

<b>WWRF 39, "Ready 'n' Go – 5G trials and testbeds"</b> <b>18<sup>th</sup> -20<sup>th</sup> October 2017 ,</b> <b>Castelldefels (Barcelona), Spain</b>	
<b>Day 1: Wednesday 18<sup>th</sup> of October 2017</b>	
08:00-09:00	Registration
<b>Opening Session– (Auditorium - B4)</b> <b>Moderator: Hendrik Berndt</b>	
09:00-09:05	Welcome Remark – <b>Prof. Ana Isabel Pérez-Neira</b> , CTTC Scientific Coordinator
09:05-09:10	WWRF Overview – <b>Dr. Nigel Jefferies</b> , WWRF Chairman
09:10-09:40	<p><b>Keynote 1: European 5G Trials: The way forward</b>  <b>Colin Willcock (5G Infrastructure Association Chair)</b></p>  <p><b>Abstract:</b> the presentation will give a high-level overview of the 5G Pan-EU trial roadmap. The four main pillars of the trial plans will be introduced and concrete proposals made for how to facilitate greater impact and influence from these trial activities.</p> <p><b>CV:</b> Colin Willcock graduated from the University of Sheffield, UK, with a B.Sc. in Physics in 1986, an MSc. In Astronomical Technology from the University of Edinburgh in 1987 and a Ph.D. in Parallel Computation from the University of Kent at Canterbury in 1992. Dr. Willcock joined Nokia in 1999, and is currently Head of Radio Network Standardization. He has participated extensively in standardization activities at ETSI, ITU-T and 3GPP, and also has extensive experience of European research having led a number of European projects. In March Colin was elected as the new board chairman for the 5G Industry Association.</p>
09:40-10:10	<p><b>Keynote 2: 5G test-beds and trials at the Bristol City/region at UK nation-wide</b>  <b>Dimitra Simeonidou (University of Bristol)</b></p>  <p><b>Abstract:</b> this talk will discuss experiences and opportunities from end-to-end 5G deployments in the City of Bristol and plans for nationwide 5G trials</p> <p><b>CV:</b> Dimitra is a Full Professor at the University of Bristol, the Director of the Smart Internet Lab (<a href="http://www.bristol.ac.uk/smart">www.bristol.ac.uk/smart</a>), the Chief Scientific Officer (CSO) of Bristol Is Open and the Head of the High Performance Networks group (HPN). Her research is focusing in the fields of High Performance Networks, Software Defined Networking, Network Convergence and Smart City infrastructures. She is the author and co-author of over 500 publications, numerous patents and several major contributions to standards. She has been co-founder of two start-up companies. The latest company is the University of Bristol, venture capital funded, spin-out Zeetta Networks (<a href="http://www.zeetta.com">http://www.zeetta.com</a>), delivering SDN solutions for enterprise networks  Dimitra is a Royal Society Wolfson scholar</p>

10:10-10:40	<p><b>Keynote 3: 5G trials in Europe of Smart Energy Use Cases</b>  <b>Fiona Williams (Ericsson GmbH)</b></p> <p><b>Abstract:</b> The ongoing introduction of even higher levels of power generation based on Renewable Energy Sources (RES) is challenging the stability of power networks. Additionally, the European Commission has proposed the use of RES to cover up to 100% of power generation needs. New techniques are needed to regulate frequency and voltage in this context. Proposed new concepts have challenging communications and ICT requirements, in particular in relation to latency and security, which could be fulfilled by 5G. Security is the key issue for utilities as the reality of successful cyber-attacks and the threat of further attacks grows. Concept development, simulations with 5G hardware in the loop and field trials are needed to validate the new techniques as the basis for proposing new and modified network codes and ancillary service definitions, which form important standards in the energy sector regulating power network operation. This presentation will describe the power network challenges and the solutions offered by 5G, which will be trialled in several European countries in 2018 and 2019.</p> <p><b>CV:</b> Dr. Fiona Williams is a Research Director of Ericsson, based in Aachen, Germany; driving innovations in 5G based ICT solutions and their use in sectors such as energy. As initiator and leader of large-scale collaborative programs and projects in the national and European context, she has built up research, innovation and IPR activities for Ericsson, bringing results through to business innovation as solutions, products and as spin-off companies. She built up and runs a range of research and innovation activities in Ericsson Eurolab. She holds board positions in several industrial and academic organizations.</p> 
10:40-11:05	<b>Coffee Break (Hall – B4)</b>
<b>Plenary Session – (Auditorium - B4)</b> <b>Moderator: Nigel Jefferies</b>	
11:05-11:30	<p><b>Keynote 4: Managing the SDN/NFV post hype era</b>  <b>Josep Martrat (Atos Research and Innovation)</b></p> <p><b>Abstract:</b> The arrival of NFV promised the dynamic deployment and management of virtualised network functions (VNFs) within the network infrastructure. In addition, the centralisation of the network control plane, separating it from the data plane, achieved via SDN, should allow for greater network programmability. Combination of both SDN/NFV shall bring unique service capabilities in addition to significant cost reduction. Major CSPs and vendors already executed their proofs of concepts (PoCs) and planned initial deployments but they faced multiple adoption difficulties such as immaturity of solutions, different network service descriptors in multi-vendor environments, fit in OSS system, legacy elements in network, etc. This is slowing down CSP investments and hitting vendor sales forecasts. One of the biggest barrier was related to the way how Open Source (OS) communities in</p> 

	<p>SDN / NFV work (OSM, ONAP, OPNFV, ODL, etc) versus the existing specifications (not standards). Additional software developments and specs extensions are needed which is damaging the interoperability and associated SDN/NFV promise.</p> <p><b>CV:</b> Josep Martrat holds a Degree in Telecommunication Engineering from Polytechnic University of Catalonia (UPC). He is currently Market Manager of Telecom, Media and IT services at Atos Research and Innovation. He works on the establishment of the innovation strategy for Atos' portfolio around telecoms. His research activity includes study of Cloud technologies, network virtualization (SDN/NFV) and new services in Future Internet and the use of SLAs in the business world. He coordinated BonFIRE initiative about designing, building and operating a multi-cloud facility for experimentation with hybrid clouds (public &amp; private). He is currently coordinating SONATA / 5GTANGO projects about agile network service development and deployment on software networks (SDN/NFV) that is releasing a NFV-based SDK, a validation, verification (V&amp;V) NFV catalogue, and a MANO service platform.</p>
11:30-11:55	<p><b>Keynote 5: Update on the IMT-2020 standardization process</b>  <b>Sergio Buonomo (Radiocommunication Bureau (BR) - the International Telecommunication Union (ITU))</b></p> <p><b>Abstract:</b> Five years ago, ITU initiated a series of studies to produce what is necessary for the future of IMT in year 2020 and beyond. The work has now shifted to developing the detailed specifications for IMT-2020 (5G) and identifying suitable radio spectrum to make it a reality. The presentation will give a high-level overview of the IMT-2020 standardization process and its latest developments.</p>  <p><b>CV:</b> Sergio Buonomo is Counsellor at the Radiocommunication Bureau (BR) of the International Telecommunication Union (ITU) and he is responsible for ITU-R Study Group 5 on Terrestrial systems which includes fixed services, land mobile, wireless access, and IMT systems  In the past, he worked for about ten years as microwave engineer at European Space Agency in charge of antenna and propagation studies to support space projects. In 1998, he joined ITU where has covered several positions in different departments.  Sergio Buonomo has a PhD in Electromagnetics engineering at the University of Naples, Italy and a PhD in Physics.</p>
11:55-12:20	<p><b>Keynote 6: Pedestrian safety as a “killer” Application for 5G</b>  <b>Klaus David (Kassel University)</b></p>  <p><b>Abstract:</b> This presentation will start by providing an overview about accident scenarios. Based on this, an ideal system approach and some of its key requirements are detailed. This shows the relevance for 5G. Next various architectures are presented and evaluated. Then the approach of a context filter and how e.g. step detection helps to improve the location accuracy will be given.</p> <p><b>CV:</b> Klaus David is University Professor since 1998 and since 2000 head of the chair of communication technology (ComTec) at Kassel University, Germany. His</p>

	<p>research interests include mobile applications and context awareness. He has 12 years industrial experience in HP, Bell Northern Research, IMEC, T-Mobile (Head of Group), IHP (Head of Department). He has published over 200 articles, including 3 books, and has registered over 10 patents. He is: Editor in Chief IEEE VT Magazine, BoG IEEE VT, NGMN advisor (next generation mobile networks), WWRF publication manager. He is involved in conferences, such as TPC chair IST Future Network &amp; Mobile Summit 2012 or several times TPC member of IEEE PerCom and a regular technology and strategy consultant to industry as well as co-founder of 2 start-up companies.</p>
12:20-12:45	<p><b>Keynote 7: 5G-enabled Emergency Networks</b>  <b>Christos Politis (Kingston University, UK)</b></p> <p><b>Abstract:</b> A key feature in an emergency management system (EMS) is an effective and efficient critical communication platform that provides situational awareness and coordination. However, the current communication platforms for EMS are susceptible to being incapacitated or destroyed by the disaster or the network congestion that arise because of such disaster. Furthermore, current platforms are human-in-the-loop based, requiring substantial human resources and cost for surveillance, preparation and actuation in case of emergencies. This Presentation will describe the main concept DARE project and how to incorporate an autonomous i.e. self-governed, self-healing disaster/network failure detection mechanism to reduce the cost of control signalling traffic.</p>  <p><b>CV:</b> Christos Politis is Professor (Chair) of Wireless Communications at Kingston University, School of Computer Science and Mathematics (CSM). There he is the co-Director of the Digital Information Research Centre (DIRC) with a staff of about 25 academics, 20 postdoctoral researchers and over 60 PhD students, making it one of the largest in the field in the UK. Upon joining Kingston University in 2007, he co-founded and led a research group on Wireless Multimedia &amp; Networking (WMN). He teach modules on wireless systems and networks. Prior to this post, he worked for Ofcom, the UK Regulator and Competition Authority, as a Senior Research Manager. While at the University of Surrey, he was a postdoc working on virtual distributed testbeds in the Centre for Communication Systems Research (now the 5G Innovation Centre). This was preceded by placements with Intracom-Telecom SA and Maroussi 2004 SA in Athens, Greece. He have managed to raise funding from the EU and UK research and technology frameworks under the ICT and Security programmes. He hold two patents and have published over 170 papers in international journals and conferences and chapters in ten books. He advise several governmental and commercial organisations on their research programmes/ agendas and portfolios. He is a senior member of the IEEE, UK chartered engineer and member of the Technical Chamber of Greece.</p>
12:45-14:00	<p><b>Lunch Break (Campus Restaurant)</b></p>
<p><b>Working Group Parallel Session #1</b>  <b>1:30h duration</b></p>	

14:00 – 15:30	<p style="text-align: center;"><b>WG D (Auditorium – B4)</b></p> <p><b>Technologies for Systems Beyond 5G</b></p> <p><b>Session chair: Prof Angeliki Alexiou (University of Piraeus, Greece)</b></p> <p>Assuming success, 5G will not just introduce a new way of thinking in wireless networks design and optimization, but a new era, where ‘Wireless Connectivity as a Utility’ will completely transform the way people, things and (any) application devices communicate, store and process information. 5G is also about an end-to-end converged transport network and cloud infrastructure, and particularly optical networks are key to meet the transport requirements of the mobile x-haul (fronthaul/ midhaul/ backhaul) in terms of high-bandwidth, low-latency, jitter and synchronization. As speed (data rate), data volume, distance, agility (latency), security and reliability become ‘non-issues’, ‘infinite’ capacity and unlimited connectivity initiate an ecosystem paradigm shift, according to which the optical network and cloud infrastructure as a whole is always available, scalable, and functioning ‘in the background’, whereas wireless access is ubiquitous and technology agnostic (independent). By achieving these ambitious targets, 5G will open up novel, green field research directions that only under the prism of the new thinking on wireless and optical integration can unleash their true potential. This Session will host presentations that address the design, analysis and assessment of innovative theoretical models, information theory and signal processing approaches, resource and interference management strategies and overall network architecture for systems beyond 5G.</p> <p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>• <b>Views on Beyond 5G</b> - Hyeon Woo LEE (Dankook University, Korea).</li> <li>• <b>Integration of Wireless and Optical Technologies to Meet the Requirements of 5G Networks</b> - Alexis A. Dowhuszko (CTTC, Spain).</li> <li>• <b>Low Complexity Channel Estimation Scheme for Spectrally Efficient FDM Systems in 5G Cellular Network</b> - Hedaia Ghannam and Izzat Darwazeh (University College London, UK).</li> <li>• <b>Towards 5G Infrastructure-redundant Communications for Next Generation Railways</b> - Stephan Sand, Paul Unterhuber and Mohammad Soliman (DLR, Germany).</li> <li>• <b>Wrap-up and future activities.</b></li> </ul>
11:15 – 12:45	<p style="text-align: center;"><b>EMW (Auditorium – B6)</b></p> <p><b>E/m-Health and Wearables</b></p> <p><b>Session chair: Christos Politis (Kingston University, UK)</b></p> <p>The EMW working group aim at developing an e/m-Health and wearables vertical industry paradigm to expose the requirements of such systems, (Health as a Service-HaaS) to be 5G enabled. Furthermore, get the experts from this vertical industry involved in the WWRF VIP and beyond. The WG has already published a white paper and is currently revamping its proposal to big 5G industries to fund some of its work. During this session, you will learn everything about our activities including the discussion for a new white paper (Design and specify an e/m-Health and wearables System Architecture in the 5G Ecosystem – Prototype Specs).</p> <p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>• <b>Intro and welcome</b></li> </ul>

	<ul style="list-style-type: none"> <li>• <b>Many mobiles, little cloud: where is the mobile cloud in Ghanaian healthcare?</b> - Kenneth Kwame Azumah, Reza Tadayoni, Lene Tolstrup Sørensen (Aalborg University Copenhagen, Denmark).</li> <li>• <b>Many mobiles, little cloud: where is the mobile cloud in Ghanaian healthcare?</b> - Kenneth K. Azumah (Aalborg University, Denmark).</li> <li>• <b>White Paper 2 discussion.</b></li> <li>• <b>EMW Project: Next steps.</b></li> </ul>
15:30-16:00	<b>Coffee Break (Hall – B4)</b>
<b>Special Session # 1: (1h 30 min) – (5G Connected Car) – (Auditorium - B4)</b> <b>Co-Organizers: Jesus Alonso-Zarate (CTTC) and Mikael Fallgren (Ericsson Research)</b>	
<p>This special session, organized by the 5GCAR Project consortium, is devoted to discuss the role of 5G technologies for the connected car. 5G technologies will enable cars and vehicles to be connected to the networks and also to be able to talk to each other ensuring low reliability and ultra-low latency. Enabling such kind of connectivity will leverage disruptive new applications that will allow to improve driving efficiency and boost road safety. The session will be split in two parts. First, a series of talks will be provided introducing key topics related to the topic of 5G and the automotive vertical sector. Then, a panel discussion will be initiated for a highly interactive discussion about the topic.</p>	
16:00-17:00	<b>TALKS</b> <ul style="list-style-type: none"> <li>• <b>The 5GCAR Project</b> - Mikael Fallgren (Ericsson, Sweden).</li> <li>• <b>V2X channel measurements and modeling</b> - Mate Boban (Huawei, Germany) and Taimoor Abbas (Volvo Cars, Sweden).</li> <li>• <b>Integrated Moving Networks</b> - Tommy Svensson (Chalmers University, Sweden).</li> <li>• <b>Fog computing and the connected car</b>- Ricard Vilalta (CTTC, Spain).</li> <li>• <b>5G and the transformation of the automotive ecosystem</b> - Andres Laya (Ericsson, Sweden)</li> </ul>
17:00-17:30	<b>DISCUSSION PANEL</b> <b>Participants:</b> <ul style="list-style-type: none"> <li>• <b>Taimoor Abbas</b> (Volvo Cars, Sweden)</li> <li>• <b>Mate Boban</b> (Huawei, Germany)</li> <li>• <b>Mikael Fallgren</b> (Ericsson, Sweden)</li> <li>• <b>Tommy Svensson</b> (Chalmers)</li> <li>• <b>Ricard Vilalta</b> (CTTC, Spain)</li> <li>• <b>Andres Laya</b> (Ericsson, Sweden)</li> </ul>
<b>Visit to CTTC labs and facilities</b>	
17:30-18:30	<b>ADRENALINE Testbed®</b> The research activities of the Optical Networks and Systems group rely on experimentation, proof-of-concept development and systems validation -- emulating conditions close to production systems -- carried on the ADRENALINE testbed. It encompasses multiple related systems, such as a platform for the design of efficient sliceable optical transceivers based on OFDM or an end-to-end infrastructure supporting 5G/IoT operational and user-oriented services (e.g., 5G network slicing with per-slice user control), covering the aggregation and core network segments. ADRENALINE makes extensive use of SDN/NFV concepts, combining the efficient orchestration of networking, computing and storage resources, such as hierarchical network orchestration and over-arching control in

heterogeneous networking scenarios or ETSI NFV Management and Orchestration over disaggregated data centers.

More information: <http://networks.cttc.es/ons/adrenaline/>

**Presenter: Ramon Casellas**

#### **EXTREME Testbed®**

The EXTREME Testbed® is an experimental framework targeting mobile and transport network research on concepts such as SDN, NFV, and MEC. It is composed of multiple general purpose servers in the Mobile Networks Department Lab (centralized computing) and distributed throughout the CTTC building (distributed computing), which can also be dynamically reconfigured to act as network nodes featuring wired and wireless technologies, incl. mmwave. They are managed through a series of experiment automation tools allowing fast scenario deployment and result generation. During the visit, a demonstration on hierarchical multi-domain multi-technology (wireless/optical) network resource orchestration will be presented that integrates not only EXTREME Testbed® resources, but also optical network resources of the ADRENALINE Testbed®. This integrated transport network will carry both fronthaul and backhaul traffic of an LTE mobile network deployed over this computing and networking substrate.

**Presenters: Jorge Baranda and Josep Mangués**

More information: [http://networks.cttc.es/mobile-networks/extreme\\_testbed/](http://networks.cttc.es/mobile-networks/extreme_testbed/)

#### **GEDOMIS® Testbed**

In 5G, it is expected that the execution of the functions of the communication protocol stack will be split among different processing elements depending on specific requirements of the traffic (e.g., in terms of data rate and delay requirements), deployment architectures or other performance metrics of interest for the operator (e.g., energy consumption). The demo, prototyped within the H2020/5G PPP project Flex5Gware, will showcase three different function splits, which will be assessed in terms of their energy consumption.

**Presenter: Nikolaos Bartzoudis**

More information: <http://technologies.cttc.es/phycom/gedomis/>

#### **GESTALT®**

GESTALT (GNSS SignAL Testbed) is a CTTC facility equipped with SoA hardware and GNSS-SDR, an open source Global Navigation Satellite Systems software-defined receiver, developed and maintained by CTTC. GESTALT® facilitates fast development, deployment and testing of GNSS receivers and easy inclusion of all sort of algorithms (signal processing blocks) by leveraging on a flexible definition of receiver architectures. The hardware includes broadband, geodetic grade antennas, GNSS signal generators for controlled experiments; state-of-the-art radio-frequency front-ends able to work concurrently in three GNSS frequency bands, with configurable bandwidth, frequency downshifting and filtering; digitation working at sample rates as high as 80 Msps with 8-bit, coherent I/Q samples and high-speed interfaces to a host computer. The architecture follows an open modular approach that permits real-time operation of software receivers and validation of both HW/SW receivers using both synthetic signals (with controlled parameters) and real-life signals received at the antenna platform.

**Presenter: Carles Fernández**

More information: <http://www.cttc.es/project/global-navigation-satellite-system-software-defined-receiver/>

Day 2: Thursday 19 <sup>th</sup> of October 2017	
08:00-09:00	Registration
<p align="center"><b>Special Session # 2: (1h 45 min) – (Wireless Artificial Intelligence) – (Auditorium - B4)</b> Co-Organizers: Bin Tan (Huawei)</p> <p>Artificial Intelligence (AI) is changing the world. It has impacted our life in various area, e.g. cars, shopping, advertisements; however it still not clear how to adopt AI technology on the mobile network? In this special session 4 experts from Academia, Operator, Vendor and Solution provider would bring us a sets of talks about how AI may benefit the mobile network? What can be achieved by introducing AI? What is the impact of AI to the mobile ecosystem? You may also provide your precious views or comments in the follow-up panel discussion. A Wireless AI Alliance has been established in China earlier this year, including CMCC, Huawei and Alibaba as the fund members. Dr. I from CMCC will introduce the alliance in the special session.</p>	
09:00-10:00	<p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>• <b>Machine learning in Communication: Hype, reality or Hyper-reality</b> - Prof. Izzat Darwazeh (University College London, UK)</li> <li>• <b>Wireless Big Data in Action</b> - Dr. Chih-Lin I (CMCC, China)</li> <li>• <b>The future of wireless network-Mobile AI</b> - Mr. Hua Huang (Huawei, China)</li> <li>• <b>AI in the Edge</b> - Mr. Phil Claridge (Mandrel Systems Ltd, UK)</li> </ul>
10:00-10:30	<p><b>DISCUSSION PANEL</b></p> <p><b>Participants:</b></p> <ul style="list-style-type: none"> <li>• <b>Prof. Izzat Darwazeh</b> (University College London, UK)</li> <li>• <b>Dr. Chih-Lin I</b> (CMCC, China)</li> <li>• <b>Mr. Hua Huang</b> (Huawei, China)</li> <li>• <b>Mr. Phil Claridge</b> (Mandrel Systems Ltd, UK)</li> </ul>
10.30-10:45	<b>Announcement of Wireless AI Alliance (CMCC, Huawei, Alibaba)</b> - Dr. Chih-Lin I (CMCC, China)
10:45-11:15	<b>Coffee Break (Hall – B4)</b>
<b>Working Group Parallel Session #2</b> <b>1:30h duration</b>	
11:15 – 12:45	<p align="center"><b>WG A/B (Auditorium - B4)</b></p> <p><b>User Needs &amp; Requirements; Services, and Devices, in a Wireless World</b>  <b>Session chair: Knud Erik Skouby (Aalborg University Copenhagen, Denmark)</b></p> <ul style="list-style-type: none"> <li>• <b>Gaze-aware Video Streaming Solutions for Mobile VR in Future 5G Networks</b> - Pietro Lungaro and Konrad Tollmar (KTH, Sweden).</li> <li>• <b>Multi-Channel Mobile Wireless Network Attacks on SMS</b> - Omega Obinnah, Charles Clarke, Eckhard Pfluegel, Christos Politis and M.J.Tunnickliffe (Kingston University, UK).</li> <li>• <b>Many mobiles, little cloud: where is the mobile cloud in Ghanaian healthcare?</b> - Kenneth K. Azumah (Aalborg University, Denmark).</li> <li>• <b>Draft for WWRF Security White Paper</b> - Samant Khajuria, Knud Erik Skouby and Lene Sørensen (Aalborg University, Denmark) and Marcus Wong (Huawei, USA)</li> <li>• <b>Draft for update of Millenial WP</b> - Samant Khajuria, Knud Erik Skouby and Lene Sørensen (Aalborg University, Denmark).</li> </ul>

11:15 – 12:45	<p style="text-align: center;"><b>WG HF (Auditorium – B6)</b></p> <p><b>High Frequencies Radio Communications Technologies</b>  <b>Session chair: Prof Angeliki Alexiou (University of Piraeus, Greece)</b></p> <p>Higher frequencies (above 6 GHz) radio communication technologies are expected to play a significant role in realising this vision of wireless transmissions towards the region of 1 Tbit/s. Due to the ultra-large bandwidth required to achieve such data rates, carrier frequencies of tens or even several hundreds of GHz bandwidths are necessary compared to present 5 -20 MHz. To achieve the goal of data rates of 2-3 orders of magnitude higher compare to the current 5G vision, fundamental research, system and channel modelling and enabling technologies in the following three technological key areas are required:</p> <ol style="list-style-type: none"> <li>1. Channel modelling and propagation</li> <li>2. Physical layer including RF front end and baseband (waveform and modulation aspects)</li> <li>3. Wireless access issues, including multiple access and radio resources and interference management.</li> </ol> <p>In this session contributions in the area of the above research topics will be presented. Moreover, the White Papers currently in progress will be discussed:  <b>WP1:</b> Channel Modelling for mmWAVE and THz radio communications – Requirements, Challenges, State of the Art and Global Initiatives  <b>WP2:</b> Air Interface and Wireless Access technologies for mmWave and THz radio communications – Challenges and Trends and expected Impact</p> <p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>• <b>Comparative analysis of large antenna array technologies for millimeter-wave multi-stream transmission</b> - Alexander Maltsev, Andrey Pudeyev, Ilya Bolotin, and Ali Sadri (Comminications and Devices Group, Intel Corp.,US) , and Olesya Bolkhovskaya (University of Nizhny Novgorod, Russia)</li> <li>• <b>Cost-efficient technologies for development of the high-gain steerable antennas for mmWave communications</b> - Alexander Maltsev, Andrey Pudeyev, Ilya Bolotin and Artem Lomayev (Comminications and Devices Group, Intel Corp.,US) and Olesya Bolkhovskaya, Valentin Seleznev and Alexander Rulkov (University of Nizhny Novgorod, Russia).</li> <li>• <b>MAC Level Analysis of mm-wave/THz Communication for 5G and B5G System</b> - Shahid Mumtaz (Instituto de Telecomunicações Aveiro, Portugal).</li> <li>• <b>Wrap-up and future activities</b></li> </ul>
12:45-14:00	<b>Lunch Break (Campus Restaurant)</b>
14:00-14:30	<b>General Assembly (Auditorium - B4)</b>
<p style="text-align: center;"><b>Special Session # 3: (1h 30 min) – (5G Trials and Testbeds) – (Auditorium - B4)</b>  <b>Organizer: Raul Muñoz (CTTC)</b></p> <p>Multiple European 5G trials will be in progress by 2018, and most of the 5G pre-commercial technologies under trials will be available for commercial deployment by 2020. At the service level, 5G will generate a new ecosystem for business innovation involving many vertical markets (e.g. automotive, energy, media and entertainment, e-health and industry) using the 5G network with different service requirements. Despite of the standard will cover eMBB, mMTC and URLLC, and it will be unified and non-fragmented to ensure global and cost-effective mobility of users and</p>	

equipment, from a trial perspective, early experimental deployments needs to define specific use cases and scenarios. Thus, it is required to work not only towards accelerating global 5G standards, but also on trialling and interoperability/ cooperation/ coordination to ensure full interoperability.

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| 14:30-16:00 | <ul style="list-style-type: none"> <li>• <b>The 5G Operating System as a Nervous System for Country2.0</b> - Antonio Manzalini, (Telecom Italia Mobile, Italy).</li> <li>• <b>5G trials in the Netherlands</b> - Toon Norp (TNO, Netherlands).</li> <li>• <b>Telefonica path towards 5G - exploration of new capabilities for transport networks</b> - Luis Miguel Contreras Murillo (Telefónica I+D, Spain).</li> <li>• <b>5G Test Network – Enabling trials for vertical industry</b>-Jyrki Huusko (VTT, Finland).</li> <li>• <b>5GBarcelona and its 5G Neutral Host pilot</b> - Sergi Figuerola (I2CAT foundation, Spain).</li> </ul> |
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16:00-16:30	<b>Coffee Break (Hall – B4)</b>
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**Special Session # 4: (1h 30 min) – (5G Mobile Transport Networks) – (Auditorium - B4)**  
**Co-Organizers: Josep Mangués (CTTC) and Alain Mourad (Interdigital)**

In 5G, the mobile transport network is going through a real transformation. On one hand, new fronthaul interfaces (compared to CPRI) are emerging leading to an accelerated convergence with the backhaul into an integrated packet-based transport. This is commonly referred to as Xhaul, and the design of the data, control and management planes of such integrated transport have been the focus of the flagship H2020 5G-PPP 5G-Crosshaul project (2015-2017). On the other hand, multiple tenants are set to share the mobile transport network infrastructure requesting topologies and resources tailored to the needs of each tenant. These tenants are not just conventional MNOs and MVNOs, but notably vertical industries demanding low latencies such as automotive, healthcare, multimedia, etc. The slicing and multi-domain service orchestration of the mobile transport network are therefore essential toolsets that need to be developed by building on SDN, NFV and MEC frameworks. These toolsets are under development by the recently launched H2020 5G-PPP 5G-Transformer project (2017-2019). This special session will look at the latest advances in the design of the 5G mobile transport network, providing an up-to-date view of emerging solutions, standards, and remaining gaps.

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| 16:30-18:00 | <ul style="list-style-type: none"> <li>• <b>Data plane integration for 5G fronthaul and backhaul - A Proof of Concept from 5G-Crosshaul</b> - Charles Turyagyenda (InterDigital, UK)</li> <li>• <b>Multi-domain hierarchical 5G-Crosshaul control infrastructure</b>- Josep Mangués-Bafalluy (CTTC, Spain)</li> <li>• <b>Energy efficient service orchestration in converged fronthaul/backhaul</b>- Gino Carrozzo (NextWorks, Italy)</li> <li>• <b>SODALITE: SDN Wireless backhauling for dense networks of 4G/5G Small Cells</b> - Daniel Camps-Mur (i2cat, Spain)</li> <li>• <b>Slicing across multiple administrative domains</b>- Luis M. Contreras (Telefónica I+D, Spain)</li> <li>• <b>5G-TRANSFORMER: enabling multi-domain network slicing at the mobile transport for verticals</b> - Carlos J. Bernardos (UC3M, Spain)</li> </ul> |
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18:00-22:30	<b>Social event and Dinner</b>
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Day 3: Friday 20 <sup>th</sup> of October 2017	
08:00-09:00	Registration
<p align="center"><b>Special Session # 5: (1h 45 min) – (Satellite communications for 5G and beyond) – (Auditorium - B4)</b></p> <p align="center"><b>Co-Organizers: Ana Pérez-Neira (CTTC) and Roberta Mugellesi (ESA, UK)</b></p> <p>This session deals with the emerging role of Low Earth Orbit (LEO), Medium Earth Orbit (MEO) and Geostationary satellites (GSO) in 5G service delivery for backhaul, wide area rural, and dense urban mobile broadband and fixed access (fibre by pass). The session analysis also the positive impact that technology and commercial innovation are having on satellite industry economics.</p>	
09:00-10:45	<ul style="list-style-type: none"> <li>• <b>IoT + Mobility <math>\approx</math> IoV</b> - Seshadri Mohan (UA Little Rock, United States)</li> <li>• <b>ESA perspective on 5G SatCom</b>, Roberta Mugellesi (ESA, UK)</li> <li>• <b>Hybrid satellite/terrestrial backhauling</b> - Ana Pérez-Neira (CTTC, Spain)</li> <li>• <b>Scorsese - A proof of concept for advanced multimedia distribution in integrated satellite 5G networks</b> - Thomas Schlichter (Fraunhofer, Germany)</li> <li>• <b>Satellite 5G trials &amp; testbed roadmap</b> - Simon Watts (Avanti, UK)</li> <li>• <b>Hybrid satellite/terrestrial virtualization</b> - Ramón Ferrús (UPC, Spain)</li> </ul>
10:45-11:15	Coffee Break (Hall – B4)
<p align="center"><b>Working Group Parallel Session #3</b></p> <p align="center"><b>1:30h duration</b></p>	
11:15 – 12:45	<p align="center"><b>WGC (Auditorium - B4)</b></p> <p><b>New directions in communication architectures and technologies</b></p> <p><b>Session chair: Dr. Sudhir Dixit (Basic Internet Foundation, USA)</b></p> <p>The Working Group C focuses on new approaches to communications technologies that leverage the convergence of IT and telecommunications. It is anticipated that the future mobile industry will extensively use software, virtualization and cloud computing in future networks (both wireless and wired). The group develops end-to-end network architectures, identifies specific requirements and issues and address them by providing solutions that are practical and business driven, and thus accelerate the adoption of 5G where IT will play a major role. Virtual network slicing to develop custom networks for specific industry verticals and services from the common underlying physical infrastructure is also an important mission of this group. The session will have talks on various interesting technologies and solutions, some of which are listed below.</p> <ul style="list-style-type: none"> <li>• Software network architectures and software design approaches to meet the specific requirements of future wireless carrier networks.</li> <li>• Mapping of 5G performance requirements to virtualized hardware and software that is decentralized, including potentially those that virtualize the user (5G) devices.</li> <li>• Convergent wireless/ wireline access and core network segments leveraging cloud, virtualization and big data <ul style="list-style-type: none"> <li>○ Smart Virtualized Infrastructure</li> <li>○ Smart management of the Cloud-RAN</li> <li>○ Software-defined wireless networks (SDN)</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ Network Function Virtualization (NFV)</li> <li>○ End-to-end network slicing</li> </ul> <p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>● <b>Orchestration Using Transport API End to End Hierarchical Network</b> - Ricard Vilalta, et al., (CTTC/CERCA, Spain).</li> <li>● <b>Downlink Preamble Design for Accurate Timing Synchronization in Ultra-Dense Cellular Networks</b> - Subhankar Banerjee, Krishna Madan, C.R. Venkatesh and K. Giridhar (Indian Institute of Technology, Madras-India).</li> <li>● <b>Mobile Network Architecture: End-to-End Network Slicing for 5G and Beyond</b> (The path from concepts to practice: The 5G PPP Phase 2 project 5G-MoNArch) – Christoph Schmelz, Simon Fletcher , et al., (Nokia Bell Labs, RealWireless, etc.).</li> <li>● <b>Gaze-aware Video Streaming Solutions for Mobile VR in Future 5G Networks</b> - Pietro Lungaro and Konrad Tollmar (KTH, Sweden).</li> <li>● <b>Wrap-up and future activities.</b></li> </ul>
11:15 – 12:45	<p style="text-align: center;"><b>CV (Auditorium – B6)</b></p> <p><b>Connected Vehicles</b>  <b>Session chair: Dr Seshadri Mohan (UA Little Rock, USA)</b></p> <p>During this session, we will examine some of the research issues relating to establishing communication between vehicles and other entities in the transport environment. This will include examining the requirements of the automotive and transport industries on technology for 5G and beyond, and the identification of use cases for 5G in these industries, and the status and progress of research into the use of 5G technologies in the road transport environment.</p> <p><b>TALKS</b></p> <ul style="list-style-type: none"> <li>● <b>Introduction of new chairman.</b></li> <li>● <b>Survey: Challenges and Perspectives of VANETs Mobility Modelling</b> - Sundire Madhekwana, Alexandros Ladas, Christos Politis (Kingston University, UK).</li> <li>● <b>Recap of plenary session presentations from Prof. David and Dr Mohan.</b></li> <li>● <b>Discussion of new charter and workplan for the platform.</b></li> <li>● <b>Wrap-up and future activities.</b></li> </ul>
12:45-14:00	<p><b>Lunch Break (Campus Restaurant)</b></p>
<p><b>Special Session # 6: (1h 30 min) – (Cybersecurity) – (Auditorium - B4)</b>  <b>Organizer: Knud Erik Skouby (Aalborg University Copenhagen, Denmark)</b></p> <p>Security and privacy controls for wireless and other communication systems have traditionally been built along the way as needs have been observed. With the exploding amount of data and cyber security attacks on the front page practically every day, this is no longer a viable way. This session will focus on the security and privacy issues that out of these considerations need to be addressed in the upcoming 5G specifications looking specifically at the requirements in the General Data Protection Regulation (GDPR). Cases related to IoT related services are discussed and some technical solutions presented</p>	
14:00-15:30	<ul style="list-style-type: none"> <li>● <b>Security challenges in the future 5G Networks in supporting IOT services-</b> Haiguang Wang (Huawei, Singapore)</li> </ul>

	<ul style="list-style-type: none"><li>• <b>Security, Privacy and Trust in IoT</b> - Philippe Cousin (Easy global market, France)</li><li>• <b>GDPR implications for Security and Privacy in 5G</b> - Samant Khajuria (Aalborg University, Denmark)</li></ul>
<b>Closing Plenary – (Chair) - (Auditorium - B4)</b>	
15:30-16:15	<b>WG reports, final wrap up and next event information.</b>