Proceedings

Nineteenth Strategic Workshop (SW'17)

Future Wireless Ecosystems (FWE)

Venue

WESTIN DRAGONARA RESORT

Dragonara Road,   St. Julian's STJ 3143, Malta

May 29-31, 2017

Welcome Message

It is our great pleasure to welcome all the participants to the 19th Strategic Workshop (SW'17), to be held at, WESTIN DRAGONARA RESORT, Dragonara Road, St. Julian's STJ 3143, Malta, On May 29-31, 2017.

The first workshop was held in Delft, the Netherlands in 1994 with an objective to discuss the candidates for the air interface access technique of the third generation mobile communications. This and the following workshops, Sardinia 2000, Rebild 2001, Prague 2002, Ellsinore 2003, Rome 2004, St. Restrup 2005, Mykenos 2006, Malaga 2007, Madeira 2008, Rebild 2009, Florence 2010, Saint-Paul De Vence 2011, Dronninglund 2012, Marbella in 2013, Skørping in 2014, and Villa Mondragone, Monte Porzio Catone in 2015 and Reykjavik, ICELAND in 2016, have given fruitful contributions to the wireless world evolution including famous projects like FRAMES, MAGNET, and novel concepts such as WISDOM, Future Generation beyond 2020, COINS, and, Human Bond Communications (HBC).

The theme of the workshop is "Future Wireless Ecosystems (FWE)". In addition to the technical presentations on (FWE), a major goal of the workshop is to speed up innovation and the path to commercialization of the relevant technologies and a strong partnership between industry and academia. We believe that these pervasive wireless ecosystems will become an integral part of our world in the near-future and beyond. In fact enabling such a pervasive communication and computing infrastructure will only further drive this revolution to fruition. To meet this objective, we are organizing a dedicated Panel and Session in the area of Future Wireless Ecosystems (FWE). During this workshop, we aim to engineer communication and computing system which is unique and it is intricately tied to supporting various human-cantered applications while at the same time appearing to be seamless and invisible to end-users. In terms of key enabling technologies, the communications/networking challenge is that of designing hierarchical, distributed, decentralized and adaptive protocols for dense wireless networks and integrating efficiently with the future Internet as a whole.

Looking forward to welcoming you personally in WESTIN DRAGONARA RESORT, Malta,

Ramjee Prasad, Marina Ruggieri

Program and Coordination Committee:

Ramjee Prasad, Founder President, CTIF Global Capsule, Professor, Aarhus University, Herning, Denmark
Marina Ruggieri, CTiF-Italy, University of Rome "Tor Vergata", Italy.
Giuliana Contaldi, Laurentina Viaggi Srl, Rome, Italy, SW´17 Secretariat

Monday May 29, 2017

20.00	Informal dinner discussions

Tuesday May 30, 2017

08.45	**Registration**
09.15-09.30	*Welcome and Introduction*: Ramjee Prasad, CGC/ GISFI, Aarhus University, Herning, Denmark
09.30-11.20	**Session I; FWE Concept: Vision & Innovation**
	Session Chair: Luis Muñoz, University of Cantabria, Spain
	Josef Noll, (wireless ecosystem for sustainable development), UiO/ITS, Norway Ingrid Moerman, (Radio softwarisation and virtualization) , Imec-Ghent, University, Belgium
	Rui Aguiar, (deviceless communications), University of Aveiro, Portugal
	Liljana Gavrilovska,(Radio Access Virtualization in Future Wireless Ecosystems), Ss Cyril and Methodius University in Skopje, Macedonia
11.20-11.40	**Coffee Break**
11.40-13.40	**Session II; FWE: Technology Oriented Business Models & Standardisation**
	Session Chair: Rui Aguiar, University of Aveiro, Portugal
	Marja Matinmikko, (Reshaping regulations for 5G micro operators), University of Oulu, Finland
	Peter Lindgren, (Multi Business Model Innovation and Technology), Åarhus University, Denmark
	Luis Muñoz,(The Internet of Things and the Digital Single Market), University of Cantabria, Spain
	Sadia Anwar, (5G technology and smart health care standardization), Aarhus University, Denmark
13.40-14.30	**Lunch**
14.30-16:30	**Panel Discussion I; FWE: Business Oriented Technology Paradigm**
	Moderator: Josef Noll, UiO/ITS , Norway
	Panellists
	Luis Muñoz, University of Cantabria, Spain
	Peter Lindgren, Århus, University,Denmark
	Ingrid Moerman, Imec- Ghent University, Belgium
	Marja Matinmikko , University of Oulu, Finland
	Chih-Cheng Tseng, National Ilan University, Taiwan
16.30-17.00	**Coffee Break**
17.00	**Surprise Sight Seeing**
20.00	**Gala Dinner**

Wednesday May 31, 2017

09.00-11.00	Session III; FWE: Applications, Services, and Security
	Session Chair: Liljana Gavrilovska, Ss Cyril and Methodius University in Skopje, Macedonia
	Alberto Carreras, (Cloud Ran and the impact of centralization over transmission efficiency in the radio access network), University of Málaga, Spain
	Leonardo Badia, (The complexity of living beings in smart wireless networks), University of Padova, Italy,
	Chih-Cheng Tseng,(Analysis of DRX Mechanism for Next Generation Mobile Communication Networks), National Ilan University, Taiwan
	Paulo Pereira Monteiro, (Joint of Radar and Communication Systems for Beyond 5G), University of Aveiro, Portugal
11.00-11:20	Coffee Break
11:20-13:20	**Panel Discussion II; FWE: H2020 Project Concept**
	Moderator: Ramjee Prasad, Aarhus University, Denmark
	Panellists
	Liljana Gavrilovska, Ss Cyril & Methodius University in Skopje, Macedonia
	Josef Noll, UiO/ITS , Norway
	Alberto Carreras, University of Málaga, Spain
	Paulo Pereira Monteiro, University of Aveiro, Portugal
	Marja Matinmikko, University of Oulu, Finland
13:20-13:40	**Concluding remarks:** Ramjee Prasad, *CGC / GISFI*, Aarhus University, Herning, Denmark
13.40-14.30	**Lunch**
	Departure

Opening and Introduction

Ramjee Prasad

President, CTIF Global Capsule,
Professor, Department of Business Development and Technology, Aarhus University,
Herning, Denmark

Short Bio

Dr. Ramjee Prasad is a Professor of Future Technologies for Business Ecosystem Innovation (FT4BI) in the Department of Business Development and Technology, Aarhus University, Denmark. He is the Founder President of the CTIF Global Capsule (CGC). He is also the Founder Chairman of the Global ICT Standardization Forum for India, established in 2009. GISFI has the purpose of increasing of the collaboration between European, Indian, Japanese, North-American and other worldwide standardization activities in the area of Information and Communication Technology (ICT) and related application areas.

He has been honored by the University of Rome "Tor Vergata", Italy as a Distinguished Professor of the Department of Clinical Sciences and Translational Medicine on March 15, 2016. He is Honorary Professor of University of Cape Town, South Africa, and University of KwaZulu-Natal, South Africa.

He has received Ridderkorset af Dannebrogordenen (Knight of the Dannebrog) in 2010 from the Danish Queen for the internationalization of top-class telecommunication research and education.

He has received several international awards such as: IEEE Communications Society Wireless Communications Technical Committee Recognition Award in 2003 for making contribution in the field of "Personal, Wireless and Mobile Systems and Networks", Telenor's Research Award in 2005 for impressive merits, both academic and organizational within the field of wireless and personal communication, 2014 IEEE AESS Outstanding Organizational Leadership Award for: "Organizational Leadership in developing and globalizing the CTIF (Center for TeleInFrastruktur) Research Network", and so on.

He has been Project Coordinator of several EC projects namely, MAGNET, MAGNET Beyond, eWALL and so on.

He has published more than 30 books, 1000 plus journal and conference publications, more than 15 patents, over 100 PhD Graduates and larger number of Masters (over 250). Several of his students are today worldwide telecommunication leaders themselves.

List of Participants:

- Ramjee Prasad, Aarhus University, Denmark

- Luis Muñoz, University of Cantabria, Spain

- Josef Noll, UiO/ITS, Norway

- Ingrid Moerman , Imec-Ghent, University, Belgium

- Rui Aguiar, University of Aveiro, Portugal

- Liljana Gavrilovska, Ss Cyril and Methodius University in Skopje, Macedonia

- Marja Matinmikko, University of Oulu, Finland

- Peter Lindgren, Åarhus University, Denmark

- Alberto Carreras, University of Málaga, Spain

- Leonardo Badia, University of Padova, Italy

- Chih-Cheng Tseng, National Ilan University, Taiwan

- Paulo Pereira Monteiro, University of Aveiro, Portugal

- Sadia Anwar, Aarhus University, Denmark

- Giuliana Contaldi, Laurentina Viaggi Srl, Rome, Italy

Session I; FWE Concept: Vision & Innovation

Session Chair

Luis Muñoz, University of Cantabria, Spain

Short Bio

Professor Luis Muñoz received both the Telecommunications Engineering degree and Ph.D. from the Polytechnical University of Cataluña (UPC), Spain, in 1990 and 1995, respectively. He also holds a Master in Mathematics, Statistic and Operation Research (Licenciado en Ciencias Matemáticas, UNED). He is head of the Network Planning and Mobile Communications Laboratory belonging to the Communications Engineering Department (DICOM) at the University of Cantabria, Spain. His research focuses on advanced data transmission techniques, heterogeneous wireless multihop networks, Internet o Things, technologies and services in the context of smart cities and applied mathematical methods for telecommunications. He has participated in several National and European research projects belonging to the 4th, 5th, 6th and 7th and H2020 Framework Program in which he was technical manager of Smart Santander. He has published over 150 journal and conference papers. He serves as editor of several journals and he has been invited to participate in the Steering Committee and Technical Program Committee of the most relevant international conferences. In parallel to this activity, he serves as consultant for the Spanish Government as well as for different companies in Europe and USA. Last but not least, he has served as expert of the ETSI and European Commission.

Speakers

Josef Noll, UiO/ITS , Norway

Short Bio

Josef Noll is Visionary at the Basic Internet Foundation and professor at the University of Oslo (UiO). Through the foundation he addresses "information for all" as the basis of sustainable development and digital inclusion. Regarding sustainable infrastructures, where communication and security are key topics for the transfer to a digital society, he leads the national initiative "Security in IoT for Smart Grids" (IoTSec.no), Norway's largest research project within IoT security. In 2017 the 20 partner opened the Smart Grid Security Centre to contribute to trusted and more secure power grids and smart home/city services.

He was leader of several EU and Eurescom projects. He is IARIA fellow, reviewer of EU FP7/H2020 projects, and evaluator of national and EU research programmes. His industrial background includes head of the 'Mobility and Personal Communications group' at Telenor R&D, staff member at the European Space Agency, and integrated circuit designer at SIEMENS.

Title: - Wireless Ecosystem for Sustainable Development

Abstract

2016 was a fantastic year from the mobile & wireless business point of view. For the first time, an IoT network was used for a network attack. The Mirai toolkit, taking out Dyn and thus Amazon, PayPal and others, demonstrated that the current security mechanisms for IoT devices are not appropriate. A second milestone was the service deployment of Telecom services over customer networks, namely Voice over Wifi (VoWifi).

Both examples show the necessity for partnership for future service delivery. Traditional Telecom services focussing on a desired service quality, will meet novel service requirements including trust, security and privacy.

The major change, also impacting the wireless industries, will come from the demands of the Agenda 2030 from the United Nations. The UNO member countries have agreed on 17 Sustainable Development Goals (SDG 2030), each of them being supported by indicators and measurable targets. Sustainability demands in terms of energy consumption and recycling, but also addressing education, health and equality in a global perspective.

Continuation of traditional, purely revenue-oriented thinking, has already put but mobile industry into the backseat when it comes to the adoption of digital services. Though, connecting he next billion through a freemium business model is a potential option for the future wireless ecosystem. The talk will provide examples of the Digital Inclusion pilot project in Africa (http://Digi.BasicInternet.no), establishing pilots for digital health in Tanzania and the wireless ecosystem in the Democratic Republic of Congo.

Ingrid Moerman , Imec-Ghent, University, Belgium

Short Bio

Ingrid Moerman received her degree in Electrical Engineering (1987) and the Ph.D. degree (1992) from the Ghent University, where she became a part-time professor in 2000. She is a staff member at IDLab, a core research group of imec with research activities embedded in Ghent University and University of Antwerp. Ingrid Moerman is coordinating the research activities on mobile and wireless networking, and she is leading a research team of about 30 members at Ghent University. Her main research interests include: Internet of Things, Low Power Wide Area Networks (LPWAN), High-density wireless access networks, collaborative and cooperative networks, intelligent cognitive radio networks, real-time software defined radio, flexible hardware/software architectures for radio/network control and management, and experimentally-supported research. Ingrid Moerman has a longstanding experience in running and coordinating national and EU research funded projects. At the European level, Ingrid Moerman is in particular very active in the Future Networks research area, where she has coordinated and is coordinating several FP7/H2020 projects (CREW, WiSHFUL, eWINE, ORCA) and participating in other projects (FLEX, Flex5Gware, Fed4FIRE+).

Ingrid Moerman has received 14 awards and prizes during her career, of which 9 best paper awards, 2 prizes awarded by FWO (Research Foundation - Flanders), the IMEC Prize of excellence 2001, one MSc Thesis Award (as promoter), and one best demo/exhibit award (at ICT 2013).

Ingrid Moerman is author or co-author of more than 700 publications in international journals or conference proceedings.

Title: - Radio softwarisation and virtualisation

Abstract

Our world is increasingly defined by software. Even sectors that used to rely mainly on hardware are changing rapidly. From use cases like self- driving cars to the inspection of factory plants, digital assets make the difference.
In line with this trend, Software Defined Radio (SDR) has emerged. With SDR, transceiver components that are typically implemented on hardware are now implemented by means of software. Software is not only easier and faster to develop, but also easier to upgrade and customise.
However, a pure software approach also has significant drawbacks. Although SDR shortens development cycles, programmers need to resort to hardware coded solutions (FPGA, ASIC) when low

latency operation and high throughput is required. Unfortunately, hardware coding is a time-consuming process in comparison to software-based solutions.

imec has solved the SDR software-hardware dilemma by building a platform with a novel software-hardware co-design philosophy. This platform offers software APIs for orchestration radio hardware. These APIs are associated with FGPA accelerators and an on-chip data and control network. As such, the platform offers the same flexibility and short development cycle as software, while still achieving the high performance of a hardware design. This platform further allows to instantiate multiple transceiver chains that can operate simultaneously on a single SDR device, just like running multiple programs on the same CPU. This SDR evolution triggers the future vision of "radio apps",

Rui Aguiar, University of Aveiro, Portugal

Short Bio

Rui L. Aguiar received his degree in telecommunication engineering in 1990 and his Ph.D. degree in electrical engineering in 2001 from the University of Aveiro. He is currently a Full Professor at the University of Aveiro, responsible for the networking area, and has been previously an adjunct professor at the INI, Carnegie Mellon University. He is a Visiting Research Scholar at Universidade Federal de Uberlândia, Brazil. He is coordinating a research line nationwide in Instituto de Telecomunicações, on the area of Networks and Multimedia. He is leading the Technological Platform on Connected Communities, a regional cross-disciplinary industry-oriented activity on smart environments.

His current research interests are centred on the implementation of advanced wireless networks and systems, with special emphasis on 5G networks and the Future Internet. He has more than 450 published papers in those areas, including standardization contributions to IEEE and IETF. He has served as technical and general chair of several conferences, from IEEE, ACM and IFIP, and is regularly invited for keynotes on 5G and Future Internet networks. He sits on the TPC of all major IEEE ComSoc conferences. He has extensive participation in national and international projects, of which the best example is his position as Chief Architect of the IST Daidalos project, and has extensive participation in industry technology transfer actions. He is currently associated with the 5G PPP Infrastructure Association and is the current Chair of the steering board of the Networld2020 ETP. He is a chartered engineer, senior member of IEEE, Portugal ComSoc Chapter Chair, and a member of ACM. He is associated editor of Wiley's ETT, Springers' Wireless Networks and of the recently launched Elsevier's ICT Express.

Title: - Deviceless communications

Abstract

Over the past two decades, we have been witnessing an evolution in the ability to connect people and things, using fast wired and wireless technologies while on the move. Evolutions made it possible for new services to be provided over this developing networking setting, integrating not only different types of access technologies and media, but also a plethora of new kinds of devices and applications that benefited from data interexchange. As a consequence, the heterogeneity and requirements have also become more stringent, which demanded a greater degree of networking preparedness and control. However, such control execution, in order to be able to provide not only good QoE and QoS, but, ultimately, a smooth experience, demands for a more flexible and dynamic approach towards its

execution. Devices with complementary characteristics, such as devices with screens, others with sound speakers, can easily co-exist in the nearby surroundings of other processing nodes, such as sensors, gateways or even smartphones. Currently, there is no uniform way for the different devices to tap into each other's' resources, and provide a magnified complementing experience to the users and applications, where a service can be provided in a much better way, by having the video being casted into a nearby (currently unused) TV screen, its sound being sent through powerful speakers, instead of the internal smartphone's counterparts. What if, in the nearby future, devices around us could interact and, according to the user needs and different application requirements, seamlessly and autonomically collaborate into an aggregated construct, able to provide augmented services to users? Which are the challenges, possibilities and main benefits of such a truly connected technological fabric? This paper will propose a model where user will no longer rely on his specific devices, but lead to the ultimately pervasive concept, of assuming the communication to be assured by his environment.

Liljana Gavrilovska,Ss Cyril and Methodius University in Skopje, Macedonia

Short Bio

Dr. Liljana Gavrilovska currently holds the position of full professor at the Faculty of Electrical Engineering and Information Technologies, Ss Cyril and Methodius University in Skopje. She is Head of the Center for Wireless and Mobile Communications (CWMC) working in the area of telecommunication networks and wireless and mobile communications. Prof. Gavrilovska participated in numerous EU funded projects such as ASAP, PACWOMAN, MAGNET, MAGNET Beyond, ARAGORN, ProSense, FARAMIR, QUASAR and ACROPOLIS, CREW and eWall; NATO funded projects such as RIWCoS and ORCA and several domestic research and applicative projects, mostly as a leader of national team. Her major research interest is concentrated on cognitive radio networks, future mobile systems, wireless and personal area networks, cross-layer optimizations, broadband wireless access technologies, ad hoc networking, traffic analysis and heterogeneous wireless networks. Dr. Gavrilovska is author/co-author of more than 200 research journal and conference publications and technical papers and several books and books' chapters. She is a senior member of IEEE.

Title: - Radio Access Virtualization in Future Wireless Ecosystems

Abstract

The paradigm of network virtualization penetrates in different aspects of future networking platforms inevitably affecting the design of future 5G systems. The legacy radio access networks, use static deployments and operation, and are inefficient in handling any spatio-temporal fluctuations of the traffic demand and are energy inefficient. Future wireless ecosystems will have to focus on cutting-edge technological concepts that will efficiently address the problems of legacy networks. Radio access virtualization represents an auspicious technology that can leverage high data rates and high radio access adaptability across software defined wireless networks. The concepts of virtualization in access domain affect the heterogeneous RANs and Machine-type access technologies. This presentation will present the visions and concepts behind radio access virtualization, specifically focusing on RAN and M2M virtualization. The presentation will also provide insights and initial results of an innovative demo set up capable of efficient virtualization of different types of wireless technologies.

Session II; FWE: Technology Oriented Business Models & Standardization

Session Chair

Rui Aguiar, University of Aveiro, Portugal

Short Bio

Rui L. Aguiar received his degree in telecommunication engineering in 1990 and his Ph.D. degree in electrical engineering in 2001 from the University of Aveiro. He is currently a Full Professor at the University of Aveiro, responsible for the networking area, and has been previously an adjunct professor at the INI, Carnegie Mellon University. He is a Visiting Research Scholar at Universidade Federal de Uberlândia, Brazil. He is coordinating a research line nationwide in Instituto de Telecomunicações, on the area of Networks and Multimedia. He is leading the Technological Platform on Connected Communities, a regional cross-disciplinary industry-oriented activity on smart environments.

His current research interests are centred on the implementation of advanced wireless networks and systems, with special emphasis on 5G networks and the Future Internet. He has more than 450 published papers in those areas, including standardization contributions to IEEE and IETF. He has served as technical and general chair of several conferences, from IEEE, ACM and IFIP, and is regularly invited for keynotes on 5G and Future Internet networks. He sits on the TPC of all major IEEE ComSoc conferences. He has extensive participation in national and international projects, of which the best example is his position as Chief Architect of the IST Daidalos project, and has extensive participation in industry technology transfer actions. He is currently associated with the 5G PPP Infrastructure Association and is the current Chair of the steering board of the Networld2020 ETP. He is a chartered engineer, senior member of IEEE, Portugal ComSoc Chapter Chair, and a member of ACM. He is associated editor of Wiley's ETT, Springers' Wireless Networks and of the recently launched Elsevier's ICT Express.

Speakers

Marja Matinmikko, University of Oulu, Finland

Short Bio

Dr. Marja Matinmikko is University Researcher and Project Manager at Centre for Wireless Communications (CWC), University of Oulu. Prior to joining CWC in 2016, she worked at VTT Technical Research Center of Finland Ltd in 2001-2015 where she led national spectrum sharing trial projects. Currently she manages uO5G project for developing a new micro operator concept to boost local service delivery in 5G from business, technology and regulatory perspectives. She holds a Dr.Sc. degree in Telecommunications Engineering from University of Oulu about spectrum sharing techniques, and is finalizing her Ph.D. degree in Industrial Engineering and Management on stakeholder analysis for Licensed Shared Access (LSA) concept. She received "Young Scientist of the Year" award in Finland in 2013 for her active collaboration between industry, academic, and regulatory domains. She chaired cognitive radio system (CRS) studies at ITU-R WP5A in 2012-2014. She has published around 100 scientific papers and 100 contributions to spectrum regulatory forums in Europe (CEPT) and globally (ITU).

Title: - Reshaping regulations for 5G micro operators

Abstract:-

5G is expected to disrupt the mobile communication business ecosystem and open the market to drastically new sharing based network operational models to serve different vertical sectors' customers. Operations in higher frequency bands and network slices will lower the investment barrier for new entrant micro operators to deploy local networks and offer versatile services. To realize the full vision of 5G to benefit the society and promote competition, innovation and emergence of new services, the current strict regulations governing electronic communications and particularly the mobile communication business will need to be revisited. This presentation will describe the regulatory landscape around mobile communication business ecosystem and identify the key changes needed to enable fast and scalable deployment of locally operated 5G small cell networks to realize its full benefits

Peter Lindgren, Åarhus University, Denmark

Short Bio:-

Professor Peter Lindgren, Peter Lindgren holds a full Professorship in Multi business model and Technology innovation at Aarhus University – Business development and technology innovation and has researched and worked with network based high speed innovation since 2000. He is author to several articles and books about business model innovation in networks and Emerging Business Models. He has been researcher at Politechnico di Milano in Italy (2002/03) and Stanford University, USA (2010/11) and has in the time period 2007 – 2010 been the founder and Center Manager of International Center for Innovation www.ici.aau.dk at Aalborg University. He works today as researcher in many different multi business model and technology innovations projects and knowledge networks among others E100 - http://www.entovation.com/kleadmap/, Stanford University project Peace Innovation Lab http://captology.stanford.edu/projects/peace-innovation.html, The Nordic Women in business project - www.womeninbusiness.dk/, The Center for TeleInFrastruktur (CTIF) at Aalborg University www.ctif.aau.dk, EU FP7 project about "multi business model innovation in the clouds" - www.Neffics.eu. He is co-author to several books. He has an entrepreneurial and interdisciplinary approach to research and has initiated several Danish and International research programmes.His research interests are multi business in technology innovation networks model and, multi business model typologies and new global business models.

Title: - multi business in technology innovation networks model

Abstract

The field of Artificial Intelligence (AI) has grown more and more important as a research topic in the technical and engineering community. Hardly any in the business model community have tried to work and research on this. How AI Be used in business model innovation can and what can we expect to gain from this new technology tool and opportunity.

Luis Muñoz, University of Cantabria, Spain

Short Bio

Professor Luis Muñoz received both the Telecommunications Engineering degree and Ph.D. from the Polytechnical University of Cataluña (UPC), Spain, in 1990 and 1995, respectively. He also holds a Master in Mathematics, Statistic and Operation Research (Licenciado en Ciencias Matemáticas, UNED). He is head of the Network Planning and Mobile Communications Laboratory belonging to the Communications Engineering Department (DICOM) at the University of Cantabria, Spain. His research focuses on advanced data transmission techniques, heterogeneous wireless multihop networks, Internet o Things, technologies and services in the context of smart cities and applied mathematical methods for telecommunications. He has participated in several National and European research projects belonging to the 4th, 5th, 6th and 7th and H2020 Framework Program in which he was technical manager of SmartSantander. He has published over 150 journal and conference papers. He serves as editor of several journals and he has been invited to participate in the Steering Committee and Technical Program Committee of the most relevant international conferences. In parallel to this activity, he serves as consultant for the Spanish Government as well as for different companies in Europe and USA. Last but not least, he has served as expert of the ETSI and European Commission.

Title: The Internet of Things and the Digital Single Market

Abstract

Forthcoming demands on cities worldwide have led urban ecosystem stakeholders to look for solutions which can guarantee the sustainability and efficiency of the everyday processes and services managed by them. It is needless to say that Internet of Things will play a key role in making cities much more liveable and efficient. However, so far there are many barriers which difficult the early adoption of such technologies. In this talk some of the potential enablers and standardization activities aiming at overcoming such barriers will be presented.

Sadia Anwar

Short bio

Sadia Anwar received her degree in doctor of Pharmacy in 2011 form Government College University, Pakistan. She had worked for three years as a community pharmacist and she also worked as a Clinical and Drug information consultant. Her areas of expertise were prescription checking for errors and selection of most appropriate dosage form. Supervise medicines if these are kept properly, quality checking of different dosage forms specially IV products their storage, and economical purchase of medication. Ward rounds for patient consultation and to check drug interactions by taking their history. To advise and arrange public awareness programs with medical colleges regarding toxicological information, Poison treatment and hazards management. She came to Denmark in December 2015 and started working as a Guest Researcher at CTiF in the department of electronic systems, Aalborg University under "IICT Endowment Fund for Sustainable Development Scheme" under the supervision of Professor Ramjee Prasad. She worked for Interdisciplinary area specifically more focused in 4 sections: medicine, Telecommunication, Big data and economics. She joined Aarhus University in 2016 and now her Research is focused on Efficient and cost effective future Health care, business models for future pharmaceutical industries to be more customized and patient oriented. Economic impacts of future health care using big data analytics and wireless broadband networks.

Title: 5G technology and smart health care standardization

Abstract

The use of smartphones has been increasing rapidly and it is expected that in future most people will have a smartphone capable of high speed Internet connection. The capability of smartphones with high definition display, computation power and multitude of sensors made it an excellent candidate for telemedicine application. Telemedicine's applications and high data medical information generally require high definition visuals and lower latency connection, in addition mobility and reliability. The next generation of wireless communication standard, known as 5G, will provide data speed in (Gigabit per second) Gb/s with lower latency and higher reliability connection, and can be better approach for future telemedicine. In this presentation, we survey the current state of telemedicine along with examining the characteristics of 5G technology. We also present research challenges concerning 5G and telemedicine standerization.

Panel Discussion I; FWE: Business Oriented Technology Paradigm

Moderator

Josef Noll, UiO/ITS, Norway

Panelists

- Luis Muñoz, University of Cantabria, Spain

- Peter Lindgren, Åarhus, University,Denmark

- Ingrid Moerman, Imec-Ghent University, Belgium

- Marja Matinmikko , University of Oulu, Finland

  - Chih-Cheng Tseng, National Ilan University, Taiwan

Session III; FWE: Applications, Services, and Security

Liljana Gavrilovska,Ss Cyril and Methodius University in Skopje, Macedonia

Short Bio

Dr. Liljana Gavrilovska currently holds the position of full professor at the Faculty of Electrical Engineering and Information Technologies, Ss Cyril and Methodius University in Skopje. She is Head of the Center for Wireless and Mobile Communications (CWMC) working in the area of telecommunication networks and wireless and mobile communications. Prof. Gavrilovska participated in numerous EU funded projects such as ASAP, PACWOMAN, MAGNET, MAGNET Beyond, ARAGORN, ProSense, FARAMIR, QUASAR and ACROPOLIS, CREW and eWall; NATO funded projects such as RIWCoS and ORCA and several domestic research and applicative projects, mostly as a leader of national team. Her major research interest is concentrated on cognitive radio networks, future mobile systems, wireless and personal area networks, cross-layer optimizations, broadband wireless access technologies, ad hoc networking, traffic analysis and heterogeneous wireless networks. Dr. Gavrilovska is author/co-author of more than 200 research journal and conference publications and technical papers and several books and books' chapters. She is a senior member of IEEE.

Speakers
Alberto Carreras, University of Málaga, Spain

Short Bio

Alberto Carreras received the engineering degree in Telecommunication Systems from the University of Málaga (Spain) in 2015, and he is currently studying M.Sc. in Mobile Communications Engineering. He joined the Communication Engineering Department, University of Málaga, in 2016, as an Associate Researcher, where he participates in R&D contracts with several industry partners related to cellular communications. His main research field is performance evaluation of mobile communication systems by developing and using simulation tools, especially over LTE networks and the latest progresses of mobile networks. His current research activity is focused on Cloud Ran and the impact of centralization over transmission efficiency in the radio access network.

Title: - eWM-SIM: An efficient system-link level simulator upgraded to LTE-A Pro

Abstract??

In this paper, we present a novel and efficient link-level simulation framework for the donwlink (DL) of Long Term Evolution Advanced Pro (LTEA Pro) cellular networks. The tool, called enhanced Wireless Mobile SIMulator (eWM-SIM), is available to be downloaded so that researchers can use it to evaluate the performance for different network configurations. In this work, the main characteristics of eWM-SIM are presented. As a case of use, the performance of the DL of a heterogeneous network is analyzed. In such kind of networks, it is usually to combine two types of access points: Macro Access Points (MAPs), with a regular coverage area; and Pico APs (PAPs), with a reduced coverage area. This combination allows to increase the bit rate of the network. Indeed, PAPs can help absorbing some charge from the MAP and thus increase the utility of a given bandwidth reserved to mobile networks. It is usually to increase the PAP area and, thus, the number of users associated to them, by means of a bias in the transmission power of the PAPs. However, this technique, known as Cell Range Expansion (CRE), can lead to a significant increase in the interference experienced by the offloaded users. To handle this challenge, several techniques based on inter-cell interference (eICIC) has been proposed. Among them, Almost Blank Subframe (ABS) has been selected to be implemented in eWM-SIM. In such technique, the radio resources are partitioned so that the MAP is active only on a certain fraction of them and is periodically muted on the remaining fraction. Doing that, the offloaded users are protected form MAP interference by scheduling them on those resources the MAP is muted. In this work, the Average Spectral Efficiency (ASE) of the network has been obtained with and without the application of such eICIC technique. Simulation results confirm that there

exist an optimal Cell Range Expansion (CRE) bias in the cell association that maximizes the ASE. This optimal value depends on whether it is applied or not an eICIC technique. Interestingly, it is confirmed that, in any case, this optimal bias does not depend on the number of PAPs, while increasing the number of PAPs leads to a higher ASE for the same bias.

Leonardo Badia, University of Padova, Italy,

Short Bio

Leonardo Badia graduated from the University of Ferrara, Italy, where he received his PhD in 2004. Between 2002 and 2003 he was on leave at the Royal Institute of Technology (KTH), Stockholm, Sweden, as a visiting researcher. From 2006 to 2011 he was with the IMT Advanced Study Institute, in Lucca, as an Assistant Professor. In 2011, he joined the Faculty of the University of Padova, Italy, where he is presently an Associate Professor. His research interests lie in the broad area of communication systems, computer networks, wireless networks, digital signal processing. Specifically, his main expertise is related to the following topics: game theory applied to wireless networking; network science for communications systems; cross-layer optimization for next generation systems; mathematical models of transmission protocols in multimedia scenarios.

Title: - The complexity of living beings in smart wireless networks

Abstract

The increasing complexity of wireless networks should also be reflected into a definition of structures for their analysis that allows for transcending their basic physical interactions. This is useful not only for the sake of a simpler representation but also because it is a fundamental descriptive elements of natural structures such as living beings, societies, and ecosystems. More specifically, we compare and assimilate three examples of networks: (i) a wireless next generation network, empowered with D2D communications; (ii) a smart city with delocalized services and management, including for example energy harvesting and crowdsensing; (iii) the human brain, that received a lot of attention in several research projects. All of these systems are characterized by an underlying physical connectivity that certainly is necessarily required for end-to-end delivery (e.g., of information, energy, public transportation, synapses). However, this aspect gives just a myopic perspective that neglects the grand view of the system. Indeed, logical connectivity and interdependencies are certainly more relevant than the physical interaction; on the other hand, they are often considered to be almost detached from reality, and also this extreme approach is dissatisfactory from an engineering perspective.

We argue that these aspects should be reflected by a proper network model, where physical interrelations are clearly considered as an enabler of the logical connectivity, yet the two are not totally disjoint and a true holistic representation of the network is made possible. We review network models that seem to be promising in this sense, in particular, multi-layered network structures appear to be well tailored to this end, and we evaluate their pros and cons. Finally, we

discuss how this can possibly lead to a unified view of wireless networks seen as living systems, and we highlight possible consequences of this approach.

Chih-Cheng Tseng, National Ilan University, Taiwan

Short Bio

Chih-Cheng Tseng received his B.S. and M.S. from the National Taiwan University of Science and Technology, Taipei, Taiwan, Republic of China, in 1994 and 1997 respectively, all in electronic engineering. He received his Ph. D. from the Graduate Institute of Communications Engineering, National Taiwan University, Taipei, Taiwan, Republic of China, in 2007.
He is currently an associate professor of the Department of Electrical Engineering, National Ilan University, I-Lan, Taiwan, Republic of China. He was a visiting researcher at the Center for TeleInFrastruktur (CTIF), Aalborg University, Denmark on 2007 summer.
He has been actively involved in professional activities, serving as a TPC Co-Chair of Qshine 2015, co-organizer of NGWiFi workshop in IEEE WCNC 2014, HetCarrierCom workshop in IEEE Globecom 2015, and 5G CAT workshop in Qshine 2016, general secretariat of WPMC 2012, special session organizer of the GWS 2013 and GWS 2014, and reviewer for international journals and conferences.
His research interests include the design and performance evaluation of the mobile communications (4G and beyond) and wireless ad hoc/sensor networks.

Title: - Analysis of DRX Mechanism for Next Generation Mobile Communication Networks

Abstract

Energy consumption is a major concern in future wireless communications due to the consensus for a greener world. 4G LTE-Advanced (LTE-A) is continuously evolving to 5G to meet the growing demands for high-speed wireless communications. However, high-speed signal processing on user equipment (UE) causes excessive power consumption. The discontinuous reception (DRX) mechanism is a critical technique for tackling this issue. Delay constraint and power savings are two contradictory performance metrics associated with the DRX mechanism. Using recursive deduction and Markov model, this talk introduces an in-depth analysis on the average delay and average power consumption of the DRX mechanism. Since the performance of the DRX mechanism is governed by a set of parameters that interact with one another in an intricate manner, the values of key parameters are tested to assess their impacts on the performance of the DRX mechanism. The obtained results give an insight into the improvement of the DRX mechanism for the next generation mobile communication networks.

Paulo Pereira Monteiro, University of Aveiro, Portugal

Short Bio

Paulo P. Monteiro received the diploma "Licenciatura" in Electronics and Telecommunications Engineering from the University of Aveiro in 1988, the M.Sc. in Electronic Engineering, from the University of Wales UK, in 1990 and the Ph.D. in Electrical Engineering, from the University of Aveiro, in 1999. Presently, he is Associate Professor at the University of Aveiro and Researcher at the Instituto de Telecomunicações. From October 2002 until March 2007 he was at Siemens S.A, Portugal as a Head of Research of Optical Networks. From April 2007 until June 2012 he was at Nokia Siemens Networks (NSN) Portugal as a Research Manager. From July 2012 until May 2013 he was research Manager at NSN Portugal. In May 2013, the Optical Networks business unit of Nokia Siemens Networks began operating as a new company Coriant where he left in June 2013. In 1992, he joined the Department of Electronic and Telecommunications Engineering of University of Aveiro and the Optical Communications Group of Institute for Telecommunications as an Assistant Professor and Researcher, respectively. In 1999, he became an Auxiliary Professor at the University of Aveiro and he was promoted to Associate Professor in 2005. His main research interests include Fixed Mobile Convergence, Optical communication Systems and Networks. He is coordinator of research infrastructure ORCIP (Optical Radio Convergence Infrastructure for Communications and Power Delivering) and he has been involved in several projects of the European Union programs on R&D, namely RACE projects: R1051 and R2011; in ACTS projects: ESTHER (AC063), UPGRADE (AC045) and SPEED (AC049); in IST projects: ATLAS (IST-1999-10626); MUFINS (IST-2002-004222) and TRIUMPH (IST-027638 STP). PIDEA EUREKA project THE MOST and in ICT project GALACTICO (ICT-2009-6-258407). He was the coordinator of a CELTIC project OPTRONET and a large-scale integrating project FUTON (FP7 ICT-2007–215533). Presently, he is the coordinator of the research infrastructure ORCIP (Optical Radio Convergence Infrastructure for Communications and Power Delivering) and project coordinator of RETIOT (Reflectometry Technologies to Enhance the Future Internet of Things) and SOCA (Smart Open CAmpus). He has authored/co-authored more than 18 patent applications and over 300 refereed papers and conference contributions.

Title: - Joint of Radar and Communication Systems for Beyond 5G

Abstract

The explosive growth of data traffic coupled with the explosion in the number of radars / sensors foreseen for the coming years will provide new challenges. Apart from the cost and size reduction, and improved spectrum efficiency, the integration of the two technologies brings

further benefits. Namely, the communication domain complements the radar domain information to enable the formation of higher resolution scene imagery and the radar domain is instrumental for the establishment, coordination and maintenance of a high capacity communication link through the effective use of the space domain. For example, the advantages of merging these two technologies such as: cooperative beam alignment, tracking capabilities and image resolution enhancement with lower bandwidth by sharing the information of several radars spatially distributed. The remaining bandwidth not used for radar imaging can be reutilized, for example, to alleviate the spectrum scarcity problem in sub 6GHz bands. The dual-functionality approach would allow intelligent transportation systems to simultaneously reap the benefits of autonomously sensing the driving environment (via radar) and cooperatively exchanging information such as velocity, braking, and entertainment content among vehicles (via communication). Similarly, to the case of the intelligent transportation system, sensing and communication are also fundamental for the IoT paradigm and therefore their unification will bring significant advantages for the Future of the IoT.

We will address the joining of radar and communication systems as a Future Wireless Ecosystem

Panel Discussion II; FWE: Project Concept

Moderator

Rui Aguiar, University of Aveiro, Portugal

- **Panelists**

- Liljana Gavrilovska, Ss Cyril & Methodius University in Skopje, Macedonia

- Josef Noll, UiO/ITS, Norway

- Alberto Carreras, University of Málaga, Spain

- Paulo Pereira Monteiro, University of Aveiro, Portugal

- Marja Matinmikko, University of Oulu, Finland

Concluding Remarks

Ramjee Prasad
President, CTIF Global Capsule,
Professor, Department of Business Development and Technology, Aarhus University,
Herning, Denmark