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# Monday, October 28

## Monday, October 28 13:45 - 16:45

### T1: Tutorial

How to Make a Standard: A Practical Introduction

**Dr James Irvine**

This tutorial will provide a practical introduction to the standards development process.Standards aren't just about the best technology - they are also driven by the needs and interdependency of industry players. Writing standards therefore involves much more than assessing the technical proposals.Influencing standards is essential for research activities to have impact, particularly in the area of communications. However, few university courses truly prepare graduates for involvement in standards, seeing this as the role of industry. This often means standards are driven by the larger players who have the staff and resources to dedicate to the system.

IEEE SA and IEEE Educational Activities have developed a standards simulation game, which can be used to train professions and students in the standards development process. This interactive session will start with an overview of the IEEE standards development process, before giving participants a chance to try the game for themselves. The session will end with practical tips on how to engage students and young professionals more in the standardization process.

# Tuesday, October 29

## Tuesday, October 29 9:00 - 11:00

### TS1: IoT, URLLC and V2X (I)

Chair: Jorge Navarro-Ortiz (University of Granada, Spain)

***Overview of 5G URLLC System and Security Aspects in 3GPP***

Takahito Yoshizawa (KU Leuven, Belgium); Sheeba Baskaran (Huawei Technologies Sweden AB, Sweden); Andreas Kunz (Lenovo, Germany)

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***Toward a Blockchain-based Platform to Manage Cybersecurity Certification of IoT devices***

Ricardo Neisse (European Commission Joint Research Centre, Italy); José Luis Hernandez Ramos (European Commission - Joint Research Centre (JRC), Belgium); Sara Nieves Matheu García (University of Murcia, Spain); Gianmarco Baldini (Joint Research Centre - European Commission & Universita degli studi di Insubria, Varese, Italy); Antonio Fernando Skarmeta Gomez (University of Murcia, Spain)

pp. 6-11

***The use of 5G Non-Public Networks to support Industry 4.0 scenarios***

Jose Ordonez-Lucena (Telefonica I+D, Spain); Jesus Folgueira Chavarria and Luis M. Contreras (Telefonica, Spain); Antonio Pastor (Telefonica I+D, Spain)

pp. 12-18

***Swarm-Based Energy Efficient Scheduling for Wireless Sensor Networks***

Tim van der Lee and George Exarchakos (Eindhoven University of Technology, The Netherlands); Sonia Heemstra de Groot (Eindhoven Technical University, The Netherlands)

pp. 19-24

***Concepts and requirements of IoT networks using IoT Data Exchange Platform toward International standards***

Tetsuya Yokotani (Kanazawa Institute of Technology, Japan); Kazuya Kawai (Information-technology Promotion Agency, Japan (IPA), Japan)

pp. 25-30

***Improving Hardware Security for LoRaWAN***

Jorge Navarro-Ortiz, Natalia Chinchilla-Romero, Juan J. Ramos-Muñoz and Pablo Muñoz (University of Granada, Spain)

pp. 31-36

## TS2: 5G Radio and Wireless Communications (I)

Chair: Pablo Ameigeiras (University of Granada, Spain)

***Energy Efficient Power Allocation for Multi-User MIMO Downlink Systems with Statistical Delay Constraints***
Jae-Hong Kwon and Young-Chai Ko (Korea University, Korea); Jinwoo Shin (Agency for Defense Development, Korea)
pp. 37-42

***Unified Statistical Channel Model of Ship (or Shore)-to-Ship FSO Communications with Pointing Errors***
Kug-Jin Jung and Sung Sik Nam (Korea University, Korea); Mohamed-Slim Alouini (King Abdullah University of Science and Technology (KAUST), Saudi Arabia); Young-Chai Ko (Korea University, Korea)
pp. 43-46

***On the Effect of C/I Correlation on Cellular Wireless Network Downlink Performance***
Ali Arsal and Mehmet F Demirkol (ULAK Communications Inc., Turkey)
pp. 47-52

***Co-existence of Micro, Pico and Atto Cells in Optical Wireless Communication***
Osama Zwaid Alsulami (University of Leeds, United Kingdom (Great Britain)); Mohamed Musa (University of Leeds, LS2 9JT, United Kingdom (Great Britain)); Mohammed Alresheedi (King Saud University, Saudi Arabia); Jaafar Elmirghani (University of Leeds, United Kingdom (Great Britain))
pp. 53-57

***A Software Defined Radio Platform for Decode and Forward Relay Nodes Implementation***
Jose Antonio Marín García and Cristina Romero Franco (Universidad Politécnica de Madrid & Information Processing and Telecommunications Center, Spain); José I. Alonso (Universidad Politécnica de Madrid, Spain)
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# Tuesday, October 29 11:30 - 12:15

## K1: Keynote 1

Open Source Software in the SAVI Things Testbed
**Prof. Alberto Leon-Garcia**

We are currently redesigning the SAVI (Smart Applications on Virtual Infrastructure) multitier cloud testbed to provide an application platform for smart city experiments, and specifically to deploy in the City of Vaughan, a rapidly growing city north of Toronto. In this talk we will discuss the various open source software that we have considered, experimented with and selected for our platform. We will focus on our design of the critical middleware layer, but also discuss the deployment of ML in the multitier cloud and the issues that arise in introducing widespread containerization.

# Tuesday, October 29 12:15 - 13:00

## K2: Keynote 2

Network Slicing: Concepts, Standardization, Open Issues
**Dr. Sławomir Kukliński**

The network slicing is relatively a new concept that allows for the creation of multiple network and service instances over a shared infrastructure. Network slices are dynamic entities, mutually isolated and typically built using distributed cloud infrastructure. There are multiple benefits of the network slicing approach: the network slices can be deployed quickly, and slice tenants do not need to have the infrastructure to define their solutions. Moreover, each network slice can be appropriately tailored to its service(s). The technology also enables a delegation of network slice management to slice operator (a tenant) and allows creation of network slices even by the end-users. The network slicing impacts the business model of the telco ecosystem. Due to the mentioned features, there is no doubt that the network slicing will revolutionize the way in which networks and services are built and operated. The network slicing is considered as a key technology

of 5G. In the talk, the concepts, standardization efforts (3GPP, ITU-T, ETSI) and open issues related to network slicing will be presented. The talk will deal with architectural approaches, management and orchestrations issues (scalability). I will also discuss the technical limitation of current approaches in the context of new business model and outline the necessary modifications of the current approaches.

## Tuesday, October 29 14:15 - 15:00

### K3: Keynote 3

Connectivity Standards in Edge Autonomy Applications

**Fernando Garcia-Aranda**

The nexus of increased computational density and high-speed ubiquitous network connectivity is enabling a new class of "Edge Autonomy" Aapplications. These are fully-decentralized, peer-to-peer systems able to interact intelligently with their environment. These complex systems integrate software and hardware components from many providers requiring a new class of "network connectivity standards" that provides the foundation for robust, real-time syntactic and semantic interoperability. In this presentation, we provide examples of edge autonomy applications and introduce some of the standards that address the connectivity challenges of these systems.

## Tuesday, October 29 15:00 - 15:45

### K4: Keynote 4

Beyond 5G: Key Technologies and Standards

**Dr. Konstantinos Samdanis**

As the 5G enters a stable phase in terms of the system architecture, 3GPP Release 17 starts to investigate advanced features that would shape its evolution. This talk aims to provides an insight analysis for mobile networks beyond 5G considering the advancements and implications introduced by the evolution of softwarization, agile control and deterministic services. It elaborates the 5G landscape elaborating new business prospects, emerging use cases and key technologies that constitute the pillars for the evolution beyond 5G considering new radio paradigms, micro-service oriented core network, native IP based user plane, network analytics and the support of low latency - high reliability.

# Wednesday, October 30

## Wednesday, October 30 9:00 - 11:00

### TS3: Access Network, Edge Computing and Transport

Chair: Christele Bouchat (Alcatel Bell, Belgium)

***Traffic Engineered Transport for 5G Networks***

John M Kaippallimalil (Futurewei Technologies Inc., USA); Young Lee (Futurewei Technologies, USA); Tony Saboorian and Mazin Shalash (Futurewei, USA); Ulas Can Kozat (Facebook, USA)

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***Realizing Multi-Access Edge Computing Feasibility: Security Perspective***

Pasika S Ranaweera (University College Dublin, Ireland & University of Ruhuna, Sri Lanka); Anca Delia Jurcut (University College Dublin, Ireland); Madhusanka Liyanage (University of Oulu, Finland & University College Dublin, Ireland)

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***5GEN: A tool to generate 5G infrastructure graphs***

Jorge Martín-Pérez and Carlos J. Bernardos (Universidad Carlos III de Madrid, Spain); Luca Cominardi (Universidad Carlos III, Spain); Alain Abdel-Majid Mourad (Interdigital Europe Ltd, United Kingdom (Great Britain))

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***Docker Enabled Virtualized Nanoservices for Local IoT Edge Networks***

Johirul Islam (University of Oulu, Finland); Erkki Harjula (Project Manager, Finland); Tanesh Kumar (University of Oulu, Finland); Pekka Karhula (VTT Technical Research Centre of Finland, Finland); Mika E Ylianttila (University of Oulu, Finland)

pp. 79-85

***Preference-based and Homogeneous Coalition Formation in Fog Computing***

Mohamed Sharaf (Al-Azhar University); Tarek El-Ghazawi (The George Washington University, USA)

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## TS4: 5G Radio and Wireless Communications (II)

Chair: Yuri C. B. Silva (Federal University of Ceará & Wireless Telecom Research Group (GTEL), Brazil)

***A Multi-Stream Pricing-Based Precoding and Power Control Algorithm for Dynamic TDD Networks***

Francisco Rafael Guimarães (Wireless Telecomunication Research Group, Federal University of Ceará, Brazil); Gabor Fodor (Ericsson Research & Royal Institute of Technology (KTH), Sweden); Walter da Cruz Freitas, Jr. (Federal University of Ceará & Wireless Telecom Research Group, Brazil); Yuri C. B. Silva (Federal University of Ceará & Wireless Telecom Research Group (GTEL), Brazil)

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***A Novel Architecture for Multihop Relaying in 3GPP LTE and 5G Networks***

Shashi Ranjan and Pranav Jha (Indian Institute of Technology Bombay, India); Prasanna Chaporkar and Abhay Karandikar (IIT Bombay, India)

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***Optical Wireless cabin communication system***

Osama Zwaid Alsulami (University of Leeds, United Kingdom (Great Britain)); Mohammed Alresheedi (King Saud University, Saudi Arabia); Jaafar Elmirghani (University of Leeds, United Kingdom (Great Britain))

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***Processing Time Aware Resource Allocation in Software Defined RANs***

Michael Einhaus, Igor Kim and Mohamad Buchr Charaf (Hochschule für Telekommunikation Leipzig (HfTL), Germany); Paul Arnold (Deutsche Telekom AG & DT, Germany)

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***On the Performance of the Spatial Reuse Operation in IEEE 802.11ax WLANs***

Francesc Wilhelmi (Pompeu Fabra University, Spain); Sergio Barrachina-Muñoz and Boris Bellalta (Universitat Pompeu Fabra, Spain)

pp. 114-119

***Sharing gNB components in RAN slicing: A perspective from 3GPP/NFV standards***

Oscar Adamuz-Hinojosa, Pablo Muñoz, Pablo Ameigeiras and Juan M. Lopez-Soler (University of Granada, Spain)

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# Wednesday, October 30 11:30 - 13:00

## P1: Panel 1

Standards and Applications leveraging 5G and IoT

Moderators

- Christele Bouchat (Nokia, Belgium)
- Kamran Sayrafian (National Institute of Standards & Technology, USA)

Pantelists

- Prof. Maziar Nekovee (University of Sussex, UK)
- Dr. Yan Chen (Huawei Technologies, China)

- Ms. Maria Cuevas (British Telecom, UK)
- Dr. Jesus Alonso-Zarate (Centre Tecnològic de Telecomunicacions de Catalunya, Spain)

# Wednesday, October 30 14:15 - 16:15

## P2: Panel 2

Network Analytics and Automation

Moderators

- Konstantinos Samdanis (Nokia Bell Labs, Munich)

Panelists

- Dr. David Gutiérrez-Estévez (Samsung, UK)
- Dr. Faqir Zarrar Yousaf (NEC, Germany)
- Prof. George Alexandropoulos (University of Athens)
- Prof. Alberto Leon-Garcia (University of Toronto)

# Wednesday, October 30 16:45 - 18:45

## TS5: IoT, URLLC and V2X (II)

Chair: Andreas Kunz (Lenovo, Germany)

***Tensor-Based Modeling and Processing for Channel Estimation in Two-Hop V2X MIMO Systems***

Paulo R. B. Gomes (Federal University of Ceará, Brazil); Gabor Fodor (Ericsson Research & Royal Institute of Technology (KTH), Sweden); Walter da Cruz Freitas, Jr. (Federal University of Ceará & Wireless Telecom Research Group, Brazil); André de Almeida (Federal University of Ceará & Wireless Telecom Research Group - GTEL, Brazil); Yuri C. B. Silva (Federal University of Ceará & Wireless Telecom Research Group (GTEL), Brazil)

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***5G V2X Architecture and Radio Aspects***

Karthikeyan Ganesan (Lenovo Germany GmbH, Germany); Prateek Basu Mallick (Lenovo, Germany); Joachim Loehr (Lenovo Germany GmbH, Germany); Dimitrios Karampatsis (Lenovo UK Ltd, United Kingdom (Great Britain)); Andreas Kunz (Lenovo, Germany)

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***Standardizing Security Evaluation Criteria for Connected Vehicles: A Modular Protection Profile***

Konstantinos Maliatsos (University of Piraeus & National Technical University of Athens, Greece); Christos Lyvas (UniPI, Greece); Panagiotis Pantazopoulos (Institute of Communication and Computer Systems (ICCS), Greece); Costas Lambrinoudakis and Athanasios G. Kanatas (University of Piraeus, Greece); Matthieu Gay (Airbus CyberSecurity, France); Angelos Amditis (Institute of Communication and Computer Systems, Greece)

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***Kalman-Filter-Based Tracking of Millimeter-Wave Channel Parameters for V2X Applications***

Antonio Regilane Paiva (Federal University of Ceará (UFC) & Wireless Telecommunications Research Group (GTEL), Brazil); Gabor Fodor (Ericsson Research & Royal Institute of Technology (KTH), Sweden); Walter da Cruz Freitas, Jr. (Federal University of Ceará & Wireless Telecom Research Group, Brazil); Yuri C. B. Silva (Federal University of Ceará & Wireless Telecom Research Group (GTEL), Brazil); Carlos Filipe Moreira e Silva (Federal University of Ceará, Brazil)

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***Trustworthiness in IoT - A Standards Gap Analysis on Security, Data Protection and Privacy***

Nader Samir Labib, Matthias R. Brust, Grégoire Danoy and Pascal Bouvry (University of Luxembourg, Luxembourg)

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***Survey of Security Aspect of V2X Standards and Related Issues***

Takahito Yoshizawa and Bart Preneel (KU Leuven, Belgium)

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## TS6: Softwarization, Slicing, Automation and Network Management

Chair: Juan J. Ramos-Muñoz (University of Granada, Spain)

***Secure Keying Scheme for Network Slicing in 5G Architecture***

Pawani Porambage (University of Oulu, Finland); Yoan Miche (Nokia Solutions and Networks, Finland); Aapo Kalliola (Nokia Bell Labs & Aalto University, Finland); Madhusanka Liyanage (University of Oulu, Finland & University College Dublin, Ireland); Mika E Ylianttila (University of Oulu, Finland)

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***A Joint Admission Control & Resource Management Scheme for Virtualized Radio Access Networks***

Behnam Rouzbehani (Instituto Superior Técnico, University of Lisbon & INESC-ID, Portugal); Vladimir Marbukh (National Institute of Standards and Technology, USA); Kamran Sayrafian (NIST, USA)

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***Adjustable Robust Optimization Problem for Designing Fog-Assisted IoT Infrastructures***

Masayuki Tsujino (NTT, Japan)

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***Artificial Intelligence as a Service (AI-aaS) on Software-Defined Infrastructure***

Saeedeh Parseefard, Iman Tabrizian and Alberto Leon-Garcia (University of Toronto, Canada)

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***Testbed Federation for 5G Experimentation: Review and Guidelines***

Louiza Yala (Orange Labs, France); Marius Iordache (Orange, Romania); Ayoub Bousselmi and Sofiane Imadali (Orange Labs, France)

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***iFUSION: Standards-based SDN Architecture for Carrier Transport Network***

Luis M. Contreras (Telefonica, Spain); Oscar González de Dios (Telefonica I+D, Spain); Victor Lopez (Telefonica, Spain); Juan Pedro Fernández-Palacios (Telefónica I+D, Spain); Jesus Folgueira Chavarria (Telefonica, Spain)

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