Overview of the 37th WWRF Meeting

Members of industry and academics discussed future mobile-radio standard fifth-generation (5G) technology at the 37th Wireless World Research Forum (WWRF) meeting, held 5–7 October 2016 in Kassel, Germany. International industrial representatives and scientists from 15 countries participated in 19 plenary talks, 16 working-group sessions, and two comprehensive tutorials on key 5G technologies. The experts discussed the current status, market potentials, and technical standards of 5G technology. The program included talks on connected vehicles, mobile health services, next-generation Ethernet-based fronthaul/xhaul, the Internet of Things (IoT), and an outlook beyond 5G. Working-group sessions addressed user needs and requirements, services and devices of 5G technology, new directions in communication architectures, and technologies, including high-frequency technologies. Highlights included the talks:

- by Dr. Howard Benn, “5G Mobile Communications—Key Enabling Technologies and Recent R&D Results” (Samsung)
- by Dr. Huang Hua, “5G Shape the Future—AI Inside” (Huawei)
- by Dr. Philippe Sehier and Dr. Rudolf Winkelmann, “The Future of Transport Networks Towards 5G” (Nola Bell Labs)
- by Markus Kreitmaier, “IoT Facilitated by EnOcean: Technology, Applications and Business Cases” (EnOcean)
- by Dr. Klaus David and Dr. Hendrick Berndt, “Beyond 5G: Let’s Start Talking 6G” (Kassel University).

The fast pace of digitization is having a major impact on what are known as vertical industries, including health care, transport, logistics, manufacturing, and energy, in smart cities and other similar environments, and in the education and public-information sectors. This is providing opportunities for the information and communications technology (ICT) industry together with these vertical industries and new players to bring to the market novel and innovative solutions. It is clear that 5G technology is going to be a key enabler of this transformation, accommodating the diverse connectivity, storage, and processing needs in each of these industry sectors.

Each new direction for 5G technology—from enhanced mobile broadband to massive connectivity supporting the IoT and high-reliability low-latency connections to provide secure real-time control applications—provides opportunities for vertical industries to exploit these enhanced capabilities. Fundamental advances, such as the concept of network slicing, will enable 5G technology to be provided as a system of systems to a wide range of customers. Supporting this will be a new community of developers and entrepreneurs to implement a new wave of technology innovation for vertical applications. The WWRF is at the heart of this process, with its vertical industry platforms creating a bridge between the ICT and vertical industries and its meetings providing opportunities to promote and discuss new developments.

The three best of more than 30 articles were selected from the meeting in Kassel, Germany, for publication in this issue of IEEE Vehicular Technology Magazine. The first article, “Boosting 5G Through Ethernet” by Nathan J. Gomes, Philippe Sehier, Howard Thomas, Philippe Chanclou, Bomin Li, Daniel Münch, Philipp Assimakopoulos, Sudhir Dixit, and Volker Jungnickel, proposes using Ethernet as a new transport protocol for the fronthaul. With its use, two major challenges can be addressed: accommodating ever-higher data rates and...
transporting fronthaul signals over public fixed-access networks, such as passive optical networks.

The second article is “Multicell Device-to-Device Communication” by Marios I. Poulakis, Antonis G. Gotsis, and Angeliki Alexiou. This new approach could become one important innovation of 5G technology. The third article is “Staying Connected on the Go,” by Chia-Lin Lai, Shahzoob Bilal Chundrigar, Samer T. Talat, and Hsien-Wen Chang, from the Industrial Technology Research Institute in Taiwan. In this article, a network-slicing concept is adopted and used as a base for the developed network-sharing mechanism.

**Author Information**

Apostolos Papathanassiou is a senior principal engineer with the Next Generation and Standards organization of the Intel Client and Internet of Things Businesses and Systems Architecture Group. He is responsible for long-term evolution physical layer and media access control standardization and has been leading different fifth-generation (5G) technology development and standardization activities. He is the 5G Automotive Association Working Group 4 (Standards and Spectrum) chair and a member of the Wireless World Research Forum Steering Board. He has made more than 50 scientific contributions to international journals, conferences, and books since 1994, has worked on more than 20 awarded patents/patent applications in third-generation, fourth-generation, 5G, and Wi-Fi wireless communications systems since 1996, and has made more than 100 contributions to wireless standardization bodies since 1999.

Wern-Ho Sheen received his Ph.D. degree in electrical engineering from the Georgia Institute of Technology, Atlanta, in 1991. He is currently a professor with the Department of Communications Engineering and director of the Center for Telecommunication Research, National Chung Cheng University, Taiwan. His research interests include communication theory, wireless communication systems, and signal processing for communications. He has consulted extensively with industry and research institutes in Taiwan. From 2005 to 2007, he led a team of 50 researchers conducting fourth-generation system design and participating in its international standardization. He has coauthored 120 scientific papers and more than 200 technical contributions to standards developing organizations, including IEEE 802.11j, IEEE 802.16m, and the Third Generation Partnership Project long-term evolution. He holds 50 patents.

Chin-Liang Wang is currently a distinguished professor with the Department of Electrical Engineering and the Institute of Communications Engineering, National Tsing Hua University, Taiwan. Since September 2015, he has also been a visiting professor at the Institute for Communication Systems and the 5G Innovation Centre, University of Surrey, United Kingdom. His current research interests are primarily in baseband technologies for fifth-generation wireless communications and cooperative communications. He received the Distinguished Electrical Engineering Professor Award from the Chinese Institute of Electrical Engineering in 2010, the National Science Council Distinguished Research Award in 2013, the Distinguished Engineering Professor Award from the Chinese Institute of Engineers in 2014, and the Colin Pillinger International Exchanges Award from the Royal Society, United Kingdom, in 2015. He has been recognized as an IEEE Fellow for his contributions to signal processing algorithms and architectures for digital communications.

Christos Politis received his B.Eng. degree from the National Technical University of Athens, Greece, and his M.Sc. and Ph.D. degrees from the University of Surrey, United Kingdom. He is a professor (and chair) of wireless communications at Kingston University, School of Computer Science, United Kingdom. He is also the director of the Digital Information Research Centre. He teaches modules on wireless systems and networks. He holds two patents and has published more than 180 papers in international journals and conferences and chapters in ten books. He advises several governmental and commercial organizations on their research programs/agendas and portfolios. He is a U.K. Chartered Engineer and a member of the Technical Chamber of Greece. He is a Senior Member of the IEEE.