASES FOR 6G, PETER LINDGREN, VICE-PRESIDENT CGC, AARHUS UNIVERSITY, DENMARK

Presentation

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. 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   ,   www.thedigibusiness.com, www.vdmbee.com .