



9th International Conference on Network of the Future - NoF 2018

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Program NoF 2018

NoF 2018					
19/11/2018		20/11/2018		21/11/2018	
8:15	Registration	8:30	Registration	8:30	Registration
9:15	Welcome	9:00	Keynote 2: Christian Destré "NFV/SDN orchestration: facing myths and reality"	9:00	Session 4: "Data and traffic analysis"
9:30	Keynote 1: Bruce Maggs "A Speed-of-Light Internet Service Provider"	10:00	Break	10:20	Break
10:30	Break	10:30	Session 3: "Security and planning"	11:00	Keynote 3: Hanna Bogucka "Energy-Efficient Massive Networks of the Future"
11:00	Session 1: "Routing and Transport Protocols"	12:00	Lunch	12:00	Lunch
12:30	Lunch	13:00	Panel "Slicing in 5G networks: Friend or Foe?"	13:00	Session 5: "IoT"
13:30	Session 2: "Network slicing"	14:30	Tutorial 2 (part 1): Navid Nikaein "RAN Slicing and Control: Challenges, Technologies, and Tools"	14:30	Best Paper Award Ceremony and Closing session
14:50	Tutorial 1 (part 1): Krzysztof Walkowiak "Spectrally-spatially flexible optical networks: technology and optimization"	15:30	Break		
16:00	Break	16:00	Tutorial 2 (part 2): Navid Nikaein "RAN Slicing and Control: Challenges, Technologies, and Tools"		
16:30	Tutorial 1 (part 2): Krzysztof Walkowiak "Spectrally-spatially flexible optical networks: technology and optimization"	18:00			
18:00		19:00	Conference Dinner		
19:30	Welcome reception				





NoF 2018 Foreword

It is our great pleasure to welcome you to the 9th International Conference on Networks of the Future (NoF 2018), that will be held on November 19-21, 2018 in Poznań, Poland, one of the most dynamic cities in Europe.

Networks are currently witnessing a significant transformation that is resulting in new ways to address the deployment of applications and services in a digital society. Major trends like softwarization leveraged by Software-Defined Networking (SDN), Network Function Virtualization (NFV) and Cloud & Edge Computing, and the introduction of new radio techniques are shaping the evolution in the Telecom and ICT industries, today emphasized by the current developments regarding 5G networks and services. Other paradigms like Information-centric networking are also impacting the way content can be delivered to customers. As such, besides technological advances, networking requires further research from architecture to operations, that would alleviate complexity and allow smart and reliable automation of service delivery.

NoF 2018 is addressing the challenges and latest issues raised in the design of future networks in all their dimensions. The program includes:

3 Keynotes

"*A Speed-of-Light Internet Service Provider*", by **Bruce Maggs**, *Duke University and Akamai*, USA

"*NFV/SDN orchestration: facing myths and reality*", by **Christian Destré**, *Orange Labs*, France

"*Energy-Efficient Massive Networks of the Future*", by **Hanna Bogucka**, *Poznań University of Technology*, Poland

2 Tutorials

"*Spectrally-spatially flexible optical networks: technology and optimization*", by **Krzysztof Walkowiak**, *Wroclaw University of Science and Technology*, Poland

"*RAN Slicing and Control: Challenges, Technologies, and Tools*", by **Navid Nikaein**, *Eurecom*, France

1 **Distinguished Expert Panel** addressing the hot topic of Slicing in 5G networks, moderated by **Roberto Riggio**, *FBK – Create-Net*, Italy
5 technical sessions, covering current interests for future networks

Being located in the Center of Europe, Poznań is certainly the right place to organize NoF 2018. The city has a long history from the early rise of Poland, and it has been at crossroads of many economical relationships for centuries. It has also undergone major transformation towards the digital world, hosting many ICT companies, especially because of its famous universities. The conference is taking place in Poznań University of Technology, located right in the center of the city, within walking distance from the train station and offering quick access to the medium-sized airport, just a few miles away.

We wish you a fruitful and enriching time at NoF 2018, and an enjoyable stay in Poznań, Poland.



Filip Idzikowski
(Poznań University of
Technology, Poland)



Prosper Chemouil
(Independent Advisor,
France)



NoF 2018 Keynote Speakers

**Bruce Maggs**

(Duke University and Akamai, USA)

A Speed-of-Light Internet Service Provider

Bruce Maggs received the S.B., S.M., and Ph.D. degrees in computer science from the Massachusetts Institute of Technology in 1985, 1986, and 1989, respectively. His advisor was Charles Leiserson. After spending one year as a Postdoctoral Associate at MIT, he worked as a Research Scientist at NEC Research Institute in Princeton from 1990 to 1993. In 1994, he moved to Carnegie Mellon, where he stayed until joining Duke University in 2009 as a Professor in the Department of Computer Science. While on a two-year leave-of-absence from Carnegie Mellon, Maggs helped to launch Akamai Technologies, serving as its first Vice President for Research and Development.

He retains a part-time role at Akamai as Vice President for Research. In 2017 he won the Best Dataset Award at the Passive and Active Measurement Conference, The Best Paper Award at CoNEXT, a Distinguished Paper Award at USENIX Security, and the 2017 IEEE Cybersecurity Innovation Award for work that appeared at IEEE Security and Privacy. In 2018 he was part of a large team that received the inaugural SIGCOMM Networking Systems Award for the Akamai CDN.

Abstract: *A variety of network applications, including electronic commerce and games, are either enabled by or benefit greatly from low latency communications. Studies have shown, however, that over medium and long distances the time to send a packet from one city to another on the public Internet is typically more than three times larger than the lower bound implied by the speed of light in free space. Hence for applications like high-frequency trading, where the winner of a communications race receives all the benefits, special purpose networks have been deployed.*

For example, between New Jersey and Chicago a succession of networks has been deployed, first fiber-based and then microwave-based, with each network reducing latency by a fraction of a millisecond over the previous. This talk explores the possibility of using the same radio technology to build a network backbone spanning the 120 largest population centers in the United States. The design places radios on existing towers, using topographic maps to ensure line-of-sight connectivity between towers. The impact of weather on the network is evaluated using historical weather data. Our analysis suggests that it should be possible to achieve mean speeds of over 95% of the speed of light over medium and long distances at a transmission cost of under \$1 per GB.

**Christian Destré**

(Orange, France)

NFV/SDN orchestration: facing myths and reality

Christian Destré is currently leading the orchestration technical studies of the Orange On-Demand Networks program, consolidating the NFV orchestration journey for Orange affiliates. He was also involved in many research activities related to Autonomic Networking and network management for 10 years and was the technical manager of the EU FP7 UNIVERSELF project between 2010 and 2013. He received a PhD degree (computer science) from Université d'Evry (France) in 2004.

Abstract: *NFV/SDN success can be tightly related to keep one promise: facilitate and deliver automation. The orchestration word is often used in this context even if it has various implicit meanings depending on profession and business position. Lot of research and development works are showing and demonstrate that we can go from basic (script based) orchestration towards advanced (cognitive based) orchestration.*

However, from a communications service provider point of view, it is not obvious how to proceed with this journey as there are still gaps between operational/field reality, usable implementation and target, with the risk to not reduce complexity but just shift it. In this talk, I will discuss some of the key challenges we are currently facing including: the orchestration complexity related to business process implementation, the capabilities and limitations of orchestration engines and the network configuration puzzle.

**Hanna Bogucka**

(Poznan University of Technology, Poland)

Energy-Efficient Massive Networks of the Future

Hanna Bogucka received the Ph.D. degree with honors and the Doctor Habilitus degree in Telecommunications from Poznan University of Technology (PUT), Poznan, Poland in 1995 and 2006 respectively. Currently, she is a full professor and a Deputy-Dean for Research at the Faculty of Electronics and Telecommunications at PUT.

Prof. Hanna Bogucka is involved in the research activities in the area of wireless communications: radio resource management, opportunistic radio access, cognitive radio, and green-communication. She has been involved in multiple European 5th – 7th Framework Programme and Horizon 2020 projects dealing with novel wireless flexible transmission techniques and cognitive radio technologies, as well as in the European COST actions, National Science Centre projects, and industry cooperation.

Prof. Bogucka is the author of 180 papers, published in major IEEE journals and magazines, and in the proceedings of international conferences and of book chapters. She has also published 3 handbooks in the area of radio communications and digital signal processing (in Polish) and 3 scientific monographs on flexible and cognitive radio.

Prof. Bogucka has been the Technical Program co-Chair of a number of conferences, the technical program committee member of many major IEEE ComSoc and VTS conferences and a reviewer for IEEE journals over many years. Currently she is the Executive Editor of Wiley Transactions on Emerging Telecommunications Technologies.

Prof. Bogucka has been the member of the IEEE Kiyo Tomiyasu Award Committee in the term of 2012/13 and 2013/14, appointed IEEE Communications Society Director of the EAME Region (Europe, Africa, Middle East) and the Board of Governors member for 2014-2015 term, and elected IEEE Radio Communications Committee Chair for the term of 2015-2016. Currently, she is the member of IEEE Awards Board, and IEEE ComSoc Nominations and Election Committee member. In 2016 she has been elected the member of the Polish Academy of Sciences.

Abstract: *Since the United Nations General Assembly in December 1987, and its Resolution 42/187, sustainable development has become an issue and an aspiration of our civilization. Communities world-wide continuously make efforts in promoting ecology to address future issues of global warming. Currently, 2% of the world-wide energy is consumed by the ICT industry which discharges more than 830 million tons of CO2 every year. Mobile radio communication sector used to be considered as responsible of 9% of that figure. However, recent industry reports estimate that while the overall carbon footprint of all ICT technology will almost double between 2007 and 2020, the footprint of mobile communications might almost triple within the same period resulting in 235 million tons of CO2 –equivalent per year in 2020. This is mainly due to the estimated exponential increase of the multimedia traffic in future radio networks, as well as due to networks densification and expanding Internet of Things. Therefore the challenges for the future networks are set to achieve 10 times the energy efficiency together with spectral efficiency compared with today's 4G systems.*

This keynote talk will addresses the trends in mobile data traffic and related power consumption as well as the opportunities to increase energy efficiency of future radio communication networks, systems and devices. We will consider relevant and realistic power-consumption models that include increased processing complexity and radio-environment awareness in the network, both envisioned for enhanced performance in the networks of the future. The competitive green technologies and network architectures to expand network capacity, possible tradeoffs and solutions to increase energy-efficiency for high data-rates in 5G (and beyond) radio will be discussed. Finally, we will attempt to assess the economic, social and environmental impact of potential energy savings of these green technologies.

NoF 2018 Panel Speakers

Slicing in 5G networks: Friend or Foe?

Abstract: Mobile networks are currently witnessing a dramatic increase in the amount of data traffic exchanged by their users. This trend can be mainly ascribed to the rapid adoption of data-hungry mobile applications and services, e.g. Netflix. The fifth generation of the mobile network (5G) is expected to provide adequate support for such applications while at the same time laying the foundations for new categories of services like massive Machine Type Communications (mMTC) and Ultra-Reliable Low Latency Communications (UR-LLC). This calls for a service-oriented approach for network resource provisioning and for abstracting the physical network resources into multiple end-to-end virtual logical networks or slices, one for each service category. The panel aims at addressing the following questions

- What is network slicing?
- How is slicing different from QoS management? Are we re-inventing DiffServ/IntServ?
- Which are the challenges for management and orchestration of slices?
- How is the industry embracing network slicing?
- Are over the top providers a threat or an opportunity for operators?
- How many slices can we create? One per user? One per vertical?
- Is slicing the right answer for resource constrained networks, e.g. cellular?
- Which are the gaps in NFV and SDN open source frameworks for network slicing?

Moderator:

Roberto Riggio
(FBK CREATE-NET, Italy)

Roberto Riggio is Head of the Wireless and Networked System Unit at FBK CREATE-NET. His research interests include software-defined mobile networks, active network slicing, and distributed management and orchestration of network services. He has published more than 100 papers in internationally refereed journals and conferences and has generated more than 2.7 M€ in competitive funding. He is also the holder of two patents.

He received several awards including: the IEEE INFOCOM 2013 Best Demo Award, the IEEE ManFI 2015 Best Paper Award, and the IEEE CNSM 2015 Best Paper Award. He serves in the TPC/OC of leading conferences in the networking field and he is associate editor for the Wiley International Journal of Network Management, the Springer Wireless Networks journal, and the IEEE Transactions on Network and Service Management. He is the Project coordinator of H2020 5G-CARMEN, a 18.5 ME project on 5G for connected, cooperative, and automated mobility. He is the co-founder of the IEEE 5GMan workshop. He is a member of the ACM and a Senior Member of the IEEE.

Panelists:

Krzysztof Kozłowski
(Orange Labs, Poland)

Krzysztof Kozłowski is the director of International Orange Labs in Poland. Graduated MSc from Warsaw Technical University in 1993. He has also post-graduate diplomas from Franco-Polish School in Poznań and Ecole National des Télécommunications de Bretagne (1994), IHEST and Kozłowski University (AMBA). Acting in the functions of head of Research and Development Centre, Network Quality Department Director, head of Network

Optimization and Director of Research Network Development and Service Platforms Branch, he has managed operations, multidisciplinary teams and big transformation project. He has successfully restructured Research and Development Centre in Orange Labs and merged organizations of Network and R&D and participated in creation of concept for Service Management Centre for Orange Group and implemented SMC in Poland. He has built start-up accelerator "Orange FAB", implemented innovation and creative ideas incentive and reward program and launched innovation related patenting process and tax deduction scheme for Orange employees. He is actively engaged in research programmes both in Poland and European level. In 2018 Orange was recognized as one of few most active companies in this area in Poland. In 2018 was honoured with "Złoty Cyborg" for promoting innovation and building positive partnerships with business, research and scientific communities.

Stuart Clayman
(UCL, UK)



Stuart Clayman received his PhD in Computer Science from University College London in 1994. He has worked as a Research Lecturer at Kingston University and at UCL. He is currently a Senior Research Fellow at UCL EEE department. He co-authored over 40 conference and journal papers. His research interests and expertise lie in the areas of software engineering and programming paradigms; distributed systems; virtualised compute and

network systems, network and systems management; sensor systems and smart city platforms, and artificial intelligence systems. He has been involved in several European research projects since 1994. He is currently a leader in the NECOS Network Slicing project, looking at cross domain slicing and orchestration for Networks and Data Centers. He also has extensive experience in the commercial arena undertaking architecture and development for software engineering, distributed systems and networking systems. He has run his own technology start-up in the area of NoSQL databases, sensor data, and digital media.



Navid Nikaein
(EURECOM, France)

Navid Nikaein is an Assistant Professor in Communication System Department at Eurecom. He received his Ph.D. degree in communication systems from the Swiss Federal Institute of Technology EPFL in 2003. He is leading a research group focusing on experimental system research related to wireless systems and networking and opensource platforms for 5G. Broadly, his research contributions are in the areas of wireless access layer techniques, networking

protocols and architectures, flexible RAN/CN following SDN, NFV, MEC design principles, and wireless network prototyping and emulation/simulation platforms. He is also very active in collaborative research projects related to 5G and beyond in the context of European FP6, FP7, H2020 framework programmes. He is also leading the development of the radio access layer of OpenAirInterface.org and its evolution towards 5G as well as coordinating the Mosaic-5G.io initiative to deliver agile 4G/5G service delivery platforms.



Leonardo Goratti
(Zodiac Aerospace, Germany)

Leonardo Goratti received his PhD degree from the University of Oulu (Finland) and his MSc from the University of Firenze (Italy). He currently holds the position of Senior System Engineer at Zodiac Inflight Innovations Germany in the R&D Group. Before he was with the Fondazione Bruno Kessler in Trento (Italy), and with the European Joint Research Center of Ispra (Italy). Dr. Goratti's interests span across software-defined networking (SDN) and network

functions virtualization (NFV) for the Fifth Generation (5G) mobile network, LTE-Advanced and millimeter wave communications. Dr. Goratti is also an expert in Medium Access Control theory, including device-to-device and machine-type communications. His research interests also include spectrum management models and techniques. Currently, Dr. Goratti is working on the design aspects and performance evaluation of 5G networks in multi-access edge computing with application to Inflight Communications. Dr. Goratti has authored more than 70 research papers in distinguished IEEE journals and conferences. Dr. Goratti is TPC member in international conferences, and he served as reviewer in distinguished journals such as IEEE JSAC, IEEE Communications Magazine and IEEE communications Letters.

NoF 2018 Tutorials Speakers

**Krzysztof Walkowiak**

(Wroclaw University of Science and Technology, Poland)

Spectrally-spatially flexible optical networks: technology and optimization

Krzysztof Walkowiak received the Ph.D. degree and the D.Sc. (habilitation) degree in computer science from the Wroclaw University of Science and Technology, Poland, in 2000 and 2008, respectively. In 2017, he received the professor title in technical science from President of Poland. Currently, he is working as a Full Professor at the Department of Systems and Computer Networks, Faculty of Electronics, Wroclaw University of Science and Technology. His research interest is mainly focused on modeling and optimization of communication networks including: elastic optical networks, cognitive optical networks, cloud computing, overlay networks, content-oriented networks, survivable networks. Prof. Walkowiak has been involved in many research projects related to optimization of communication networks. He received the 2014 Fabio Neri Best Paper Award, Best Paper Award in the 7th International Workshop on Design of Reliable Communication Networks (DRCN 2009), Best Paper Award in the 7th International Workshop on Reliable Networks Design and Modeling (RNDM 2015). Prof. Walkowiak published more than 250 scientific papers including over 50 papers in JCR journals, in the field of optimization and modeling of communication networks. He is an Associate Editor of the Journal of Network and Systems Management and he serves as a reviewer for many international journals and conferences. Prof. Walkowiak is a senior member of IEEE and ComSoc. Web page: <https://www.kssk.pwr.edu.pl/people/walkowiak> Piotr Lechowicz received his M.S. degree in computer science from the Wroclaw University of Science and Technology, Poland, in 2016. He is currently working toward his Ph.D. degree in computer science in the Department of Systems and Computer Networks, Faculty of Electronics, Wroclaw University of Science and Technology. His research interests include modeling and optimization of spectrally-spatially flexible optical networks.

Abstract: Network traffic has been consistently growing at a huge speed over last few decades and across various networks, from the optical core to fixed and mobile access. The major reason behind this increase is due to the advent of services, applications and technologies including cloud computing, content-oriented networking, Internet of Things and 5G. Consequently, to overcome the possible future capacity crunch, new network technologies are required with a special focus on optical networks that are implemented in backbone networks. At this time, there are two popular optical approaches utilized in backbone optical networks: long-established Wavelength Switched Optical Network (WSO) implemented with the Wavelength Division Multiplexing (WDM) technology and more recent Elastic Optical Network (EON). The key difference between WSOs and EONs is the use of frequency grid. In particular, WSOs operate within rigid/fixed frequency grids with 50 GHz spacing and with single-line-rate (SLR) transponders making use of single-carrier modulation techniques. In turn, EONs utilize flexible frequency grids, where the spectrum resources are divided into narrow frequency slices of 12.5 GHz, what allows to allocate flexibly appropriate-sized optical bandwidth, by means of a contiguous concatenation of optical spectrum, to an end-to-end lightpath and according to traffic demand. Moreover, EONs enable the application of advanced and spectrally-efficient modulation formats. As a consequence, the EONs utilize network resources more efficiently and, at the same time, they provide network connectivity adaptively and according to bandwidth demands. However, due to the predicted traffic growth and the possibility of the capacity crunch in the time perspective of next years, some new concepts and ideas are indispensable in optical networks. Space division multiplexing (SDM) is a new optical network technology that goes beyond the capabilities of spectrally-flexible EONs by supporting parallel transmission of several co-propagating spatial modes in suitably designed optical fibers. The simplest version of SDM assumes a use of fiber-bundles composed of physically-independent, single-mode fibers. More advanced SDM deployments will be based on multicore fibers (MCF) or multimode fibers (MMF). Spectrally-spatially flexible optical networks (SS-FONs), which combine SDM with EON technologies, bring many benefits including an enormous increase in transmission capacity, extended flexibility in resource management due to the introduction of the spatial domain, as well as potential cost savings thanks to the sharing of resources and the use of integrated devices.

The tutorial will concentrate on spectrally-spatially flexible optical networks with a special focus of two aspects: technology and optimization. First, the general idea of the SS-FONs technology will be explained including details on both Elastic Optical Networks and Space-Division Multiplexing technologies. Practical issues related to hardware and software solutions will be discussed including: fibers, crosstalk, transponders, switching architectures and control plane. The second part of the talk will be focused on optimization of spectrally-spatially flexible optical networks. In particular, the basic optimization problem in SS-FONs, namely Routing, Space and Spectrum Allocation (RSSA) problem will be formulated and analyzed. Various approaches for solving the RSSA problem will be described including ILP (Integer Linear Programming) modeling, heuristic and metaheuristic algorithms. Some illustrating results obtained on real topologies will be reported. The key performance metrics that must be addressed in optimization of SS-FONs will be examined, namely, spectrum usage, CAPEX cost, energy consumption, spectrum fragmentation. Moreover, issues related to modeling and optimization of various traffic patterns following from cloud computing and content-oriented networking as well as aspects of network resilience will be discussed. The last part of the talk will be focused on new research challenges that arise in the context of SS-FONs.

**Navid Nikaein**

(EURECOM, France)

RAN Slicing and Control: Challenges, Technologies, and Tools

Navid Nikaein is an Assistant Professor in Communication System Department at Eurecom. He received his Ph.D. degree in communication systems from the Swiss Federal Institute of Technology EPFL in 2003. He is leading a research group focusing on experimental system research related to wireless systems and networking and opensource platforms for 5G. Broadly, his research contributions are in the areas of wireless access layer techniques, networking protocols and architectures, flexible RAN/CN following SDN, NFV, MEC design principles, and wireless network prototyping and emulation/simulation platforms. He is also very active in collaborative research projects related to 5G and beyond in the context of European FP6, FP7, H2020 framework programmes. He is also leading the development of the radio access layer of OpenAirInterface.org and its evolution towards 5G as well as coordinating the Mosaic-5G.io initiative to deliver agile 4G/5G service delivery platforms.

Abstract: The softwarization of network processing components coupled with virtualization of network infrastructure constitutes the foundation for a multi-service and multi-tenant architecture. In this context, radio access network (RAN) slicing and control are emerging as a key enabler to flexibly customize and manage virtualized base stations in runtime while sharing the radio resources among them, with the objective of accommodating operators, service providers, over-the-top, and service providers' requirements. This tutorial will shed light on the challenges, solutions and technologies, and enabling tools focusing on open-source tools to realize network slicing with data-driven control in 5G leveraging machine learning (ML) techniques. Particularly, the tutorial will also rely on concrete prototypes and solutions with alternative RAN slicing and control approaches to assess how the performance guarantee and isolation properties are provided to each slice and how the runtime control is used to optimize the network and service objectives.

NoF 2018 Program - Monday, November 19

09:15-09:30 Welcome

09:30-10:30 Keynote 1: A Speed-of-Light Internet Service Provider

Session Chair : Mariusz Glabowski (Poznan University of Technology, Poland)
Speaker : Bruce Maggs (Duke University and Akamai, USA)

10:30-11:00 Coffee Break

11:00-12:30 Session 1: "Routing and Transport Protocols"

Session Chair : Luca Chiaraviglio (University of Rome Tor Vergata, Italy)

An Evolutionary Multipath Routing Algorithm using SDN

Noel Farrugia, Johann A. Briffa and Victor Buttigieg (University of Malta, Malta)

MDTCP: Towards a Practical Multipath Transport Protocol for Telco Cloud Datacenters

Dejene Boru Oljira, Karl-Johan Grinnemo, Anna Brunstrom and Javid Taheri (Karlstad University, Sweden)

A Transparent Reordering Robust TCP Proxy To Allow Per-Packet Load Balancing in Core Networks

Tacetin Ayar (Istanbul Technical University, Turkey), Łukasz Budzisz (TU Berlin, Germany), Berthold Rathke (TU Berlin, Germany)

12:30-13:30 Lunch Break

13:30-14:50 Session 2: "Network slicing"

Session Chair : Wojciech Kabacinski (Poznan University of Technology, Poland)

Open issues in network slicing

Slawomir Kuklinski (Orange Polska & Warsaw University of Technology, Poland), Krzysztof Kozłowski (Orange Labs Research & Orange SA, Poland), Lechosław Tomaszewski (Orange Polska, Poland)

Extending Slices into Data Centers: the VIM on-demand model

Stuart Clayman (University College London (UCL), United Kingdom (Great Britain)), Francesco Tusa and Alex Galis (University College London, United Kingdom (Great Britain))

Business models of network slicing

Slawomir Kuklinski (Orange Polska & Warsaw University of Technology, Poland), Lechosław Tomaszewski (Orange Polska, Poland), Krzysztof Kozłowski (Orange Labs Research & Orange SA, Poland), Slawomir Pietrzyk (IS-Wireless, Poland)

14:50-16:00 Tutorial 1 (part 1): "Spectrally-spatially flexible optical networks: technology and optimization"

Session Chair : Marco Polverini (University La Sapienza Roma, Italy)
Speaker : Krzysztof Walkowiak (Wroclaw University of Science and Technology, Poland)

16:00-16:30 Coffee Break

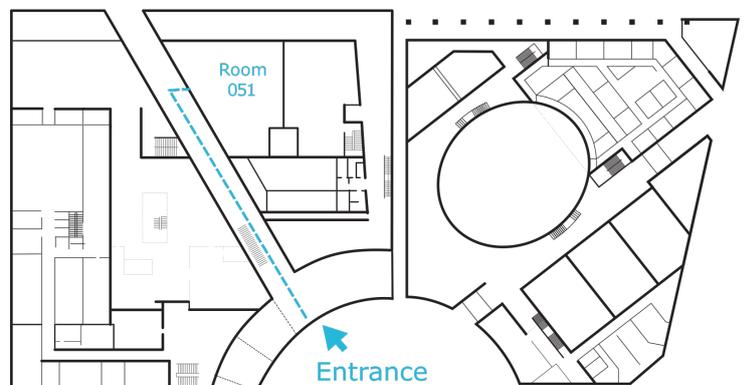
16:30-18:00 Tutorial 1 (part 2): "Spectrally-spatially flexible optical networks: technology and optimization"

Session Chair : Marco Polverini (University La Sapienza Roma, Italy)
Speaker : Krzysztof Walkowiak (Wroclaw University of Science and Technology, Poland)

19:30 Welcome Reception



LIBRARY AND LECTURING CENTER





NoF 2018 Program - Tuesday, November 20

09:00-10:00 Keynote 2: NFV/SDN orchestration: facing myths and reality

Session Chair : Prosper Chemouil (Orange Labs (retired), France)
Speaker : Christian Destré (Orange, France)

10:00-10:30 Coffee Break**10:30-12:00 Session 3: "Security and planning"**

Session Chair : Piotr Remlein (Poznan University of Technology, Poland)

ACLFLOW: An NFV/SDN Security Framework for Provisioning and Managing Access Control Lists

Leopoldo Alexandre Mauricio (Universidade Federal do Rio de Janeiro / GTA / UFRJ, Brazil), Marcelo Gonçalves Rubinstein (Universidade do Estado do Rio de Janeiro, Brazil), Otto Carlos M. B. Duarte (Universidade Federal do Rio de Janeiro, Brazil)

Multi-Period Mission Planning of UAVs for 5G Coverage in Rural Areas: a Heuristic Approach

Jaime Galán-Jiménez (University of Extremadura, Spain), Luca Chiaraviglio (University of Rome Tor Vergata, Italy), Lavinia Amorosi (University of Rome Sapienza, Italy), Nicola Blefari-Melazzi (University of Rome Tor Vergata, Italy)

Implementation of smart contracts for blockchain based IoT applications

Georgios Papadodimas, Georgios Palaiokrassas, Antonios Litke and Theodora Varvarigou (National Technical University of Athens, Greece)

12:00-13:00 Launch Break**13:00-14:30 Panel: "Slicing in 5G networks: Friend or Foe?"**

Moderator : Roberto Riggio (FBK CREATE-NET, Italy)
Krzysztof Kozłowski (Orange Labs, Poland), Stuart Clayman (UCL, UK), Navid Nikaein (EURECOM, France), Leonardo Goratti (Zodiac Aerospace, Germany)

14:30-15:30 Tutorial 2 (part 1): "RAN Slicing and Control: Challenges, Technologies, and Tools"

Session Chair : Pawel Sroka (Poznan University of Technology, Poland)
Speaker : Navid Nikaein (EURECOM, France)

15:30-16:00 Coffee Break**16:00-18:00 Tutorial 2 (part 2): "RAN Slicing and Control: Challenges, Technologies, and Tools"**

Session Chair : Pawel Sroka (Poznan University of Technology, Poland)
Speaker : Navid Nikaein (EURECOM, France)

19:00 Conference Dinner

NoF 2018 Program - Wednesday, November 21

09:00-10:20 Session 4: "Data and traffic analysis"

Session Chair : Adrian Kliks (Poznan University of Technology, Poland)

A Multi-level Internet Traffic Classifier Using Deep Learning

Ola Salman, Imad H Elhadj, Ali Chehab and Ayman Kayssi (American University of Beirut, Lebanon)

Interface Counters in Segment Routing v6: a powerful instrument for Traffic Matrix Assessment

Marco Polverini (University La Sapienza Roma, Italy), Antonio Cianfrani (University of Rome Sapienza, Italy), Marco Listanti (University of Rome La Sapienza, Italy)

On Eventually-Available Data in Content-Centric Networking

Dima Mansour, Claudio Marxer and Christian F Tschudin (University of Basel, Switzerland)

10:20-11:00 Coffee Break**11:00-12:00 Keynote 3: Energy-Efficient Massive Networks of the Future**

Session Chair : Filip Idzikowski (Poznan University of Technology, Poland)
Speaker : Hanna Bogucka (Poznan University of Technology, Poland)

12:00-13:00 Launch Break**13:00-14:30 Session 5: "IoT"**

Session Chair : Pawel Kryszkiewicz (Poznan University of Technology, Poland)

IoT-Botnet Detection and Isolation by Access Routers

Christian Dietz (University of the Bundeswehr Munich & University of Twente, Germany), Raphael Labaca Castro (University of the Bundeswehr Munich, Germany), Jessica Steinberger (University of Applied Sciences Darmstadt, Germany), Cezary Wilczak and Marcel Antzek (Bundeswehr University Munich, Germany), Anna Sperotto (Twente University, The Netherlands), Aiko Pras (University of Twente, The Netherlands)

Internet of Things Connectivity in Deep-Indoor Environments

Sarah Ruepp, Alba Mateo, Krzysztof Mateusz Malarski, Jakob Thrane and Martin Nordal Petersen (Technical University of Denmark, Denmark)

Combining IoT Deployment and Data Visualization: experiences within campus maintenance use-case

Rumana Yasmin (University of Oulu, Finland), Miikka Salminen (University of Oulu, Finland), Ekaterina Gilman, Juha Petäjäjärvi and Konstantin Mikhaylov (University of Oulu, Finland), Minna Pakanen and Arttu Niemelä (University of Oulu, Finland), Jukka Rieki (University of Oulu, Finland), Susanna Pirttikangas (University of Oulu, Finland), Ari T. Pouttu (Centre for Wireless Communications University of Oulu, Finland)

Demonstration of NB-IoT for Maritime Use Case

Krzysztof Mateusz Malarski, Alexander Bardram, Mikkel Larsen, Jakob Thrane and Martin Nordal Petersen (Technical University of Denmark, Denmark), Lars Møller (LCmVeloci IVS, Denmark), Sarah Ruepp (Technical University of Denmark, Denmark)

14:30-15:00 Best Paper Award Ceremony and Closing session



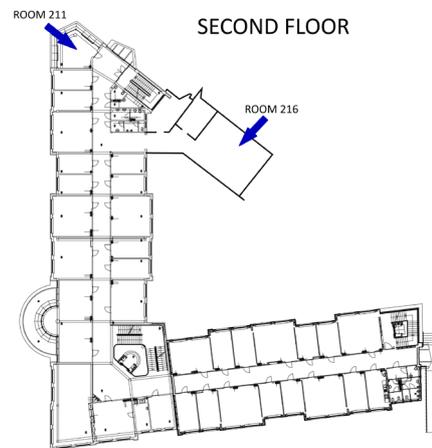
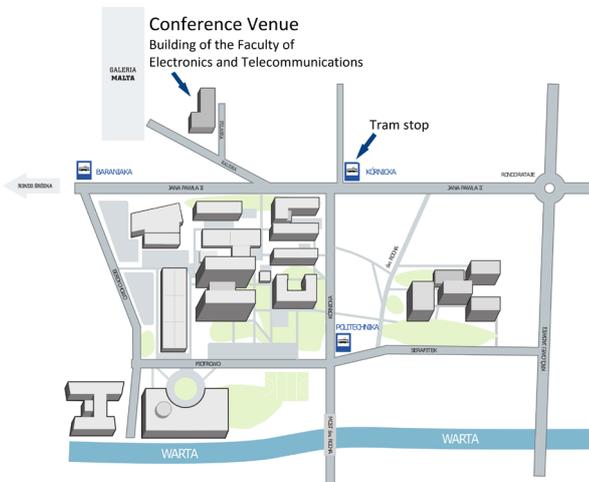
NoF 2018 Venue

The conference will take place at

**Building of the Faculty of Electronics and
Telecommunications (Budynek Wydziału
Elektroniki i Telekomunikacji)**

**Poznan University of Technology (Politechnika
Poznańska)**

**Polanka 3, 61-131 Poznań, Poland
GPS coordinates: 52.40018, 16.955638**



NoF 2018 Dinner

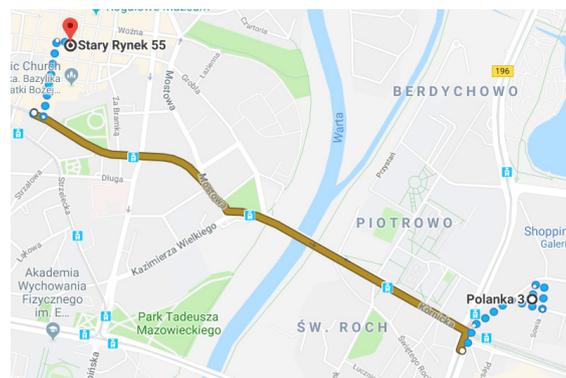


The conference dinner will take place at

**Restauracja Ratuszowa
Stary Rynek 55, 61-772 Poznań,
Poland**

**Nearest Tram:
Line 5, 13, 16 :
Kórnicka -> Wrocławska**

**13 min from conference Venue
2.1 km walk from the Venue**





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Filip Idzikowski
(Poznań University of
Technology, Poland)



Prosper Chemouil
(Independent Advisor,
France)

TPC Co-Chairs



Daphne Tuncer
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Toktam Mahmoodi
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and Design, Singapore)

