

## A Message from The General Chairs

5G is the next generation wireless network technology that is expected to significantly increase data speeds, produce ultra-low latency times, support the connection of many more devices, and increase energy efficiency of the network elements. Some future applications requiring the characteristics of 5G include:

- Vehicle-to-vehicle and vehicle-to-infrastructure communication
- Autonomous vehicles
- Remote health services and health care monitoring
- Augmented and virtual reality
- Smart cities and smart homes
- Industrial automation
- Device interconnection (IoT)

While there are significant opportunities presented through deployment of 5G, it is not without its challenges including:

- Defining standards to insure interoperability
- Building the infrastructure
- Support for a significant increase in devices on the network as well as a wide variety of devices
- Wide range in requirements for the various applications
- Cost considerations
- Reliability and security requirements
- Energy efficiency expectations

The IEEE Future Directions 5G Initiative strives to aggregate information about the various endeavors occurring worldwide in order to provide a community of professionals in industry, academia, and government working to solve the challenges associated with 5G. Through various outlets, participants in 5G Technical Community can learn and collaborate on the 5G Initiative that has applications in many industries and markets. Members of the community have access to extensive resources including publications, videos, articles, interviews, webinars, newsletters, workshops, and conferences. The IEEE 5G Initiative is run by a Steering Group and is managed by a series of Working Groups, covering areas like Publications, Events, Standards, Education and Community Development. Learn more about the organization of the Initiative [here](#). A key activity within the Initiative is the development of a Technology Roadmap, which will identify short (~3 years), mid-term (~5 years) and long-term (~10 years) research, innovation and technology trends in the communications ecosystem.

We are very pleased to welcome 5G experts to this pioneer event in Casablanca to create a 5G Community to work jointly with the worldwide 5G community and drive this effort of harmonization and alignment in this part of the world.

Enjoy the summit! Sincerely,  
UNet'17 General Chairs,  
L. Ladid, E. Sabir, M. Ghogho and M. Essaaidi.

## IEEE 5G Summit Casablanca

As Internet usages are proliferating, communications networks are faced with new shortcomings. Future networks will have to support in 2020 mobile traffic volumes 1000 times larger than today and a spectrum crunch is anticipated. Wireless access rates are today significantly lower than those of fixed access, which prevents the emergence of ubiquitous low cost integrated access continuum with context independent operational characteristics. Communication networks energy consumption is growing rapidly, especially in the radio part of mobile networks. The proliferation of connected devices makes it very difficult to maintain similar performance characteristics over an ever larger portfolio of technologies and requirements (i.e. Ultra High Definition TV vs. M2M, IoT). Heterogeneity of access technologies entails unsustainable cost with increasing difficulties to integrate an ever larger set of resources with reduced OPEX. Network infrastructure openness is still limited. It prevents the emergence of integrated OTT (cloud)-network integration with predictable end to end performance characteristics, and limits the possibility for networks to become programmable infrastructures for innovation with functionalities exposed to developers' communities.

This 5G SUMMIT focuses on exploring and elucidating all facets of the next generation of 5G technology, business and societal gaps and challenges between the current 3G-4G-LTE access-only Internet models and the proper vision of 5G, evolutionary or revolutionary, to go beyond just access by embracing and facilitating the upfront integration of all new technologies (IOT, SDN/NFV, Cloud Computing, ..) to be user-transparent, app-oriented, service-ready, ubiquitous and lowest cost.

Some of the worldwide 5G experts have been invited and attracted to share their state-of-the-art knowledge with the emerging 5G community in Morocco and around the world in view of facilitating the worldwide harmonization of research and best practices for deployment of viable user scenarios in the global 5G ecosystem, the built-in security and privacy by design in 5G, and explore the different ways to enable Internet protocols over the next generation of empowered devices in order to reach convergence and end to end transparency led by the IEEE 5G Technical subCommittee which is supporting technically this event.

## Agenda at a Glance

Thursday, May 11, 2017 (Anfa Ballroom)	
08:00 – 18:00	Registration (in the lobby of Grand Mogador Hotel)
08:30 – 09:00	<b>Welcome Coffee</b>
09:00 – 09:20	<b>Opening Session</b>
09:00 - 09:20	<ul style="list-style-type: none"> <li>• Welcome from the Summit General Chairs, Prof. Essaid Sabir, Prof. Latif Ladid</li> <li>• Introduction of the IEEE 5G Initiative, Latif Ladid</li> </ul>
09:20 – 10:45	<p><b>Moderator:</b> Latif Ladid</p> <p style="text-align: center;"><b>Global 5G Vision</b></p> <p>Diego Lopez, Head of Technology Exploration, Telefonica I+D, Madrid, Spain  <b>Title:</b> <i>On the Dialectics of Intent</i></p> <p>Kenneth Wallstedt, Director, Technology Strategy Group Function Strategy &amp; Technology, Ericsson, Sweden  <b>Title:</b> <i>5G for extreme flexibility, capacity and coverage</i></p> <p>Latif Ladid, President-Founder IPv6, co-Chair 5G World Alliance, University of Luxembourg  <b>Title:</b> <i>The why, when, where, what and how of 5G Standards</i></p>
10:45 – 11:10	<b>Coffee Break</b>
11:10 – 12:30	<p><b>Moderator:</b> Halim Yanikomeroglu</p> <p style="text-align: center;"><b>Radio Networks and Verticals</b></p> <p>Mohamed-Slim Alouini, King Abdullah University of Science and Technology (KAUST), Saudi Arabia  <b>Title:</b> <i>Paving the Way Towards 5G Wireless Communication Networks</i></p> <p>Abdelkarim Belkhadir, ANRT, Morocco  <b>Title:</b> <i>Research Trends and Development on 5G Wireless Networks</i></p> <p>Samson Lasaulce, CNRS, France  <b>Title:</b> <i>Coded Power Control</i></p>
12:30 – 14:00	<b>Lunch Break</b>

**Thursday, May 11, 2017 (Anfa Ballroom)**

14:00 – 15:30	<p><b>Moderator:</b> Mohammed-Slim Alouini</p> <p style="text-align: center;"><b>5G for Ubiquitous Networking and Verticals</b></p> <p>Mehdi Bennis, Centre for Wireless Communication University of Oulu, Finland  <b>Title:</b> <i>Proactive and context-aware networks</i></p> <p>Heinz Thorsten Bernold, The BOSTON Consulting Group United States of America  <b>Title:</b> <i>5G – The Emperor's New Clothes?</i></p> <p>Liquing Yang, University of Colorado, United States of America  <b>Title:</b> <i>Vehicular Communications and Networking: The Gateway to Connected Mobility</i></p>
15:30 – 16:00	<b>Coffee Break</b>
16:00 – 17:15	<p><b>Moderator:</b> Liquing Yang</p> <p style="text-align: center;"><b>Applications, Business Opportunities and Verticals</b></p> <p>Mehdi Bouzid, National Instrument, MENA Region  <b>Title:</b> National Instruments 5G research Platforms</p> <p>Noureddine Boudriga, Head, CN&amp;S Research Lab. SUP'COM, Tunisia  <b>Title:</b> <i>Security challenges in 5G networks</i></p> <p>David Kravitz, Vice President - Crypto Systems Research DarkMatter, Abu Dhabi, United Arab Emirates  <b>Title:</b> Blockchain: From V2V to FinTech to M2M</p>
17:15 – 18:00	<p><b>Moderators:</b> Mustapha Benjillali, INPT, Rabat-Morocco &amp; Essaid Sabir, ENSEM, Hassan II University of Casablanca, Morocco</p> <p style="text-align: center;"><b>Panel Discussion &amp; Concluding Remarks</b></p> <p>Mohamed-Slim Alouini          Abdelkarim Belkhadir          Heinz-Thorsten Bernold          Latif Ladid          Diego Lopez          Kenneth Wallstedt</p>

## Detailed Agenda

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**Speaker:** Mohamed-Slim Alouni, KAUST, Saudi Arabia

**Affiliation:** Computer, Electrical, and Mathematical Science and Engineering (CEMSE) Division, King Abdullah University of Science and Technology (KAUST), Thuwal, Makkah Province, Saudi Arabia.

**Title:** Paving the Way Towards 5G Wireless Communication Networks

**Abstract:** 5G wireless communication networks are expected to fulfill the demand for higher data rates, lower latency, and/or massive connectivity of a growing number of users/devices exploiting a variety of wireless applications. This envisioned rapid increase in the use of wireless services lead the wireless research community to start looking at new technologies to address problems related to the radio-frequency (RF) spectrum exhaustion. This includes the development of (i) new techniques and concepts such as massive multiple input multiple output (MIMO) systems and heterogeneous networks to improve the spectral efficiency at the link and network layers, respectively, and (ii) novel schemes to better utilize the unregulated bandwidth in particular in the upper millimeter wave, THz, and optical portion of the spectrum. This talk will first go briefly over the vision and goals of 5G wireless communication networks. Then it presents some of these emerging enabling technologies that need to be developed to pave the way towards the successful roll-out and operation of these future wireless networks. Finally, the talk offers at the end an overview of some of the recent results in the areas of massive MIMO systems, full-duplex communication systems, and optical (Li-Fi) wireless communication systems.



**Bio:** Mohamed-Slim Alouni (S'94, M'98, SM'03, F'09) was born in Tunis, Tunisia. He received the Ph.D. degree in Electrical Engineering from the California Institute of Technology (Caltech), Pasadena, CA, USA, in 1998. He served as a faculty member in the University of Minnesota, Minneapolis, MN, USA, then in the Texas A&M University at Qatar, Education City, Doha, Qatar before joining King Abdullah University of Science and Technology (KAUST), Thuwal, Makkah Province, Saudi Arabia as a Professor of Electrical Engineering in 2009.

Prof. Alouni is a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), a member of the Thomson ISI Web of Knowledge list of Highly Cited Researchers and of the Elsevier/Shanghai Ranking list of Most Cited Researchers, and an IEEE Distinguished Lecturer of the IEEE Communications Society. He is a recipient of the Recognition Award of the IEEE ComSoc Wireless Technical Committee in 2016 and a co-recipient of best paper awards in ten IEEE conferences (including ICC, GLOBECOM, VTC, PIMRC, and DySPAN). His current research interests include the modeling, design, and performance analysis of wireless communication systems.

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**Speaker:** Samson Lasaulce

**Affiliation:** CNRS, France

**Title:** Coded Power Control

**Abstract:** In this talk, we explain how the new idea of agent action encoding can be used to create coordination in distributed wireless networks. In particular, the concept of power modulation and a particular scheme to implement it are presented; the scheme beats classical distributed power allocation schemes such as the iterative water-filling algorithm while relying on the same knowledge. More generally, the concept of coded power control consists in embedding coordination information (e.g., about the channel state) in a sequence of transmit power levels. It is shown how information theory can be exploited to determine the limiting performance of coded power control. The framework developed applies in fact to the general problem of characterizing the limiting performance of a network with multiple agents who have partial information.



Samson Lasaulce is a CNRS Director of Research in the Laboratory of Signals and Systems (joint lab between CNRS, CentraleSupélec, and Univ. Paris Sud). He has also been a Professor with the Department of Physics at Ecole Polytechnique. Before joining CNRS he has been working for five years in private R&D companies (Motorola Labs and Orange Labs). Dr. Lasaulce is the recipient of several awards, which includes several best paper awards and the SEE Blondel Medal Award. Dr. Lasaulce has been serving as an Associate Editor for the IEEE Transactions on Signal Processing. His current research interests lie in distributed networks with a focus on game theory, network information theory, learning, distributed optimization, network control for communication and energy networks. He is a co-author of the book "Game Theory and Learning for Wireless Networks: Fundamentals and Applications".

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**Speaker:** Liuqing Yang

**Affiliation:** University of Colorado, United States of America

**Title:** Vehicular Communications and Networking: The Gateway to Connected Mobility

**Abstract:** Vehicular communications and networking is an area of significant importance in our increasingly connected and mobile world. In the past decade, this area has gained significant attention from both industry and academia for its potential of ensuring road safety, improving transportation efficiency and of enhancing travel quality. Vehicular environments are inherently challenging with doubly selective physical channels, constrained radio spectrum bandwidth resources, and constantly changing network connectivity and topology. As such, research in this area is essential for bringing to reality the many demanding vehicular applications that consist of the gateway towards the ultimate connected mobility. In this talk, I will introduce fundamentals of vehicular channels, and various practical communications and networking techniques that we particularly developed for such channels. Challenges and opportunities in this field will also be discussed to stimulate future research and development.



Dr. Liuqing Yang received her Ph.D. degree in Electrical and Computer Engineering from the University of Minnesota, Minneapolis, in 2004. She is presently a Professor with Colorado State University. Her general interests are in signal processing with applications to communications, networking and power systems – subjects on which she has published more than 250 journal and conference papers, 4 book chapters and 2 books. Dr. Yang was the recipient of the Best Dissertation Award in the Physical Sciences & Engineering from the University of Minnesota in 2004, the Best Paper Award at the IEEE ICUWB'06, ICC'13, ITSC'14, Globecom'14, and ICC'16, the ONR Young Investigator Program (YIP) award in 2007, and the NSF Faculty Early Career Development (CAREER) award in 2009. She has served as an active reviewer for more than 10 journals, as TPC chair/member for a number of conferences, and as an associate editor for IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Transactions on Intelligent Transportation Systems, IEEE Intelligent Systems, and PHYCOM: Physical Communication. Dr. Yang is an IEEE Fellow, and has been the co-chair of the Mobile Communication Networks technical committee of the IEEE ITSS since 2006.

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**Speaker:** Diego Lopez

**Affiliation:** Head of Technology Exploration, Telefonica I+D, Madrid, Spain

**Title:** On the Dialectics of Intent

**Abstract:** Intent-based networking is an extremely promising approach for the application interface of network infrastructures, especially tailored to be applicable to the management of 5G networks, and the use of slicing techniques. In this scenario, intent belongs to a particular kind of policy expressions that requires a reconciliation with other policies applicable to network services, and that requires the application of mechanisms that we can consider “dialectical”, able to produce a synthesis of the potentially conflicting policy expressions. In addition, it is necessary to find a common path among the different potential approaches, especially among the different flavors Software Networks can take in their combination of SDN control and NFV orchestration, the application of recursive frameworks, and the support for network slice isolation. The talk will highlight these issues and show how Machine Learning techniques can be used to address convergence, showing some of the main results of the COGNET project.



Dr Diego R. Lopez joined Telefonica I+D in 2011 as a Senior Technology Expert on network middleware and services. He is currently in charge of the Technology Exploration activities within the GCTO Unit of Telefónica I+D. Before joining Telefónica he spent some years in the academic sector, dedicated to research on network service abstractions and the development of APIs based on them. During this period he was appointed as member of the High Level Expert Group on Scientific Data Infrastructures by the European Commission.

Diego is currently focused on identifying and evaluating new opportunities in technologies applicable to network infrastructures, and the coordination of national and international collaboration activities. His current interests are related to network virtualization, infrastructural services, network management, new network architectures, and network

security. Diego chairs the ETSI ISG on Network Function Virtualization, actively participating in the ONF, and the IETF WGs connected to these activities, acting as co-chair of the NFVRG within the IRTF.

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**Speaker:** Maziar Nekovee

**Affiliation:** Samsung Electronics R&D Institute UK

**Title:** Missing

**Abstract:** Missing



Dr. Maziar Nekovee is 5G Group Leader and Chief Engineer at Samsung Electronics R&D Institute UK (SRUK) where he leads Samsung's European Research in 5G, including Samsung's overall involvement in the Horizon 2020 5G PPP projects mmMAGIC, METIS-II and FANTASTIC-5G. He is also an elected member of the EU's 5G Infrastructure Association, where he contributes on behalf of Samsung to 5G vision, spectrum and pre-standards working groups. Prior to joining Samsung in 2013 he was from 2001 with BT (British Telecom) where he pioneered and led research in cognitive radio and dynamic spectrum sharing technologies, with applications to rural broadband and M2M/IoT, and provided technical consultancy to business units on wireless strategy and 4G spectrum auction. Maziar has a PhD in physics and a first degree and MSc in Electrical Engineering (cum laude) both obtained in the Netherlands. He has received a number of prestigious awards for his contributions to research in mobile communications, including Samsung DMC R&D's Best Research Practice Award in 2015, BT's Innovation Award in 2011 and the Royal Society (UK Academy of Science) Industry Fellowship in 2005. He is the author of over 90 peer-reviewed papers, 1 book and has a number of patents in telecommunication technologies. His own research focuses on system architecture and spectrum aspects of 5G radio access networks and mmWave communications.

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**Speaker:** Nouredine Boudriga

**Affiliation:** Head, CN&S Research Lab. SUP'COM, Tunisia

**Title:** Security challenges in 5G networks

**Abstract:** The need for security on any telecommunication network is obvious: the necessity to provide user and message authentication and to prevent traffic and data storage eavesdropping has been the main focus for many network administrators. However, these problems become worse when wireless networking, energy consumption, and voluminous activity have been added to the equation. In fact, the ideas of a no-wires, no topology, and no size constraints network are becoming more appealing to home, small office users, and enterprises every day.

This talk attempts to point out the limitations of the current security solutions, present some of the ongoing research activities to provide acceptable security solutions, and discuss some of the open problems and challenges in 5G network security. A special emphasis is made on optical networks, wireless sensor networks, M2M communications, and cloud computing, where very attractive applications present constraining requirements. In

particular, issues such as privacy, encryption at the optical domain, and copying with high volume data and network scale are discussed.



Professor Nouredine Boudriga is an internationally known scientist/academic. He received his Doctorate in algebraic topology from the University of Paris (France) and his Doctorate of Science in computer science from the University of Tunis (Tunisia). He is currently a professor of telecommunications at the University of Carthage, Tunisia, and the director of the Communication Networks and Security Research Laboratory (CNAS).

Dr. Boudriga is the recipient of the Tunisian Presidential Award in Science and Research (2004). He has served as the general director and founder of the Tunisian National Digital Certification Agency. He has been very actively involved in research and has authored or co-authored many books and book chapters, including more than 400 published journal and conference papers. Prof. Boudriga has been active in various research activities including Wireless networking, Wireless sensor networks, Optical networks, Network security, and forensic investigation.

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**Speaker:** Heinz Thorsten Bernold

**Affiliation:** The BOSTON Consulting Group United States of America

**Title:** 5G – The Emperor's New Clothes?

**Abstract:** Judging from the many announcements from telcos, vendors and industry associations, we are rushing headlong into the world of the new and exciting 5G technology to support our insatiable appetite for mobile bandwidth, and to ensure that IoT applications like autonomous driving can deliver their promise. And yet many executives are wary of whether the business case will ever stack up, and what the returns will be.

Given the pressure on the telco operators' economics and the expected massive network investment the traditional approach where telco operators invested first and expected revenues to come will be too risky and costly. Mike Fries, CEO of Liberty Global, doubted the willingness of telco operators to invest in 5G at this year's MWC in Barcelona.

Key questions need to be addressed to ensure 5G can take off:

1. What business opportunities beyond mobile broadband does 5G really enable?
2. What level of investment is required for 5G?
3. What is the 5G business case for different types of telco players?



Heinz Bernold is an Associate Director at the Boston Consulting Group (BCG). He is a member of BCG's Technology, Media and Telecommunications practice area, serving clients worldwide. He specializes in technology & network strategy and spectrum auctions. Heinz leads BCG's 5G efforts. Before re-joining BCG, Heinz worked at Swisscom as Head of Strategy & Innovation responsible for Network, IT & Wholesale business.

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**Speaker:** David Kravitz

**Affiliation:** Vice President - Crypto Systems Research DarkMatter, Abu Dhabi, United Arab Emirates

**Title:** Blockchain: From V2V to FinTech to M2M

**Abstract:** 5G will provide a unified framework for seamless connectivity that is needed to fully exploit the potential of blockchain by integrating it securely with off-chain subscriber set-up, transaction submission- and query- communications.

Blockchain is ultimately a distributed, immutable log of events. When harnessed properly, it greatly facilitates reconciliation of event history among multiple entities. Any portion of the telecom industry that ties up assets during reconciliation would benefit -- including, but not limited to, account transaction history, account usage history, roaming charges- and MVNO accounts- reconciliation. As a major emerging set of technologies, IoT will enable new business models that telcos, in particular, can take advantage of. Blockchain enables IoT devices to perform transactions, and to be tracked relative to time and location. Mobile phones provide a natural hub for such operations, whether (resource-constrained) IoT devices use mobile phones solely as a geo-locator, communications conduit, and storage medium in the context of end-to-end secured communications, or also leverage the phone they are paired to for trusted execution and analytics processing. The major missing link of the well-known Bitcoin blockchain is the element of "permissioning", i.e., a privacy-preserving, traffic-analysis- resistant methodology that leverages external trust relationships so as to establish an auditable identity- and attributes- management authorization framework. IoT devices suitably provisioned with identity management trust anchors can securely and efficiently transact over permissioned blockchains. This can be done in such a way that ubiquitous connectivity does not have to come at the expense of forfeiting needed entity authentication and data integrity.

"Attributes" can include identities, identifiers, entitlements, etc. User or device Identity and (organizational/device manufacturer) Affiliation can be considered special cases of attributes in that these are embedded into relatively long-term Enrollment Certificates, while these as well as dynamic attributes are incorporated into Transaction Certificates. A user may possess multiple Enrollment Certificates concurrently. Enrollment Certificates are used only 'behind the scenes' to prove provenance of attributes, while Transaction Certificates are used within blockchain transactions. These Transaction Certificates replace the raw/uncertified public keys used in Bitcoin addresses. We inherit the desired property of transaction "unlinkability" from the US Department of Transportation- piloted Security Credential Management System (SCMS) PoC for vehicle-to-vehicle/V2X communications based on IEEE 1609.2-2016 Standard for Wireless Access in Vehicular Environments - Security Services for Applications and Management Messages, and Crash Avoidance Metrics Partners (CAMP) LLC Vehicle Safety Communications 5 (VSC5).

Our protocols are designed to gain the benefits of inheriting trust relationships that are established off-chain as well as leveraging trust relationships that develop through the history of blockchain transactions. Reciprocally, trust that is built up via the blockchain can be utilized for off-chain services. Using standardized X.509 PKI and SAML/OAuth/OpenID federated identity management, the system provides trusted assertions of Identities, and other attributes such as Affiliation, user or device qualifications/authorized functionalities, resource entitlements, reputation metrics, etc. Unlike traditional systems, each of these assertions is securely translated into unique proofs-of-possession that are embedded into batches of issued Transaction Certificates. This embedding uses efficient symmetric cryptography in order to hide the information from unauthorized access. While enabling the

user who owns a Transaction Certificate to privately prove possession of the attribute to intended parties on a selective release basis.

Regulatory compliance is achieved by judiciously deploying hierarchical key management such that there is a match of the one or more Affiliations of a specific auditor to Affiliations of users. This results in granting strategically limited access to information that is otherwise concealed via encryption or hashing within blockchain transactions: Only information pertaining to transactions that involve users or devices within the auditor's domain of Affiliations is exposed to the auditor. Such auditor access is granted independently of selective release by the users or devices themselves. The audit system is further refined, so that appropriate measures can be applied to limit an authorized auditor's access down to individual users or devices and/or to circumscribed transaction time periods. Furthermore, access can be graduated so as to release transaction-specific data to an auditor only if there is established cause after first being allowed to cluster transactions according to user or device Identity or other attributes. Such auditability is designed to be revocable. The issuance of Transaction Certificates is also auditable, so as to provably confine the Transaction Certificate- specific subject public keys to those that are derived via the hidden cryptographic expansion function from a long-term subject public key of a legitimate Enrollment Certificate. This inability to get an arbitrary subject public key included within a Transaction Certificate also has ramifications regarding enabling efficient but secure combining of private or public keys that improves transaction processing performance. This is accomplished without enduring the expense to clients or servers of processing individual proofs of possession of subject private keys in order to safely produce batches of Transaction Certificates.

Endorsements and other data relevant to the attributes and reputation of users or devices (relative to such attributes) that are exchanged within transactions can be processed/aggregated and fed back into the system so that future Transaction Certificates reflect such data within the embedded proofs-of-possession of attributes.

The core principles outlined above form the basis of handling know your customer/anti-money laundering (KYC/AML) for financial services transactions and know your machine (KYM) for IoT devices, without sacrificing performance or throughput. The methodology was designed to also be extensible for use in M2M and other IoT transactions that involve severely- resource-constrained devices. Transaction Certificates and the cryptographic protocols are structured so as to avoid the need for long-term storage of per-certificate keys, and to minimize client computation, cross-server synchronization, and off-chain transaction setup communications. Our further exploration into the IoT domain entails extending the capabilities to handle dynamic and static groups of stationary and mobile devices so as to corroborate legitimate assertions (such as those pertaining to location or proximity) made by each, and to aid in timely detection of anomalous device and/or user behavior for the purpose of effective containment of rogue devices and/or users via revocation of Transaction Certificates or Enrollment Certificates. Applications include improved identity fraud management and tuning of authorizations to more securely permission high-value transactions, taking advantage of the immutably ordered and time-stamped ledger to aid in correlation of both on- and off- chain transaction activity.



Dr. David W. Kravitz is Vice President of Crypto Systems Research at DarkMatter, and heads DarkMatter's blockchain team. His 35-year experience spans an extensive range of technological and cyber security related domains including cryptography, algorithms, protocols and systems design and evaluation. He has worked in a wide range of applications, including voice and data critical infrastructure, digital rights management, payments, smart grid, Internet of Things, and high-value assets transfer. Prior to joining

DarkMatter, Dr. Kravitz was a Research Staff Member with IBM Research where he was an architect of identity management, audit, and transaction privacy systems. He also oversaw the development of cryptographic constructs for next-generation ultra-high-definition content protection.

Dr. Kravitz began his career at the National Security Agency (NSA), where he “combined his exceptional skills in protocol and algorithm design with his evaluation capabilities to profoundly enhance the security posture of communications,” as stated in the Certificate of Achievement he was awarded by the Director of the NSA. Subsequently, Dr. Kravitz held a position as Senior Member of Technical Staff, Sandia National Laboratories, providing information surety of nuclear command & control and electronic commerce. He also held the position of Fellow of Technical Staff at Motorola, and as Principal Member of Technical Staff at BlackBerry.

Dr. Kravitz was the principal architect of blockchain Fabric Membership Services for the open-source Linux Foundation Hyperledger Project, and acts as Advisory Board Member to Federal Guardian, a cyber security consolidation platform. He was Chief Scientist at Wave Systems Corp., at Sparta Inc., and at Digital Video Express, where he was responsible for multiple designs in the areas of security system infrastructure and cryptography suitable for smart cards, content metering, compliant playback, security token keying, and watermark-based conditional access. As Vice President at Bankers Trust Electronic Commerce/CertCo, Dr. Kravitz designed a comprehensive internet payments and digital goods distribution platform. He holds a Ph.D. in Electrical Engineering Systems from University of Southern California, a Masters in Mathematical Sciences from Johns Hopkins University, and a Bachelors in Mathematics from Rutgers University. During his 11-year tenure at NSA, Dr. Kravitz invented the Digital Signature Algorithm (DSA), which forms one of the dozens of issued and pending patents in his name.

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**Speaker:** Kenneth Wallstedt

**Affiliation:** Director, Technology Strategy Group Function Strategy & Technology, Ericsson, Sweden

**Title:** 5G for extreme flexibility, capacity and coverage

**Abstract:** 5G for extreme flexibility, capacity and coverage.



Kenneth Wallstedt is Director, Technology Strategy, at Group Function Strategy & Technology, where he is focusing on Ericsson’s radio and spectrum management strategy. Kenneth has more than 26 years of international experience in mobile communications from various leading positions in Ericsson’s research, development and market units in Canada, Sweden, and the US. He holds an M.Sc. in electrical engineering from KTH Royal Institute of Technology in Stockholm, Sweden.

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**Speaker:** Mehdi Bennis

**Affiliation:** Centre for Wireless Communication University of Oulu, Finland

**Title:** Proactive and context-aware networks

**Abstract:** In contrast to the current reactive, centrally-managed/cloud-based and one-size-fit-all networking paradigm, the 5G networking paradigm must be proactive by design and exploits the fact that network nodes are endowed with storage, computing and cognitive capabilities; largely unexplored today. This allows the network fabric to be dynamically configured and adapted while allocating bandwidth, storage and computing resources when and where needed the most, yielding orders-of-magnitude performance improvements. The goal of this talk is to present the latest developments in 5G and some of the trending topics in both academia and industry. Among these, I will discuss edge caching, fog computing, 5G-V2X, mmwave, virtual reality and others.



Mehdi Bennis (Senior Member, IEEE) received his M.Sc. degree in Electrical Engineering jointly from the EPFL, Switzerland and the Eurecom Institute, France in 2002. From 2002 to 2004, he worked as a research engineer at IMRA-EUROPE investigating adaptive equalization algorithms for mobile digital TV. In 2004, he joined the Centre for Wireless Communications (CWC) at the University of Oulu, Finland as a research scientist. In 2008, he was a visiting researcher at the Alcatel-Lucent chair on flexible radio, SUPELEC. He obtained his Ph.D. in December 2009 on spectrum sharing for future mobile cellular systems. Currently Dr. Bennis is an Adjunct Professor at the University of Oulu and Academy of Finland research fellow. His main research interests are in radio resource management, heterogeneous networks, game theory and machine learning in 5G networks and beyond. He has co-authored one book and published more than 100 research papers in international conferences, journals and book chapters. He was the recipient of the prestigious 2015 Fred W. Ellersick Prize from the IEEE Communications Society, the 2016 Best Tutorial Prize from the IEEE Communications Society and the 2017 EURASIP Best paper Award for the Journal of wireless communications and networks. Dr. Bennis serves as an editor for the IEEE Transactions on Wireless Communication

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**Speaker:** Adrian Scarse

**Affiliation:** ETSI CTO, Head of 3GPP Mobile Competence Centre

**Title:** The why, when, where, what and how of 5G Standards

**Abstract:** This presentation will consider the standards activities for the 5G Mobile Communications System currently being developed by 3GPP with increased urgency, as operators accelerate their deployment ambitions. Architectural plans are maturing and technology choices are being made, based on the results of regional and national research activities. Substantial 5G building blocks are also under preparation within ETSI which will have an impact on 5G system performance. The digital transformation of industry (resulting in increased GDP) remains an overall objective for 5G, and so this presentation will also consider the extent to which the ICT industry is engaging other industry sectors in the 5G design process, to ensure that their requirements are properly captured.



Adrian Scarse played a central role in the creation of the "3rd Generation Partnership Project" (3GPP) and is responsible for the operations of the 3GPP Project Co-ordination Group. He heads 3GPPs' Mobile Competence Centre (MCC) which is an International team of 20 experts who provide comprehensive support to the Project. He is CTO within ETSI with operational responsibility for all

of ETSI's standards production activities. He has more than 30 years experience in the telecommunications field, which includes 25 years of experience in standardization.

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**Speaker:** Mehdi Bouzid

**Affiliation:** National Instrument, MENA Region

**Title:** National Instruments 5G research Platforms

**Abstract:** This presentation explores the evolution and challenges that come with a more connected world. Gain insight from industry influencers on how the standards being defined will shape everything from healthcare and automation to autonomous vehicles and smart factories. Also see how leading wireless researchers from Nokia and universities such as NYU, Bristol, and Lund are approaching these challenges and adapting to the new 5G landscape



Mehdi Bouzid is an electrical Engineer graduated from the National Engineering School of Tunis, ENIT, in June 2007, he is District Sales Manager with National Instruments working in the Maghreb Area, his main mission is to enable users of the National Instruments technology such as LabVIEW, RF Hardware, Software defined Radios, modular instruments and embedded systems and help them solve their Engineering challenges, peruse their research and solve their Engineering Challenges.

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**Speaker:** Abdelkarim Belkhadir

**Affiliation:** ANRT, Morocco

**Title:** How to Harmonize the 5G Efforts at the International Level.



Abdelkarim Belkhadir wa born in Rabat on 01/06/1978; He is married and have 2 children. He obtained the Engineer degree from Mohammedia School for Engineers and a Master from South Managemet Paris (Manager Telecom),

Abdelkarim is with The Moroccan Agency for Telecommunications Regulatory (ANRT), where he is in charge of the approval and standardization of telecommunications equipment since 2004.

He is the Vice-Chairman of ITU-R Commission 3 and is a Member of the Arabic Subgroup responsible for monitoring at ITU-R level work on frequency bands for IMT-2020 (5G).

## Organizers



**Professor Latif Ladid** is the Founder & President of IPv6 FORUM ([www.ipv6forum.com](http://www.ipv6forum.com)) - Chair of 5G World Alliance ([www.5gworldalliance.org/](http://www.5gworldalliance.org/)) - Chair of IEEE COMSOC IoT subCommittee - Chair of IEEE COMSOC 5G subCommittee - Chair of ETSI IPv6 ISG (incl. 5G) - Co-Chair of IEEE COMSOC SDN-NFV subCommittee - Dr. Ladid is an Emeritus Trustee, Internet Society, ISOC - IPv6 Ready Logo Program Board. He is a Research Fellow at SnT University of Luxembourg on multiple European Commission Next Generation Technologies IST Projects. He is also a Member of the 3GPP PCG (Board), Member of 3GPP2 PCG Member of UN Strategy Council GAID and Member of the Future Internet Forum for Member States - Member of WSA. Co-Founder of ETSI AFI ISG.



**Essaid Sabir** received the B.Sc. degree in Electrical engineering Electronics and Automation (2004) from Mohammed V University (Rabat, Morocco) and the M.Sc. in Telecommunications and Wireless Engineering (2007) from National Institute of Post and Telecommunications (Rabat). In 2010, he received the Ph.D. degree in Networking and Computer Sciences jointly from University of Avignon (France) and the Mohammed V University. He was a contractual Assistant Professor at University of Avignon (France), from 2009 to 2012. Essaid serves as a reviewer for several international journals (IEEE, Springer, IET, Elsevier, Wiley, etc).

Dr. Sabir is an IEEE Senior member and an active member with IEEE COMSOC, IEEE IoT and other IEEE Professional Societies. He served as a General Chair, TPC Chair or Publication chair for several conferences and scientific events including IEEE 5G Summit Casablanca, IEEE WF-IoT'16, UNet, IEEE IoTGS'17, IEEE WF-IoT'18, IEEE NGNS'14 and WINCOM'15-16. He has been on the technical program committee of numerous IEEE/ACM conferences, including Globecom, ICC, WCNC, MSWIM, ICT, WIOPT, etc.. He is being (has been) involved in several national and international/European projects. Currently, he is a full-time Associate Professor at the National Higher School of Electricity and mechanics of Casablanca (ENSEM). His current research interests include protocols design for 5G networks, D2D-M2M-IoT, NFV and Infrastructure-less networking for 5G Networks, cognitive radio, stochastic learning, networking games, pricing and network neutrality. Dr. Sabir has co-authored over 20 journal articles with high impact factor, 1 book and several book chapters, and over 60 conference publications. Dr. Sabir is a founder and the vice-treasurer of the Moroccan Association for Mobile Computing and Intelligent Embedded-Systems (MobiTic). As an attempt to bridge the gap between academia and industry, he has co-founded and co-chaired the International Symposium on Ubiquitous Networking (UNet). He has also co-founded the International Conference On Wireless Networks and Mobile Communications, (WINCOM).



**Ashutosh Dutta** is currently Lead Member of Technical Staff at AT&T's Chief Security Office in Middletown, New Jersey. His career, spanning more than 30 years, includes Director of Technology Security at AT&T, CTO of Wireless at a Cybersecurity company NIKSUN, Inc., Senior Scientist in Telcordia Research, Director of Central Research Facility at Columbia University, adjunct faculty at NJIT, and Computer Engineer with TATA Motors. He has more than 90 conference and journal publications, three book chapters, and 30 issued patents. Ashutosh is co-author of the book, titled, "Mobility Protocols and Handover Optimization: Design, Evaluation and Application," published by IEEE and John & Wiley that was recently translated into Chinese language. An active IEEE and ACM volunteer, Ashutosh served as the chair for IEEE Princeton / Central Jersey Section, Industry Relation Chair for Region 1 and MGA, PreUniversity Coordinator for IEEE MGA and vice chair of Education Society Chapter of PCJS. He co-founded the IEEE STEM conference (ISEC) and helped to implement EPICS (Engineering Projects in Community Service) projects in several high schools. Ashutosh currently serves as the Director of Industry Outreach for IEEE Communications Society and is the co-lead for IEEE 5G initiative. He was recipient of the prestigious 2009 IEEE MGA Leadership award and 2010 IEEE-USA professional leadership award. Ashutosh serves as IEEE Communications Society's Distinguished Lecturer for 2017-2018. Ashutosh obtained his BS in Electrical Engineering from NIT Rourkela, India, MS in Computer Science from NJIT, and Ph.D. in Electrical Engineering from

Columbia University under the supervision of Prof. Henning Schulzrinne. Ashutosh was honored as a Star Alumnus by his Alma mater NIT Rourkela. Ashutosh is a senior member of IEEE and ACM.



**Mounir Ghogho** has received the M.S. degree in 1993 and the PhD degree in 1997 from the National Polytechnic Institute of Toulouse, France. He was an EPSRC Research Fellow with the University of Strathclyde (Scotland), from Sept 1997 to Nov 2001. Since Dec 2001, he has been a faculty member with the school of Electronic and Electrical Engineering at the University of Leeds (England), where he is currently a Professor. Since 2010, he has also been affiliated with the International University of Rabat, where he is currently a Scientific Advisor to the President, ICT Research Director and local coordinator of the CNRS-associated international lab DataNet. He was awarded the UK Royal Academy of Engineering Research Fellowship in September 2000. He is a recipient of the 2013 IBM Faculty Award. He is currently an associate editor of the Signal Processing Magazine, and a steering committee member of the IEEE Transactions on Signals and Information Processing over Networks. In the past, he served as an Associate Editor of the IEEE Transactions on Signal Processing, the IEEE Signal Processing Letters and the Elsevier Digital Signal Processing journal. He was/is a member of the IEEE Signal Processing Society SPCOM, SPTM and SAM Technical Committees. He was the General Chair of the European Signal Processing conference Eusipco2013 and the IEEE workshop on Signal Processing for Advanced Wireless Communications SPAWC'2010. He has published over 300 journal and conference papers in the areas of signal processing, machine learning and wireless communication. He held invited scientist/professor positions at Telecom Paris-Tech (France), NII (Japan), BUPT (China), University Carlos 3rd of Madrid (Spain), ENSICA (Toulouse), Darmstadt Technical University (Germany), and Minnesota Univ. (USA).



**Mohamed Sadik** is a Professor and the Chair of the Research and Cooperation Department at the National Higher School of Electricity and Mechanics (ENSEM). He received his PhD in Electrical Engineering from the National Polytechnic Institute of Lorraine (INPL) (Nancy, France) in December 1992. Professor Sadik received his Master of Sciences and his Bachelor, both in Electronics, automatic and informatics, from University of Brest ( France). In 1993, Prof. Sadik joined the National Higher School of Electricity and mechanics; Hassan II University of Casablanca as an Assistant Professor of signal processing and other courses related to computer sciences and wireless networking. In 2004, he became an Associate Professor at ENSEM. From 2008 to 2013, he served as a chair of Electrical Engineering Department at the same institution. His earlier research activities lied in the development of biomedical autonomous systems. Recently, he has been interested in embedded system, autonomous/smart systems applied to precision agriculture and environment. He is also working on security issues, in particular for networking and embedded systems. He also participates (participated) in numerous R&D Projects. Dr. Sadik is the head of the Networking, embedded Systems and Telecommunications (NEST) research group. He serves as TCP and reviewer for several international and national conferences including WOTIC 2011, ICT2013, NGNS 2014, etc. Dr. Sadik has been involved in the organization of numerous international conferences (IEEE ITC'13, IEEE NGNS'14, WINCOM'15, etc.). He also co-founded and chaired the international Symposium on Ubiquitous Networking 2015.



**Professor Mustapha Benjillali** graduated as a mobile communications engineer from INPT, Rabat, Morocco, in 2003. He received the M.Sc. and the Ph.D. degrees in telecommunications from INRS, Montreal, Canada, in 2005 and 2009, respectively. He was a Postdoctoral Research Fellow with the Electrical Engineering Program, King Abdullah University of Science and Technology (KAUST), Thuwal, KSA. He is now an Associate Professor with the Communication Systems Department at INPT, Rabat, Morocco.

His current research interests are in the area of 5G wireless and mobile communications, including flexible and novel access technologies, green wireless systems, and intelligent wireless IoT solutions for smart cities. His focus is on the design and optimization of 5G physical and link layers, closed-form mathematical performance analysis, energy-efficiency, and resource allocation strategies.

Prof. Benjillali is an IEEE Senior Member, and an IBM Academic Initiative Member. He is also an active member with many IEEE Societies and Communities, and serves for many leading international

journals and major international conferences. Among his awards and distinctions, he is a co-recipient of the 2010 Best Paper Award of the IEEE International Conference on Communications. He is the President of the Moroccan Association for Information and Communication Technologies (AMTIC).



**Abdelmajid Badri** is a holder of a doctorate in Electronics and Image Processing in 1992 at the University of Poitiers–France. In 1996, he obtained the diploma of the authorization to Manage Researches (HDR) to the University of Poitiers–France, on the image processing. Qualified by the CNU-France in 61th section (Informatic Engineering, Automatic and Signal Processing). He is an University Professor (PES-C) at the University Hassan II of Casablanca - Morocco (FSTM) where he teaches the electronics, the signal processing, image processing and telecommunication (Department of Electric Engineering). He is a member of the laboratory EEA&TI (Electronic, Energy, Automatic and Information Processing) which he managed since 1996. The research works of A. Badri concerns the communication and Information Technology (Electronics Systems, Signal/Image Processing and Telecommunication). He managed several doctoral theses. He is a co-author of several national and international publications. He is responsible for several research projects financed by the ministry or by the industrialists. He was member of several committees of programs of international conferences and president of several international congresses in the same domain. He is a member and co-responsible in several scientific associations in touch with his domain of research. He is an expert CNRST. He was responsible for several academic structures (Director ENSAMC an interim (3 years), Vice Dean FSTM, Head of the Electric Engineering Department).



**Professor Mohammed Essaïdi** Mohamed Essaïdi, Prof. Dr. IEEE Senior Member, received the “Licence de Physique” degree, the “Doctorat de Troisième Cycle” degree and the “Doctorat d’Etat” degree in Electrical Engineering and with honors, respectively, in 1988, 1992 and 1997 from Abdelmalek Essaadi University in Tetuan, Morocco. He is a professor of Electrical Engineering in Abdelmalek Essaadi University since 1993. He is the founder and the current Chair of the IEEE Morocco Section since November 2004. He is the founder and the General Chair of Mediterranean Microwave Symposium (MMS) since the year 2000, the co-founder and the General Chair of Information and Communication technologies International Symposium (ICTIS) since 2005, and NATO Advanced Research Workshop on Information Security Assurance Co-director, Tetuan, June 3-6, 2005. He is the Chairman or a member of the Organizing and the Scientific Committees of several international symposia and conferences dealing with topics related with RF, microwaves and Information and Communication technologies and their applications. Furthermore, he is a referee of the IEEE Transactions on Microwave Theory and Techniques, IEEE Transactions on Antennas and Propagation, Advanced Computational Electromagnetics Society Journal, European Microwave Association Proceedings, Serbian Journal of Electrical Engineering and Korean Electronics and Telecommunications Research Institute Journal.

Professor Essaïdi is a member of IEEE Microwave Theory and Techniques Society, IEEE Antennas and Propagation Society, IEEE Communications Society and European Microwave Association. His biography was listed in Who’s Who in The World in 1999. He is also the co-founder and the current coordinator of the Arab Science and Technology Foundation (ASTF) RD&I network on Electrotechnology. His research interests focus mainly on RF and microwave passive and active circuits and antennas for wireless communications and medical systems.

He was the editor of the MS2000 Proceedings, the co-editor of the MMS’2002, ICTIS’05 and ICTIS’07 Proceedings and MMS’2006 special issue of the European Microwave Association Proceedings. He is the author and co-author of more than 80 papers that appeared in refereed specialized journals and symposia. He was the co-editor of the book “Information Assurance and Computer Security”, IOS Press, 2007. He was also the co-editor of the book "New Trends in Biomedical Engineering", AEU Publications, 2004 and the author of 3 book chapters. He was a Guest-Editor of special issues of European Microwave Journal (2007), International Journal Of Computer Science Applications (2007,2008) and International Journal on Computer Science and Information Systems (2008). He is the Editor-in-Chief of the International Journal on Information and Communication Technologies (Serials Publications, India) since November 2007.