



# BalkanCom 2019

## 5G and Beyond



Third International Balkan Conference on  
Communications and Networking  
Skopje, North Macedonia, June 10-12, 2019

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# Message from General Chairs

Dear Participants,

It is our privilege and great honor to welcome you to Skopje for the Third BalkanCom conference. BalkanCom 2019 will pay focus on the exciting next-decade wireless technologies known as 5G.

The 5G rollout has already started, while further R&D for new features is still on-going. The deployment of 5G and other wireless technologies have a potential to transform sectors such as transportation, health, and energy and pave a way towards connected society. Undoubtedly unexpected challenges will arise in these new areas, opening opportunities to researchers.

The countries in the Balkan area are acknowledging these developments. In an attempt to be informed and to initiate active participation they initiated this technical forum of advanced researchers and industry to open a dialog and to exchange ideas.

We offer a warm welcome to all participants of BalkanCom 2019, and wish for a fruitful gathering that will inform, inspire and motivate academics, industry and young researchers.

General Co-Chairs,



**Liljana Gavrilovska**  
SS Cyril and Methodius  
University of Skopje  
North Macedonia



**Petri Mahonen**  
RWTH Aachen  
Germany



**Alberto Leon-Garcia**  
University of Toronto  
Canada

# Message from TPC Chairs

Dear participants of the third BalkanCom conference,

It is a great pleasure to warmly welcome you in the vibrant city of Skopje, in the heart of the Balkan Peninsula, for yet another edition of the premier telecommunications and networking conference in the Balkans. We are excited to share with you an exquisite program that combines state-of-the-art topics in the broad field of communications. We are looking forward to an open and informative time and exchange of ideas among peers from all over the world.

The umbrella topic of this year's edition is "5G and Beyond". As we are at the dawn of the inevitable unleash of the full potential of large-scale 5G networks, the conference targets keynotes, papers, presentations, panel and students' work in order to stimulate knowledge sharing and learning about the exciting prospects of 5G.

We thank the Conference co-chairs, our Macedonian hosts, the members of our Committee and the authors who have contributed their work and responded to our invitation. We received papers from all over the world. The program covers 4 regular sessions with 21 papers and 6 special sessions with 27 papers/presentations, 8 posters and 1 demo, all of which range from 5G architectural design, through 5G enablers and 5G algorithms to the integration of IoT and IoE concepts within future networks. We also have a student session with 9 papers/posters that show the potential of the future telecom researchers and professionals. In terms of number of submissions, this edition is by far the most successful one. We managed to gather 205 paper authors with 31.2% from the Balkan region. Additionally, we organized a teasing panel for all 5G-sceptics to discuss on possibilities for 5G fails and how to avoid it. We have world-class panelists renown for their work in the field. Last, but not least, we have three keynotes specifically targeting novel concepts to be introduced in 5G networks and beyond. We are proud to be able to continue the BalkanCom story and believe it will be a long and successful event in the years to come.

We wish you a successful conference and look forward to welcoming you in Skopje!

BalkanCom'19 TPC Chairs

Özgür Gürbüz, Wolfgang Gerstacker, Vladimir Atanasovski



**Ozgur Gurbuz**  
Sabanci University  
Turkey



**Wolfgang Gerstacker**  
FAU Erlangen-Nürnberg  
Germany



**Vladimir Atanasovski**  
SS Cyril and Methodius  
University of Skopje  
North Macedonia

# Keynotes

## Machine Learning Enables uRLLC in Vehicular Networks



**Kwang-Cheng Chen**  
Professor  
University of South Florida  
Tampa (FL), USA

Autonomous vehicles emerge as a critical technology toward digital society. To satisfy the ultimate reliability and safety, ultra-reliable and low latency communication (uRLLC) in vehicular networks warrants the success of massive operation of autonomous vehicles. By considering multi-scale control, effective cloud computing, edge computing, and on-board computing, a new technological paradigm is required to facilitate smooth real-time functioning to interact with environments and other agents. Based on the proactive open-loop wireless communication and virtual-cell, anticipatory mobility management to predict proactive network association warrants the realization of uRLLC in vehicular networks. Machine learning techniques fitting mobile networks lead to successful anticipatory mobility management taking processing scenario and data integrity into account, which is further verified using a real-world vehicular dataset. Machine learning indeed enables, not just enhances, future mobile networking technology, and fundamentally suggests new network architecture to incorporate machine learning.

## Graph Signal Processing: Connections to Distributed Optimization and Deep Learning



**Geert Leus**  
Professor  
TU Delft  
Netherlands

One of the cornerstones of the field of graph signal processing are graph filters, direct analogues of time-domain filters, but intended for signals defined on graphs. In this talk, we give an overview of the graph filtering problem. More specifically, we look at the family of finite impulse response (FIR) and infinite impulse response (IIR) graph filters and show how they can be implemented in a distributed manner. To further limit the communication and computational complexity of such a distributed implementation, we also generalize the state-of-the-art distributed graph filters to filters whose weights show a dependency on the nodes sharing information. These so-called edge-variant graph filters yield significant benefits in terms of filter order reduction and can be used for solving specific distributed optimization problems with an extremely fast convergence. Finally, we will overview how graph filters can be used in deep learning applications involving data sets with an irregular structure. Different types of graph filters can be used in the convolution step of graph convolutional networks leading to different trade-offs in performance and complexity. The numerical results presented in this talk illustrate the potential of graph filters in distributed optimization and deep learning.

# Load Modulated Antenna Arrays: Digital RF Beyond the PA



**Ralf R. Müller**

Professor

FAU Erlangen-Nürnberg

Germany

Multiantenna transmitters are commonly associated with many additional complications when it comes to hardware design. Still many antennas, by means of the law of large numbers, allow us to make a virtue out of necessity. Few or even a single power amplifier can drive all antenna elements whose data streams are digitally and independently modulated directly before or even after the antenna connector with the help of digital RF switches directly controlled by baseband circuitry. Digital-to-analog conversion, circuit matching, and mitigation of mutual antenna coupling are subject to optimization by means of real-time signal processing. Error-vector magnitudes are to be measured in terms of the electromagnetic field on air. While load modulated arrays are highly promising for massive MIMO and millimeter wave technology, new technological challenges have to be met: RF-switches must meet the speed and power requirements of modern communication systems. Spectral shaping is a serious challenge and standing waves between various antenna elements must be avoided. This keynote gives an overview of the state-of-the-art of load modulated arrays, in general, and provides partial solutions for some of the main challenges that come with this promising technology.

# Technical Program - at a glance

<b>BalkanCom 2019</b>				
	<b>June 10 (Mon)</b>	<b>June 11 (Tue)</b>	<b>June 12 (Wed)</b>	
<b>08:30</b> -	<b><u>Opening and Welcome</u></b>	<b>Start at 09:00</b>		<b>08:30</b>
<b>11:00</b>	<b><u>Session 1:</u></b> <b><u>Post-5G Wireless</u></b> <b><u>Communication</u></b>	<b><u>Session 5:</u></b> <b><u>Softwarization in</u></b> <b><u>Communication Systems</u></b>	<b><u>Session 8:</u></b> <b><u>5G Systems</u></b>	<b>11:00</b>
<b>11:00</b> -	<b>Coffee Break</b> <b>(<u>Poster Session 1</u>)</b>	<b>Coffee Break</b> <b>(<u>Poster Session 2</u>)</b>	<b>Coffee Break</b> <b>(<u>Poster Session 3</u>)</b>	<b>11:00</b> -
<b>11:20</b>	<b><u>Session 2:</u></b> <b><u>Machine Learning for the</u></b> <b><u>Networks of the Next</u></b> <b><u>Decade</u></b>	<b><u>Panel:</u></b> <b><u>How 5G may fail and how</u></b> <b><u>to avoid it</u></b>	<b><u>Session 9:</u></b> <b><u>Wireless Sensor Networks</u></b>	<b>11:20</b> -
<b>12:40</b>				<b>12:40</b>
<b>12:40</b> -	<b>Lunch Break</b>	<b>Lunch Break</b>	<b><u>Keynote 3:</u></b> <b><u>Ralf R. Müller</u></b>	<b>12:40</b> -
<b>13:40</b>				<b>13:40</b>
<b>13:40</b> -	<b><u>Keynote 1:</u></b> <b><u>Kwang-Cheng Chen</u></b>	<b><u>Keynote 2:</u></b> <b><u>Geert Leus</u></b>	<b>Lunch Break</b>	<b>13:40</b> -
<b>14:40</b>				<b>15:00</b>
<b>14:40</b> -	<b><u>Session 3:</u></b> <b><u>Terahertz Communications</u></b>	<b><u>Session 6:</u></b> <b><u>Internet of Everything</u></b>	<b><u>Session 10:</u></b> <b><u>Wireless Power Transfer</u></b> <b><u>for Future Communication</u></b> <b><u>Networks</u></b>	<b>15:00</b> -
<b>16:00</b>				<b>16:20</b>
<b>16:00</b> -	<b>Coffee Break</b> <b>(<u>Poster Session 1</u>)</b>	<b>Coffee Break</b> <b>(<u>Poster Session 2</u>)</b>	<b>Coffee Break</b> <b>(<u>Poster Session 3</u>)</b>	<b>16:20</b> -
<b>16:20</b>				<b>16:40</b>
<b>16:20</b> -	<b><u>Session 4:</u></b> <b><u>Cloudification and SDN</u></b>	<b><u>Session 7:</u></b> <b><u>IoT and Multimedia</u></b> <b><u>Streaming</u></b>	<b><u>Session 11:</u></b> <b><u>Student Session</u></b>	<b>16:40</b> -
<b>18:00</b>				<b>18:20</b>
<b>18:15</b> -	<b>Welcome Reception</b>	<b>Tour</b>	<b>Closing Ceremony</b>	<b>18:20</b> -
<b>20:00</b>		<b>Banquet</b>		<b>18:40</b>

# Detailed Technical Program

## **Opening Ceremony**

**Time: Monday, June 10, 2019 - 8:30 - 9:10**

Welcome by the conference General Chairs, followed by addressing notes from the Ministry for Information Society and Administration (Mr. Damjan Manchevski) and the CEO of Makendonski Telecom (Mr. Nikola Ljushev), and the welcome and introduction from the conference TPC Chairs.

## **Session 1: Post 5G Wireless Communication**

**Time: Monday, June 10, 2019 - 9:10 – 10:50**

**Chair: Petar Popovski**

### **Post-Moore's Law Perspectives on Beyond-5G Systems**

Onur Sahin (Interdigital, UK)

### **Learning to learn in mMTC networks**

Ivana Nikolovska (Monash University, Australia)

### **Automatic Modulation Classification Using Parallel Fusion of Convolutional Neural Networks**

Erma Perenda (KU Leuven, Belgium); Sreeraj Rajendran (KU Leuven, Belgium); Sofie Pollin (KU Leuven, Belgium)

### **Modern Random Access for Beyond-5G Systems: a Multiple-Relay ALOHA Perspective**

Andrea Munari (German Aerospace Center, Germany); Federico Clazzer (German Aerospace Center (DLR), Germany)

### **Machine-type Wireless Communications Enablers for post-5G Systems**

Hirley Alves (University of Oulu, Finland); Parisa Nouri (University of Oulu, Finland); Onel Luis López (University of Oulu, Finland); Matti Latvaaho (University of Oulu, Finland)

## **Poster Session 1:**

**Time: Monday, June 10, 2019 – 11:00 - 11:20**

### **Collaborative Hierarchical Caching in ICN-Based 5G Networks**

Furkan Küçük (TOBB University of Economics and Technology, Turkey); Mustafa Kağan Çetin (TOBB University of Economics and Technology, Turkey); Melda Yüksel (TOBB University of Economics and Technology, Turkey); Tolga Girici (TOBB University of Economics and Technology, Turkey)

### **A Cooperative Overlay Approach at the Physical Layer of Cognitive Radio for Digital Agriculture**

Abdul Salam (Purdue University, USA); Umit Karabiyik (Purdue University, USA)

### **Injection Locking in Optical Access Networks for Broadband 5G Mobile Networks**

Jakup Ratkoceri (Ipko Telecommunication, Kosovo); Bujar Krasniqi (University of Prishtina, Kosovo); Bostjan Batagelj (University of Ljubljana, Slovenia)

### **Assessment of Data Privacy and Security in Smart Grid Applications**

Petar Krstevski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Aleksandra Krkoleva Mateska (Ss. Cyril and Methodius University in Skopje, North Macedonia); Stefan Borozan (Ss. Cyril and Methodius University in Skopje, North Macedonia)

## **Session 2: Machine Learning for the Networks of the Next Decade**

**Time: Monday, June 10, 2019 - 11:20 – 12:40**

**Chair: Merouane Debbah**

### **The research challenges for the next decade in wireless communications**

Merouane Debbah, CentraleSupélec and Huawei, France

### **Team Deep Learning for Decentralized Optimization in Wireless Communications**

Minhoe Kim (Eurecom, France), Paul De Kerret (Eurecom, France); David Gesbert (Eurecom, France)

### **Deep Learning-Aided Generalized Frequency Division Multiplexing**

Merve Turhan (Istanbul Technical university); Ersin Ozturk (Netas Telekomunikasyon A. S., Turkey); Hakan A. Çırpan (Istanbul Technical University, Turkey)

## **Keynote 1:**

### **Machine Learning Enables uRLLC in Vehicular Networks**

**Kwang-Cheng Chen (University of South Florida, USA)**

**Time: Monday, June 10, 2019 - 13:40 – 14:40**

## **Session 3: Terahertz Communications**

**Time: Monday, June 10, 2019 - 14:40 – 16:00**

**Chair: Ian Akyildiz**

### **Stochastic Antenna Misalignment Impact on the Antenna Gains in the THz Band**

Joonas Kokkonen (University of Oulu, Finland); Alexandros-Apostolos A Boulogeorgos (University of Piraeus, Greece); Mubarak Aminu (University of Oulu, Finland), Janne Lehtomäki (University of Oulu, Finland), Angeliki Alexiou (University of Piraeus, Greece), Markku Juntti (University of Oulu, Finland)

### **Analysis of Intelligent Reflecting Surface in Indoor Terahertz Communication Systems**

Xinying Ma (University of Electronic Science and Technology of China, P.R. China); Ningyuan Kuang (University of Electronic Science and Technology of China, P.R. China); Zhuoxun Li (University of Electronic Science and Technology of China, P.R. China); Wenjie Chen (University Of Electronic Science And Technology Of China, P.R. China); Yaojia Chi (University of Electronic Science and Technology of China, P.R. China); Qiye Wen (University of Electronic Science and Technology of China, P.R. China); Zhi Chen (University of Electronic Science and Technology of China, P.R. China)

### **Approximate Message Passing for Indoor THz Channel Estimation**

Viktoria Schram (Friedrich-Alexander University Erlangen-Nürnberg, Germany); Ali Bereyhi (Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany); Jan-Nico Zaech (Friedrich-Alexander University Erlangen-Nürnberg, Germany); Ralf R. Müller (Friedrich-Alexander Universität Erlangen-Nürnberg, Germany); Wolfgang Gerstacker (University of Erlangen-Nuernberg, Germany)

### **Terahertz-Band Communications for Aerial Vehicles at Different Altitudes**

Akhtar Saeed (Sabanci University, Turkey); Ozgur Gurbuz (Sabanci University, Turkey); Mustafa Alper Akkaş (Abant İzzet Baysal University, Turkey)

## **Poster Session 1:**

**Time: Monday, June 10, 2019 - 16:00 – 16:20**

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Furkan Küçük (TOBB University of Economics and Technology, Turkey); Mustafa Kağan Çetin (TOBB University of Economics and Technology, Turkey); Melda Yüksel (TOBB University of Economics and Technology, Turkey); Tolga Girici (TOBB University of Economics and Technology, Turkey)



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## **Session 4: Cloudification and SDN**

**Time: Monday, June 10, 2019 - 16:20 – 18:00**

**Chair: Alberto Leon-Garcia**

### **Performance Evaluation in Cloud-Edge Hybrid Gaming Systems**

Athanasios Tshipis (Ionian University, Greece); Konstantinos Oikonomou (Ionian University, Greece); Vasileios Komianos (Ionian University, Greece); Ioannis Stavrakakis (National and Kapodistrian University of Athens, IMDEA Networks & UC3M, Greece)

### **End-to-end Network Slicing for 5G in Multi-Region, Multi-Tenant Cloud Platform**

Simona Marinova (University of Toronto, Canada); Thomas Lin (University of Toronto, Canada); Hadi Bannazadeh (University of Toronto, Canada); Alberto Leon-Garcia (University of Toronto, Canada)

### **Performance Evaluation of SDN-based 5G Core Networks**

Strahil Panev (Ss. Cyril and Methodius University in Skopje and Ericsson Telecommunications, North Macedonia); Pero Latkoski (Ss Cyril and Methodius University in Skopje, North Macedonia)

### **Increasing path control within the Internet Core with Segment Routing across IXPs**

Kristina Dzeperoska (University of Toronto, Canada); Ali Tizghadam (TELUS and University of Toronto, Canada); Hadi Bannazadeh (University of Toronto, Canada); Alberto Leon-Garcia (University of Toronto, Canada)

### **Software platform for network testing with DPDK traffic generators**

Hasan Redžović (University of Belgrade, Serbia); Aleksandra Smiljanić (University of Belgrade, Serbia); Mihailo Vesović (University of Belgrade, Serbia)

## **Session 5: Softwarization in Communication Systems**

**Time: Tuesday, June 11, 2019 – 09:00 – 11:00**

**Chair: Ivan Seskar**

### **Is network softwarization an enabler for AI-as-a-Service?**

Alberto-Leon Garcia (University of Toronto, Canada)

### **Experimental deployment of Virtualized RAN**

Daniel Denkovski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Valentin Rakovic (Ss. Cyril and Methodius University in Skopje, North Macedonia); Liljana Gavrilovska (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Rethinking SDN Security: Controller Paralysis**

Pelin Angin (Middle East Technical University, Turkey); Alper Kaan Sirica (Middle East Technical University, Turkey); Ertan Onur (Middle East Technical University, Turkey)

### **Virtual Radios, Real Services**

Luiz DaSilva (Trinity College Dublin, Ireland)

### **Semantic Approach to Adaptivity of 5G Services**

Nenad Petrovic (University of Nis, Serbia); Milorad Tomic (University of Nis, Serbia)

### **Next Generation of Wireless Network Softwarization Testbeds**

Ivan Seskar (Rutgers University, USA)

## **Poster Session 2:**

**Time: Tuesday, June 11, 2019 - 11:00 - 11:20**

### **Demo: Semantic-driven Automated Code Generation for Autonomous Devices Coordination**

Nenad Petrovic (University of Nis, Serbia); Milorad Tomic (University of Nis, Serbia)

### **Design of SDN Manageable Switch**

Petar D. Bojovic (Union University in Belgrade, Serbia); Jelena Šuh (Telekom Srbija, Serbia); Nikola Gavrić (Faculty of Technical Sciences, Serbia); Živko Bojović (Faculty of Technical Sciences, Serbia)

### **An Advanced Real-Time Rainfall Monitoring System Based on Commercial Satellite Broadcasting Service**

Gian Luigi Gragnani (University of Genoa, Italy); Matteo Colli (Artys srl, Italy); Andrea Caridi (Artys srl, Italy); Alessandro Delucchi (Artys srl, Italy); Daniele Caviglia (University of Genoa, Italy)

### **Matching Competitive and Cooperative Game Theory in single ICT Model for Energy Efficiency**

Igor Bimbiloski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Aleksandar Risteski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Secure Fleet Management of IoT-based Intelligent Transportation Services**

Zacharenia Garofalaki (University of Piraeus, Greece); Dimitrios Kallergis (University of Piraeus, Greece); Christos Douligeris (University of Piraeus, Greece)

## **Panel: How 5G may fail and how to avoid it?**

**Time: Tuesday, June 11, 2019 - 11:20 – 12:40**

**Organizer: Petar Popovski**

We are at the start of a rollout of the 5G wireless communication systems, which are promising to fundamentally change various industries, services and vertical sectors. There is a saying that only the even generations are successful (2G, 4G), such that 5G is doomed to fail and wait for the next generation. But, besides this semi-supersitious argument, there may be other solid arguments that 5G will not deliver the revolutionary promises. The objective of the panel discussion is to identify the threats to the success of the 5G wireless systems and highlight some of the possible remedies.

**Panelists: Luiz DaSilva (Trinity College Dublin, Ireland); Driton Emini (Magenta Telekom, Austria); Alberto Leon Garcia (University of Toronto, Canada); Petri Mähönen (RWTH Aachen University, Germany); Ivan Seskar (Rutgers University, USA); Merouane Debbah (CentraleSupélec and Huawei, France)**

## **Keynote 2:**

### **Graph Signal Processing: Connections to Distributed Optimization and Deep Learning**

**Geert Leus (TU Delft, The Netherlands)**

**Time: Tuesday, June 11, 2019 - 13:40 – 14:40**

## **Session 6: Internet of Everything**

**Time: Tuesday, June 11, 2019 – 14:40 – 16:00**

**Chair: Ergin Dinç**

### **On the Limits of Molecular Communication with Coexisting Biological Systems**

Malcolm Egan (INRIA, France); Bayram Cevdet Akdeniz (INRIA, Turkey)

### **Overcoming Blockage with Artificial Potential Field Assisted Mirror Reflectors for Internet of Things in the Terahertz Band**

Manus Pengnoo (Chulalongkorn University, Thailand); Michael Taynnan Barros (Waterford Institute of Technology & Telecommunications Software and Systems Group, Ireland); Lunchakorn Wuttisittikulij (Chulalongkorn University, Thailand); Widhyakorn Asdornwiset (Chulalongkorn University, Thailand); Alan Davy (Waterford Institute of Technology, Ireland); Sasitharan Balasubramaniam (Tampere University of Technology, Finland)

### **Dynamic Energy Management in Web of Things based Smart Homes**

Bhagya Nathali Silva (Kyungpook National University, Korea); Murad Khan (Sarhad University of Sciences and Information Technology, Pakistan); Kyuchang Lee (Kyungpook National University, Korea); Yongtak Yoon (Kyungpook National University, Korea); Muhammad Diyan (Kyungpook National University, Korea); Jihun Han (Kyungpook National University, Korea); Ki Jun Han (Kyungpook National University, Korea)

### **Distributed Scheduling in 6TiSCH Networks based on "On-The-Fly" (OTF) Bandwidth Adaptation**

Gordana Gardasevic (University of Banja Luka, Bosnia and Herzegovina)

## **Poster Session 2:**

**Time: Tuesday, June 11, 2019 - 16:00 – 16:20**

### **Demo: Semantic-driven Automated Code Generation for Autonomous Devices Coordination**

Nenad Petrovic (University of Nis, Serbia); Milorad Tosic (University of Nis, Serbia)

### **Design of SDN Manageable Switch**

Petar D. Bojovic (Union University in Belgrade, Serbia); Jelena Šuh (Telekom Srbija, Serbia); Nikola Gavrić (Faculty of Technical Sciences, Serbia); Živko Bojović (Faculty of Technical Sciences, Serbia)

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### **Matching Competitive and Cooperative Game Theory in single ICT Model for Energy Efficiency**

Igor Bimbiloski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Aleksandar Risteski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Secure Fleet Management of IoT-based Intelligent Transportation Services, Zacharenia Garofalaki**

Zacharenia Garofalaki (University of Piraeus, Greece); Dimitrios Kallergis (University of Piraeus, Greece); Christos Douligeris (University of Piraeus, Greece)

## **Session 7: IoT and Multimedia Streaming**

**Time: Tuesday, June 11, 2019 – 16:20 – 18:00**

**Chair: Mihael Mohorcic**

### **High Traffic - Low Cost Video Streaming in Content Delivery Networks**

Hakan Kışsaboğlu (Medianova CDN, Turkey); Ahmet Arış (Medianova CDN, Turkey); Seçkin Alan (Medianova Internet Services, Turkey); Berk Canberk (İstanbul Technical University, Turkey)

### **Joint Multipath Flow and Layer Allocation for Scalable Video Streaming**

Yamaç Ergiz (TOBB University of Economics and Technology, Turkey); Murat Demirtaş (University of California at Irvine, USA); Tolga Girici (TOBB University of Economics and Technology, Turkey)

### **An Experimental Comparison between ELASTIC and YouTube Adaptive Video Streaming Algorithms**

Luca De Cicco (Politecnico di Bari, Italy); Saverio Mascolo (Politecnico di Bari, Italy); Vittorio Palmisano (Politecnico di Bari, Italy)

### **IoTStream: Android application service and backend implementation for IoT data streaming**

Kristijan Veljanovski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Daniel Denkovski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Automated Initial Configuration of Wireless Embedded Devices in the Internet of Things**

Ivan Boskov (Jozef Stefan Institute, Slovenia); Matevz Vucnik (Jozef Stefan Institute, Slovenia); Carolina Fortuna (Jozef Stefan Institute, Slovenia); Mihael Mohorcic (Jozef Stefan Institute, Slovenia)

## **Session 8: 5G Systems**

**Time: Wednesday, June 12, 2019 – 08:30 – 10:50**

**Chair: Liljana Gavrilovska**

### **Analysis of Capacity Bounds for Ultra Reliable Low Latency Communications**

Evgeny Khorov (IITP RAS, Russia); Artem Krasilov (NRU HSE, IITP RAS, Russia); Ilya Selnitskiy (MIPT & IITP RAS, Russia); Mikhail Tsaritsyn (IITP RAS & MIPT, Russia)

### **Reducing Cyclic Prefix Noise in OFDM Based Full-Duplex Systems**

Hayrettin Ayar (Sabanci University, Turkey); Ozgur Gurbuz (Sabanci University, Turkey)

### **On the Extension of LTE and LTE-A PRACH Receiver Design to 5G New Radio**

Francesco Linsalata (Politecnico di Milano, Italy); Maurizio Magarini (Politecnico di Milano, Italy); Riccardo Ferrari (Azcom Technology, Italy)

### **A City-Wide Experimental Testbed for Next Generation Wireless Networks**

Zhongyuan Zhao (University of Nebraska-Lincoln, USA); Mehmet Can Vuran (University of Nebraska-Lincoln, USA); Zahra Aref (University of Nebraska-Lincoln, USA); David Young (City of Lincoln, USA); Warren Humphrey (Olsson, USA); Steve Goddard (University of Nebraska-Lincoln, USA); Garhan Attebury (University of Nebraska-Lincoln, USA); Blake France (University of Nebraska-Lincoln, USA); Baofeng Zhou (University of Nebraska-Lincoln, USA); Mohammad M. R. Lunar (University of Nebraska-Lincoln, USA)

### **Using open source software for antenna design: a short review**

Gian Luigi Gragnani (University of Genoa, Italy); Claudio Montecucco (University of Genoa, Italy)

### **Strong Secrecy for general multiple-access wiretap channels**

Manos Marios Athanasakos (National Kapodistrian University of Athens, Greece); Nicholas Kalouptsidis (National Kapodistrian University of Athens, Greece)

**Solving a resource allocation problem in RFB-based 5G wireless networks** Chenghao Wang (University of Technology of Compiègne, France); Fabio D'Andreagiovanni (CNRS, Sorbonne University - UTC, France); Dritan Nace (Compiègne University of Technology, France)

## **Poster Session 3:**

**Time: Wednesday, June 12, 2019 - 11:00 - 11:20**

### **Calculation of Probability Characteristics for the Queuing System with Batched Arrivals and Walking Times**

Anastasiia Sochenkova (RUDN University, Russia); Natalia Podzharaya (RUDN University, Russia);

### **Effect of Different Channel Models on NOMA Superiority Condition**

Enis Körpe (Ege University, Turkey); Bilge Kartal (Ege University, Turkey)

### **Open Source MANO (OSM) and its benefits**

Borche Jovanovski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Energy Efficient Transmission Mode Selection for Cellular Vehicle to Everything Communications**

Merve Saimler (Koc University, Turkey); Sinem Çöleri Ergen (Koç University, Turkey)

## **Session 9: Wireless Sensor Networks**

**Time: Wednesday, June 12, 2019 – 11:20 – 12:40**

**Chair: Gordana Gardasevic**

### **Low-cost Device Implementation of a Topology Independent MAC (TiMAC) Policy**

Asterios Papamichail (Ionian University, Greece); Vasileios Dragonas (Ionian University, Greece); George Koufoudakis (Ionian University, Greece); Konstantinos Oikonomou (Ionian University, Greece); Georgios Tsoumanis (University of Ioannina, Greece); Ioannis Stavrakakis (National and Kapodistrian University of Athens, IMDEA Networks & UC3M, Greece)

### **IoT Platform for Smart Home Energy Efficiency and Optimal Lighting Control**

Igor Janchev (Managed Services, SEAVUS Group, North Macedonia); Tomislav Shuminoski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Toni Janevski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **A Distributed Method to Organize Terrestrial Nodes to Facilitate Short Drone Routes in WSNs**

Konstantinos Skiadopoulos (Ionian University, Greece); Konstantinos Giannakis (Ionian University, Greece); Konstantinos Oikonomou (Ionian University, Greece); Ioannis Stavrakakis (National and Kapodistrian University of Athens, IMDEA Networks & UC3M, Greece); Sofia Fanarioti (Ionian University, Greece)

### **Electromagnetic-Based Wireless Sensor Networks for Natural Gas Pipeline and Reservoir Monitoring**

Mustafa Alper Akkaş (Abant İzzet Baysal University, Turkey)

## **Keynote 3:**

### **Load Modulated Antenna Arrays: Digital RF Beyond the PA**

**Ralf R. Müller (University of Erlangen-Nuernberg, Germany)**

**Time: Wednesday, June 12, 2019 - 12:40 – 13:40**

## **Session 10: Wireless Power Transfer for Future Communication Networks**

**Time: Wednesday, June 12, 2019 – 15:00 – 16:20**

**Chair: Dejan Vukobratovic**

### **RF Energy Harvesting ALOHA Networks with Local Channel State Information**

Slavche Pejovski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Zoran Hadzi-Velkov (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Coded Random Access for Wireless Powered Communication Networks**

Jelena Bjelica (University of Novi Sad, Serbia); Milica Petkovic (University of Novi Sad, Serbia); Dragana Bajovic (University of Novi Sad, Serbia); Dejan Vukobratović (University of Novi Sad, Serbia)

### **UAV-assisted Wireless Powered Sensor Network over Hoyt Fading Channels**

Tharindu Ponnimbaduge Perera (National Research Tomsk Polytechnic University, Russia); Stefan Panić (Tomsk Polytechnic University & University of Priština, Serbia); Dushantha Nalin K. Jayakody (National Research Tomsk Polytechnic University, Russia); Caslav Stefanovic (Faculty of Natural Sciences and Mathematics, Kosovska Mitrovica, Serbia); Neeraj Kumar (Thapar University Patiala, India); Sahil Garg (École de Technologie Supérieure, Canada)

### **On the Maximum Energy Transmission Rate in Ultra-Reliable and Low Latency SIET**

Nizar Khalfet (INRIA, France); Samir M. Perlaza (INRIA, France)

## **Poster Session 3:**

**Time: Wednesday, June 12, 2019 - 16:20 – 16:40**

### **Calculation of Probability Characteristics for the Queuing System with Batched Arrivals and Walking Times**

Anastasiia Sochenkova (RUDN University, Russia); Natalia Podzharaya (RUDN University, Russia);

### **Effect of Different Channel Models on NOMA Superiority Condition**

Enis Körpe (Ege University, Turkey); Bilge Kartal (Ege University, Turkey)

### **Open Source MANO (OSM) and its benefits**

Borche Jovanovski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Liljana Gavrilovska (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Energy Efficient Transmission Mode Selection for Cellular Vehicle to Everything Communications**

Merve Saimler (Koc University, Turkey); Sinem Çöleri Ergen (Koç University, Turkey)

## **Session 11: Student Session**

**Time: Wednesday, June 12, 2019 – 16:40 – 18:20**

**Chair: Enrico Natalizio and Pero Latkoski**

### **Design of DGT-based Linear Receivers for GFDM Transmission in Broadband Channels**

Francesco Linsalata (Politecnico di Milano, Italy); Maurizio Magarini (Politecnico di Milano, Italy); Atul Kumar (Technische Universität Dresden, Germany)

### **Analysis of Cooperative Hybrid ARQ with Adaptive Modulation and Coding on a Correlated Fading Channel**

İbrahim Ozkan (Hacettepe University, Turkey)

### **Performance of Load Balancing Algorithms for SDN Controlled Data Center Networks with Leaf-Spine Topology**

A. Furkan Okuyucu (Sabanci University, Turkey); Cem Karataş (Sabanci University, Turkey); Albert Levi (Sabanci University, Turkey); Özgür Gürbüz (Sabanci University, Turkey)

### **Toward scalable architecture for the next generation Blockchain-based Healthcare systems**

Jovan Karamachoski (Ss. Cyril and Methodius University in Skopje, North Macedonia); Liljana Gavrilovska (Ss. Cyril and Methodius University in Skopje, North Macedonia)

### **Towards end-to-end Speech Recognition in Macedonian Language**

Marija Trajanoska (Ss. Cyril and Methodius University in Skopje, North Macedonia), Hristijan Gjoreski (Ss. Cyril and Methodius University in Skopje, North Macedonia)

## **Closing Ceremony**

**Time: Wednesday, June 12, 2019 - 18:20 - 18:40**

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