Preface

Proceedings of the
28th International Teletraffic Congress

ITC 28

Tobias Hoßfeld, Brian Mark, Gary Chan, Andreas Timm-Giel
(ITC 28 TPC Co-Chairs)
Welcome Message from General Co-Chairs

On behalf of the Organizing Committee, we are delighted to welcome you to the 28th International Teletraffic Congress (ITC 28) to be held on September 12-16, 2016 in lovely Würzburg, Germany!

Since its inception in 1955, ITC has witnessed the evolution of communications and networking: the influence of computer science on telecommunications, the advent of the Internet and the massive deployment of mobile communications and optics, the emergence of peer-to-peer networking and social network services, the ever increasing speed and flexibility of new communication technologies, networks, devices, and applications, and the ever changing operational challenges arising from these developments. ITC has also documented this evolution with state-of-the-art measurement studies, performance analyses of new technologies, recommendations for provisioning and configuration, and greatly contributed to the advancement of methodologies for network design and analysis.

Its inherent roots in solid methodological foundations have allowed ITC to constantly adapt its technological focus without losing its original identity. ITC continues to serve as a broad and lively community for researchers and practitioners dedicated to advancing the limits of knowledge in networking. As such, ITC regularly organizes such events as congresses, specialist seminars and workshops for experts to gather and discuss the latest developments in design, modelling, and performance evaluation of communication systems, networks, and services.

This year’s ITC technical program is composed of 37 contributed full papers and 6 short demo papers to be presented in two parallel sessions, three keynote addresses and a demo session. We also sponsor three workshops dedicated to timely topics: Workshop on Programmability for Cloud Networks and Applications (PROCON), 2016 International Workshop on Quality of Experience Centric Management (QCMa), COST Action ACROSS Workshop on “Quality Engineering for a Reliable Internet of Services”.

We are especially grateful to our keynote speakers: Dr. Nikhil Jain (Qualcomm Technologies), who will talk on “Internet of Everything: Engineering Challenges and Opportunities”; Prof. Wolfgang Kellerer (Technische Universität München), who will talk on “Towards flexible networking in dynamically changing environments”; and Dr. Eitan Altman (INRIA Sophia Antipolis), who will talk on “Dynamic games for analyzing competition in the Internet”.

We also thank ITC’s International Advisory Committee (IAC) for their support of student travel grants and best paper awards. The IAC has graciously decided to offer a number of travel grants available to full-time students. ITC 28 has set up three prestigious awards. The Best Paper Award will be granted to the best contribution presented at ITC 28. The Best Student Paper Award will be conferred upon the best paper whose first author is a full-time student at the time of submission of the paper and is the presenter. The Best Demo Award will be granted to the best demo presented during the ITC 28 meeting. These awards will be selected based on scientific merit and oral presentation or demo presentation quality.

A successful conference requires dedication and engagement of many people. We would like to recognize the efforts of the TPC Co-Chairs, Professors Tobias Hoßfeld, Brian Mark, Gary Chan and Andreas Timm-Giel, who put together this excellent technical program. We thank Mrs. Alison Wichmann for the local arrangements, Dr. Matthias Hirth and Dr. Florian Wamser, Local Organization Co-Chairs, as well as Mr. Christopher Metter and Dr. Florian Metz-
ger, Web & EDAS Co-Chairs. Dr. Prosper Chemouil as Award Chair reviewed the student travel grant applications and will lead the best paper award selection process. Our Publicity Co-Chairs, Prof. Florin Ciucu and Prof. Sheng Zhou, disseminated information about ITC 28 throughout the world. Our Publication Co-Chairs, Prof. Jörg Liebeherr and Prof. Michael Menth, organized the publications with the CPS publisher.

Our thanks also go to Dr. Florian Wamser, Dr. Roberto Bruschi and Dr. Anastasios Zafeiropoulos for organizing the PROCON workshop; Dr. Thomas Zinner, Dr. Oliver Hohlfeld, Dr. Raimund Schatz, and Prof. Prasad Calyam for organizing the QCMan workshop; Prof. Hans van den Berg and Prof. Rob van der Mei for organizing the ACROSS workshop. We greatly appreciate everyone who submitted papers to the conference, particularly those who will be presenting their work at ITC 28. The IEEE, IEEE Communications Society, and the Information Technology Society within VDE (ITG VDE) kindly agreed to technically co-sponsor ITC 28, and ACM SIGCOMM helped us through their in-cooperation agreement. Last, but not least, we are grateful to our corporate patrons: Infosim, kubusIT, and Orange, who generously provided financial support to ITC 28, as well as the Julius Maximilian Universität Würzburg for their support in organizing and hosting the conference.

Phuoc Tran-Gia (University of Würzburg, Germany)
Hisashi Kobayashi (Princeton University, USA)

September 2016
Welcome Message from Technical Program Co-Chairs

Welcome to Würzburg and the 28th International Teletraffic Congress (ITC 28)!

The evolution of communication and networking is changing the world we are living in. The digital connected world is triggered by the advances on telecommunications, the penetration of the Internet, the massive deployment of mobile communications and optics, the adoption of collaborative networking and social networks, the ever-increasing speed and flexibility of new communication technologies, networks, user devices, and applications, and various operational challenges arising from this development.

ITC was established as the first international conference on networking science and practice. It gathers a wide and lively community of researchers and practitioners dedicated to pushing the envelope in the area of networking. As such, ITC has provided a forum for leading researchers from academia and industry to present and discuss the latest changes and developments in design, modelling, measurement, and performance evaluation of communication systems, networks, and services.

ITC 28 has continued this tradition, while employing some new approaches to attract high-quality papers and researchers. In particular, ITC 28 introduced the concept of areas and a demo session. ITC 28 is structured into eight different areas which address hot topics in networking. Each area is chaired by two internationally well recognized experts in that area. The area chairs organized a smaller TPC per area. The idea was that the area chairs invited experts for their areas from the ITC community as well as other well-known experts worldwide. On the one hand, the concept was aimed at expanding the ITC community and attracting high-quality submissions. On the other hand, the areas helped to improve the quality of the review process. The area chairs assigned the reviews to experts in their domain and evaluate all papers in their domain.

In addition, we introduced demo sessions for ITC 28 that cuts thematically across the areas. The demo session is distinguished from the regular sessions only in the presentation format. “Demo papers” are papers whose content is best understood by an audience if the material is demonstrated rather than presented in a lecture style slide presentation. With the demo session, we aimed to provide a different kind of interactions among the participants, so as to make ITC more attractive for other communities.

Accordingly, ITC 28 is structured into the following eight different areas and demo session with the listed chairs:

Area 1: Smart cities and IoT (Alberto Leon-Garcia, Yanmin Zhu)
Area 2: Cloud services and networking (Arup Acharya, Patrick Lee)
Area 3: Mobile, wireless and 5G (Kin Leung, Thomas Hou)
Area 4: Next generation and future Internet architectures (Michael Zink, Thomas Zinner)
Area 5: Network and traffic management (Florin Ciucu, Peter Reichl)
Area 6: Network design and optimization (Thomas Bauschert, Eric Wong)
Area 7: Network measurements and analysis (Marco Mellia, Mark Squillante)
Area 8: Networked applications (Zhu Li, Lea Skorin-Kapov)
Demonstration Session (Mark Berman, Michael Jarschel, Rick McGeer)
ITC 28 attracted 116 international paper submissions across all areas, while 157 papers were registered. The 116 papers were submitted by authors from 33 different countries, out of which 20% were from the USA and Canada, 68% from Europe/Middle East/Africa, 11% from Asia/Pacific and the remainder from Latin America.

Each submitted paper was reviewed by at least three experts assigned by the area chairs and TPC chairs. All papers are single-blind reviewed. In special cases, when the discussion of reviewers did not converge, additional expert reviews were requested to come to a solicited decision. In total, there were 420 completed reviews for the 116 submitted papers, i.e. an average of 3.6 reviews per paper. The area chairs and TPC members fostered discussions to converge the reviewers’ recommendations towards a decision. In total, 300 discussion posts were provided for papers with diverging review scores. The area chairs provided a ranked list of papers with suggestions for papers to be accepted and rejected.

A full-day TPC meeting was held at the University of Würzburg, Germany, from 9.00 – 19.30 on May 3, 2016. The meeting was structured according to the areas. The area chairs presented the papers submitted to their area and the list of ranked papers.

Based on the reviews and the recommendations from the area chairs, it was decided during the TPC meeting which papers were to be accepted or rejected per area. In addition, for each area a few reserve papers were identified. It should be noted that those papers were also good contributions. After the discussion of all areas, the reserve papers were discussed by the physically attending TPC members in Würzburg. The papers were evaluated and compared across different areas in order to identify the best papers from among the reserve papers. If an accepted paper was flagged as needing improvement, shepherding of such papers was initiated by the area chairs. Shepherding was led by the area chairs or a TPC member assigned to a particular area.

Finally, 37 full papers were accepted out of the 108 full paper submissions, yielding an acceptance rate of 34%. In addition, 6 short demo papers were accepted. The statistics per area are given below. From among the authors of accepted papers, 28% are from USA and Canada, 61% from Europe/Middle East/Africa, 8% from Asia/Pacific and the remaining are from Latin America.

<table>
<thead>
<tr>
<th>Area</th>
<th>Registered</th>
<th>Submitted</th>
<th>Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Smart cities and IoT</td>
<td>8</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>2. Cloud services and networking</td>
<td>14</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>3. Mobile, wireless and 5G</td>
<td>19</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>4. Next generation and future Internet architectures</td>
<td>26</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>5. Network and traffic management</td>
<td>23</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>6. Network design and optimization</td>
<td>18</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>7. Network measurements and analysis</td>
<td>21</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>8. Networked applications</td>
<td>12</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td>Demos</td>
<td>16</td>
<td>14</td>
<td>3</td>
</tr>
</tbody>
</table>
Given the accepted papers, we then group the papers according to their topics. On behalf of the Technical Program Committee (TPC), we proudly present to you an excellent technical program covering a wide range of topics which are manifested in 12 technical oral sessions and a demo session.

<table>
<thead>
<tr>
<th>Session 1.A</th>
<th>Clouds and Data Center</th>
<th>Session 5</th>
<th>Demo Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1.B</td>
<td>Traffic and Network Management</td>
<td>Session 6.A</td>
<td>Softwarization</td>
</tr>
<tr>
<td>Session 2</td>
<td>Wireless</td>
<td>Session 6.B</td>
<td>Information and Social Networks</td>
</tr>
<tr>
<td>Session 3.A</td>
<td>Cellular</td>
<td>Session 7.A</td>
<td>Measurements</td>
</tr>
<tr>
<td>Session 4.A</td>
<td>Caching Strategies</td>
<td>Session 8</td>
<td>Virtualization</td>
</tr>
<tr>
<td>Session 4.B</td>
<td>Performance Analysis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The technical program is presented in the form of double-track sessions spanning three days, from September 13 to 15, 2016. The demo session, the three keynote speeches, and two selected sessions are presented as plenary sessions. On the first day of the congress, September 12, 2016, a half-day workshop on Programmability for Cloud Networks and Applications (PROCON) takes place. On the final day of the congress, September 16, there are two full-day workshops: (1) 2016 International Workshop on Quality of Experience Centric Management (QCMAN) and (2) Workshop of COST Action ACROSS on “Quality Engineering for a Reliable Internet of Services”.

We are delighted to have three excellent keynote speakers in the main program. We thank them for agreeing to be keynote speakers and presenting their visions in spite of their busy schedules.

- Nikhil Jain (Vice President of Technology, Qualcomm Technologies, Inc.): Internet of Everything: Engineering Challenges and Opportunities
- Wolfgang Kellerer (Technical University of Munich (TUM), Germany): Towards Flexible Networking in Dynamically Changing Environments
- Eitan Altman (INRIA Sophia Antipolis, France): Dynamic Games for Analyzing Competition in the Internet

The TPC co-chairs wish to thank in particular, the area chairs who did a fantastic job and dedicated much effort to make ITC 28 a success. We thank the TPC members and experts that provided paper reviews, contributed to the discussions and attended the TPC meeting for the conference. Without their diligence and hard work the program could not have been put together. And, of course, we thank everyone who submitted a paper and those who are presenting their work at the conference.

Further we wish to give special thanks to the University of Würzburg for hosting the TPC meeting and we are particularly indebted to Thomas Zinner for his willingness to help in all aspects of organizing ITC 28. Special thanks for their efforts in the TPC meeting are dedicated to Benny Van Houdt, Florin Ciucu, and Michael Zink. We thank the members of the ITC steering committee, particularly Michela Meo for providing guidance. Last but not least we wish to thank the previous ITC organizers for passing on their thoughts and experiences: Dragos Illie, Peter Van Daele, Markus Fiedler, Michela Meo, Sabine Wittevrongel. We thank Harry Rudin for supporting us in setting up the Elsevier Computer Networks Special Issue on “Softwarization and Caching in NGN” related to ITC 28.
Special thanks go to the ITC 28 publications chairs, Michael Menth and Jörg Liebeherr, who took care of the publication process and made the technical co-sponsorship happen with IEEE Communications Society (IEEE ComSoc) as well as the cooperation with ACM SIGCOMM. We acknowledge the publicity chairs, Florin Ciucu and Sheng Zhou, for their extensive efforts to make ITC 28 visible and to attract submissions and attendees. We thank Prosper Chemouil, the awards chair, for taking care of the student travel grants and the best paper awards. We extend our sincere thanks to Florian Metzger for facilitating the paper submission and review process electronically in EDAS, Christopher Metter for taking care of the ITC 28 mailing lists and web site, as well as the local organizers Matthias Hirth, Florian Wamser and Alison Wichmann for implementing the ITC 28 registration process, all local arrangements and the social events to make ITC 28 happen.

Finally, we would like to express our appreciation the general chairs, Phuoc Tran-Gia and Hisashi Kobayashi, for all of their hard work in putting together an excellent overall program and a wonderful ITC 28 event.

Tobias Hoßfeld (University of Duisburg-Essen, Germany)  
Brian L. Mark (George Mason University, US)  
Gary Chan (The Hong Kong University of Science and Technology, China)  
Andreas Timm-Giel (Hamburg University of Technology, Germany)  

September 2016
Committees

Conference Co-Chairs

Phuoc Tran-Gia  University of Würzburg, Germany
Hisashi Kobayashi  Princeton University, US

Technical Program Committee Chairs

Tobias Hoßfeld  University of Duisburg-Essen, Germany
Brian Mark  George Mason University, US
Gary Chan  The Hong Kong University of Science and Technology, China
Andreas Timm-Giel  Hamburg University of Technology, Germany

Local Organization Co-Chairs

Matthias Hirth  University of Würzburg, Germany
Florian Wamser  University of Würzburg, Germany

Award Chair

Prosper Chemouil  Orange Labs Networks, France

Publicity Co-Chairs

Florin Ciucu  University of Warwick, UK
Sheng Zhou  Tsinghua University, China

Publication Co-Chairs

Jörg Liebeherr  University of Toronto, Canada
Michael Menth  University of Tübingen, Germany
Web & EDAS Co-Chairs

Christopher Metter, University of Würzburg, Germany
Florian Metzger, University of Duisburg-Essen, Germany

International Advisory Council

Chair: Michela Meo, Politecnico di Torino, Italy
Vice-Chair: Dario Rossi, Telecom ParisTech / Ecole Polytechnique, France
Markus Fiedler, BTH, Sweden
Fabrice Guillemin, Orange Labs, France
Tobias Hoßfeld, University of Duisburg-Essen, Germany
Benny Van Houdt, University of Antwerp, Belgium
Michael Menth, University of Tuebingen, Germany
Zhisheng Niu, Tsinghua University, China

Area Chairs

Alberto Leon-Garcia, University of Toronto, Canada
Yanmin Zhu, Shanghai Jiatong University, China
Arup Acharya, IBM Research, US
Patrick Lee, The Chinese University of Hong Kong, China
Kin Leung, Imperial College, UK
Thomas Hou, Virginia Tech, US
Thomas Zinner, University of Würzburg, Germany
Michael Zink, University of Massachusetts Amherst, US
Florin Ciucu, University of Warwick, UK
Peter Reichl, University of Vienna, Austria
Thomas Bauschert, TU Chemnitz, Germany
Eric Wong, City University of Hong Kong, China
Marco Mellia, Politecnico di Torino, Italy
Mark Squillante, IBM Research, US
Lea Skorin-Kapov, University of Zagreb, Croatia
Zhu Li, Samsung Research America, US
Mark Berman, GENI Project Office, US
Michael Jarschel, Nokia, Munich, Germany
Rick McGeer, SAP / University of Victoria, US
Technical Program Committee Members

Area 1: Smart Cities and IoT

Azzeddine Boukerche  
University of Ottawa, Canada
Zhichao Cao  
Tsinghua University, China
Prosper Chemouil  
Orange Labs, France
Ken Duffy  
National University of Ireland Maynooth, Ireland
Omar Elloumi  
Alcatel-Lucent, France
Yaser P. Fallah  
West Virginia University, US
Yacine Ghamri-Doudane  
University of La Rochelle, France
Marco Gribaudo  
Politecnico of Milano, Italy
Hongyu Huang  
Chongqing University, China
Yu Hua  
Huazhong University of Science and Technology, China
Yuming Jiang  
Norwegian University of Science and Technology, Norway
Linghe Kong  
McGill University, Canada
Udo Krieger  
Otto Friedrich University Bamberg, Germany
Vincenzo Mancuso  
IMDEA Networks Institute, Spain
Rob van der Mei  
Centrum voor Wiskunde en Informatica, the Netherlands
Hamed Mohsenian-Rad  
University of California at Riverside, US
Zhengguo Sheng  
University of Sussex, UK
JaeSeung Song  
Sejong University, Korea
Yutaka Takahashi  
Kyoto University, Japan
Ali Tizghadam  
University of Toronto, Canada
Sabine Wittevrongel  
Ghent University, Belgium
Weigang Wu  
Sun Yat-sen University, China
Guanglin Zhang  
Donghua University, China
Xiaolong Zheng  
Tsinghua University, China

Area 2: Cloud Services and Networking

Samuli Aalto  
Aalto University, Finland
Fabrice Guillemin  
Orange Labs, France
Xiaoming Fu  
Georg-August-University of Goettingen, Germany
Carol Fung  
Virginia Commonwealth University, US
Jagadeesh Harshan  
Nanyang Technological University, Singapore
Yuchong Hu  
Huazhong University of Science and Technology, China
Atsushi Iwata  
NEC Corporation, US
Dan Li  
Tsinghua University, China
Richard T. B. Ma  
National University of Singapore, Singapore
Shachi Sharma  
IBM Research, India
Dennis Shea  
IBM Thomas J. Watson Research Center, US
Hong Xu  
City University of Hong Kong, China
Farhana H. Zulkernine  
Queen’s University, Canada
Area 3: Mobile, Wireless and 5G

Ozgur Akan Koc University, Turkey
Nirwan Ansari New Jersey Institute of Technology, US
Albert Banchs Universidad Carlos III de Madrid, Spain
Azeddine Boukerche University of Ottawa, Canada
Claudio Casetti Politecnico di Torino, Italy
Song Chong Korea Advanced Institute of Science and Technology, Korea
Baek-Young Choi University of Missouri - Kansas City, US
Chen-Nee Chuah University of California at Davis, US
Luis Correia IST – University of Lisbon, Portugal
Do Young Eun North Carolina State University, US
Nelson da Fonseca State University of Campinas, Brazil
Luigi Fratta Politecnico di Milano, Italy
Sergey Gorinsky IMDEA Networks Institute, Spain
Linke Guo Binghamton University, US
Song Guo The University of Aizu, Japan
Teruo Higashino Osaka University, Japan
Rose Qingyang Hu Utah State University, US
Jianwei Huang Chinese University of Hong Kong, China
Wonjun Lee Korea University, Korea
Douglas Leith Trinity College, Ireland
Victor Leung University of British Columbia, Canada
Renato Lo Cigno University of Trento, Italy
Marco Ajmone Marsan Politecnico di Torino, Italy
Sándor Molnár Budapest University of Technology and Economics, Hungary
Sumit Roy University of Washington, US
Zhengguo Sheng University of Sussex, UK
Sumei Sun Institute for Infocomm Research, Singapore
Li-Chun Wang National Chiao Tung University, Taiwan
Moshe Zukerman City University of Hong Kong, China

Area 4: Next Generation and Future Internet Architectures

Hans van den Berg TNO, Delft, the Netherlands
Roberto Bruschi University of Genoa, Italy
Pedro Casas AIT Vienna, Austria
Ignacio Castro Queen Mary, University of London, UK
Ciprian Dobre University Politehnica of Bucharest, Romania
Christian E. Rothenberg University of Campinas, Brazil
Serge Fdida Université Pierre et Marie Curie (UPMC), France
Oliver Hohlfeld RWTH Aachen, Germany
Hirotada Honda NTT Network Technology Laboratories, Japan
David Irwin University of Massachusetts Amherst, US
Wolfgang Kellerer TU München, Germany
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steven Latre</td>
<td>University of Antwerp and iMinds, Belgium</td>
</tr>
<tr>
<td>Michela Meo</td>
<td>Politecnico di Torino, Italy</td>
</tr>
<tr>
<td>Dario Rossi</td>
<td>Telecom ParisTech, France</td>
</tr>
<tr>
<td>Fabian Schneider</td>
<td>NEC, Germany</td>
</tr>
<tr>
<td>Paul Smith</td>
<td>AIT Austrian Institute of Technology, Austria</td>
</tr>
<tr>
<td>Kurt Tutschku</td>
<td>BTH Karlskrona, Sweden</td>
</tr>
<tr>
<td>Steve Uhlig</td>
<td>Queen Mary, University of London, UK</td>
</tr>
<tr>
<td>Martina Zitterbart</td>
<td>Karlsruhe Institute of Technology, Germany</td>
</tr>
</tbody>
</table>

**Area 5: Network and Traffic Management**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samuli Aalto</td>
<td>Aalto University, Finland</td>
</tr>
<tr>
<td>Paul Barford</td>
<td>University of Wisconsin, US</td>
</tr>
<tr>
<td>Giuseppe Bianchi</td>
<td>University of Rome “Tor Vergata”, Italy</td>
</tr>
<tr>
<td>Thomas Bonald</td>
<td>Telecom ParisTech, France</td>
</tr>
<tr>
<td>Sem Borst</td>
<td>Alcatel-Lucent, Bell Labs, US</td>
</tr>
<tr>
<td>Minghua Chen</td>
<td>Chinese University of Hong Kong, China</td>
</tr>
<tr>
<td>Jon Crowcroft</td>
<td>University of Cambridge, UK</td>
</tr>
<tr>
<td>Anja Feldmann</td>
<td>TU Berlin, Germany</td>
</tr>
<tr>
<td>Richard Gibbens</td>
<td>University of Cambridge, UK</td>
</tr>
<tr>
<td>Benny Van Houdt</td>
<td>University of Antwerp, Belgium</td>
</tr>
<tr>
<td>Ramin Khalili</td>
<td>Huawei, Germany</td>
</tr>
<tr>
<td>T.V. Lakshman</td>
<td>Bell Labs - Alcatel-Lucent, US</td>
</tr>
<tr>
<td>Patrick Loiseau</td>
<td>Eurocom, France</td>
</tr>
<tr>
<td>Ravi Mazumdar</td>
<td>University of Waterloo, Canada</td>
</tr>
<tr>
<td>Aiko Pras</td>
<td>University of Twente, Netherlands</td>
</tr>
<tr>
<td>James Roberts</td>
<td>IRT SystemX, France</td>
</tr>
<tr>
<td>Costin Raiciu</td>
<td>University Politechnica Bucharest, Romania</td>
</tr>
<tr>
<td>Hiroshi Saito</td>
<td>NTT, Japan</td>
</tr>
<tr>
<td>Miklos Telek</td>
<td>Technical University of Budapest, Hungary</td>
</tr>
<tr>
<td>Steve Uhlig</td>
<td>Queen Mary London, UK</td>
</tr>
<tr>
<td>Xinbing Wang</td>
<td>Shanghai Jiao Tong University, China</td>
</tr>
</tbody>
</table>

**Area 6: Network Planning and Optimization**

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabio D’Andreagiovanni</td>
<td>ZIB Berlin, Germany</td>
</tr>
<tr>
<td>Achim Autenrieth</td>
<td>ADVA Optical Networking, Germany</td>
</tr>
<tr>
<td>Andreas Bley</td>
<td>University of Kassel, Germany</td>
</tr>
<tr>
<td>Wolfgang Bziuk</td>
<td>University of Braunschweig, Germany</td>
</tr>
<tr>
<td>Sammy Chan</td>
<td>City University of Hong Kong, China</td>
</tr>
<tr>
<td>Joachim Charzinski</td>
<td>Hochschule der Medien, Stuttgart, Germany</td>
</tr>
<tr>
<td>Didier Colle</td>
<td>iMinds, Ghent University, Belgium</td>
</tr>
<tr>
<td>Matthias Ermel</td>
<td>Detecon, Dresden, Germany</td>
</tr>
</tbody>
</table>
Markus Fiedler  Blekinge Institute of Technology (BTH), Sweden
Gerhard Hasslinger  Deutsche Telekom, Darmstadt, Germany
Brigitte Jaumard  Concordia University, Canada
Ulrich Killat  TU Hamburg-Harburg, Germany
Arie M.C.A Koster  RWTH Aachen, Germany
Wolfram Lautenschläger  Alcatel Lucent Bell Labs, Stuttgart, Germany
Yiu-Wing Leung  Hong Kong Baptist University, China
Xi Li  NEC Eurolab, Heidelberg, Germany
Rongping Lin  University of Electronic Science and Technology of China, China
Ralf Lehnert  TU Dresden, Germany
Carmen Mas Machuca  TU München, Germany
Deep Medhi  University of Missouri, Kansas City, US
Michal Pioro  Warsaw University of Technology, Poland / Lund University, Sweden

Christian Raack  Atesio, Berlin, Germany
Jacek Rak  Gdansk University of Technology, Poland
Mathias Schweigel  Detecon, Dresden, Germany
Gangxiang Shen  Soochow University, China
Phuong Nga Tran  TU Hamburg-Harburg, Germany
Anna Tzanakaki  University of Bristol, UK
Eugen Wallmeier  Nokia Networks, Ulm, Germany
Roland Wessäly  Atesio, Berlin, Germany

**Area 7: Network Measurements and Analysis**

Patrik Arlos  BTH, Sweden
Urtzi Ayesta  CNRS LAAS France
Sem Borst  Alcatel-Lucent, Bell Labs, US
Anna Brunstrom  Karlstad University, Sweden
Giovanna Carofiglio  Cisco Systems, France
Pedro Casas  AIT Vienna, Austria
Danilo Cicalese  Telecom ParisTech, France
Benoit Donnet  Université de Liège, Belgium
Douglas Down  McMaster University, Canada
Anja Feldmann  TU Berlin, Germany
Luigi Fratta  Politecnico di Milano, Italy
Marco Gribaudo  Politecnico di Milano, Italy
Yingdong Lu  IBM Research, US
John C.S. Lui  The Chinese University of Hong Kong, China
Siva Theja Maguluri  IBM Research
Ravi Mazumdar  University of Waterloo, Canada
Rob van der Mei  Centrum voor Wiskunde en Informatica, Netherlands
Michela Meo  Politecnico di Torino, Italy
Marco Milanesio  Eurecom, France
Luca Muscariello  Orange Labs - France Télécom, France
Area 8: Networked applications

Ake Arvidsson Ericsson, Sweden
Imed Bouazizi Samsung Research America, US
Sangtae Ha University of Colorado, US
Poul Heegard Norwegian University of Science and Technology, Norway
Cheolkon Jung Xidian University, China
Luntian Mou Beijing University of Technology, China
Symeon Papavassiliou National Technical University of Athens, Greece
Peter Počta University of Zilina, Slovakia
Zhan Ma Nanjing University, China
Nikolaos Thomos University of Essex, UK
Christian Timmerer Alpen-Adria-Universität Klagenfurt, Austria
Martin Varela Technical Research Centre of Finland, Finland
Dan Wang Hong Kong Polytechnic University, China
Xin Wang Huawei Media Lab, US
Liang Zhou Nanjing University of Post & Communications, China
Rong Zheng McMaster University, Canada

Demo Session

Andy Bavier Princeton University, US
Justin Cappos NYU Polytechnic, US
Chip Elliott GPO/BBN, US
Deniz Gurkan University of Houston, US
<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marc Körner</td>
<td>TU Berlin, Germany</td>
</tr>
<tr>
<td>Thanasis Korakis</td>
<td>NYU Polytechnic, US</td>
</tr>
<tr>
<td>Robert Krahn</td>
<td>Communications and Design Group, US</td>
</tr>
<tr>
<td>Joe Mambretti</td>
<td>Northwestern University, US</td>
</tr>
<tr>
<td>Sebastian Meier</td>
<td>University of Stuttgart, Germany</td>
</tr>
<tr>
<td>Hausi Muller</td>
<td>University of Victoria, US</td>
</tr>
<tr>
<td>Akihiro Nakao</td>
<td>University of Tokyo, Japan</td>
</tr>
<tr>
<td>Simon Oechsner</td>
<td>NEC Laboratories Europe, Germany</td>
</tr>
<tr>
<td>Max Ott, NICTA</td>
<td>Australia</td>
</tr>
<tr>
<td>Subharthi Paul</td>
<td>Cisco, US</td>
</tr>
<tr>
<td>Rastin Pries</td>
<td>Nokia Munich, Germany</td>
</tr>
<tr>
<td>Glenn Ricart</td>
<td>US Ignite, US</td>
</tr>
<tr>
<td>Niky Riga</td>
<td>Geni Project Office, US</td>
</tr>
<tr>
<td>Christian E. Rothenberg</td>
<td>University of Campinas, Brazil</td>
</tr>
<tr>
<td>Charalampos Rotsos</td>
<td>University of Lancaster, UK</td>
</tr>
<tr>
<td>Paul Ruth</td>
<td>RENCI, US</td>
</tr>
<tr>
<td>Dennis Schwerdel</td>
<td>University of Kaiserslautern, Germany</td>
</tr>
<tr>
<td>James Sterbenz</td>
<td>University of Kansas, US</td>
</tr>
</tbody>
</table>
Tuesday 13th September, 2016

09:00 – 09:30 Opening by Phuoc Tran-Gia

09:30 – 10:30 **Keynote** by Nikhil Jain (Qualcomm Technologies)
*Internet of Everything: Engineering Challenges and Opportunities*

10:30 – 11:00 Coffee break

11:00 – 12:20 **Session 1.A: Clouds and Data Centers**
*Offering Resilient and Bandwidth Guaranteed Services in Multi-Tenant Cloud Networks: Harnessing the Sharing Opportunities* by Hyame Assem Alameddine; Sara Ayoubi; Chadi Assi

*Dynamic Virtual Network Traffic Engineering with Energy Efficiency in Multi-Location Data Center Networks* by Mirza Mohd Shahriar Maswood; Chris Develder; Edmundo Madeira; Deep Medhi

*An Energy-Aware Embedding Algorithm for Virtual Data Centers* by Tran Manh Nam; Nguyen Van Huynh; Le Quang Dai; Nguyen Huu Thanh

**Session 1.B: Traffic and Network Management**
*Disaster Avoidance Control against Tsunami* by Phuong Nga Tran; Hiroshi Saito

*Building a Low Latency Linux Software Router* by Alexander Beifuß; Torsten M. Runge; Daniel Raumer; Paul Emmerich; Bernd E. Wolfinger; Georg Carle

*Traffic-Driven Implicit Buffer Management – Delay Differentiation Without Traffic Contracts* by Martin Karsten; Daniel S. Berger; Jens Schmitt

12:20 – 13:45 Lunch

13:45 – 15:15 **Session 2: Wireless**
*Full Demo 1: Self-Optimization of Software Defined Radios Through Evolutionary Algorithms* by Zubair Shaik; André Puschmann; Andreas Mitschele-Thiel

*Opportunistic Channel Estimation for Implicit 802.11af MU-MIMO* by Ryan E. Guerra; Narendra Anand; Clayton Shepard; Edward W. Knightly

*DiVote: A Distributed Voting Protocol for Mobile Device-to-Device Communication* by Peter Danielis; Sylvia T. Kouyoumdjieva; Gunnar Karlsson

15:15 – 15:45 Coffee break
Tuesday 13th September, 2016 (cont.)

15:45 – 17:05  **Session 3.A: Cellular**
*Joint Optimization of User Association and User Satisfaction in Heterogeneous Cellular Networks* by Farah Moety; Mustapha Bouhtou; Taoufik En-Najjary; Ridha Nasri
*Joint Resource Allocation and User Association for Heterogeneous Cloud Radio Access Networks* by Ying Loong Lee; Li-Chun Wang; Teong Chee Chuah; Jonathan Loo
*Performance-Oriented Association in Large Cellular Networks with Technology Diversity* by Abishek Sankararaman; Jeong-woo Cho; François Baccelli

**Session 3.B: Video Streaming**
*Bridging the Gap Between QoE and User Engagement in HTTP Video Streaming* by Christian Moldovan; Florian Metzger
*A Markov Model for Evaluating Resource Sharing Policies for DASH Assisting Network Elements* by Jan Willem Kleinrouweler; Sergio Cabrero; Rob van der Mei; Pablo Cesar
*Mobile Live Video Upstreaming* by Philip Lundrigan; Mojgan Khaledi; Makito Kano; Naveen Dasa Subramanyam; Sneha Kasera

18:30 – 20:00  Welcome Reception
**Wednesday 14th September, 2016**

09:00 – 10:00 **Keynote** by Wolfgang Kellerer (Technical University of Munich, Germany)
*Towards Flexible Networking in Dynamically Changing Environments*

10:00 – 10:30 Full Demo 2: *PlanetIgnite: A Self-Assembling, Lightweight, Infrastructure-as-a-Service Edge Cloud* by Andy Bavier; Rick McGeer; Glenn Ricart

10:30 – 11:00 Coffee break

11:00 – 12:20 **Session 4.A: Caching Strategies**
*Stochastic Dynamic Cache Partitioning for Encrypted Content Delivery* by Andrea Araldo; György Dán; Dario Rossi
*Access-time Aware Cache Algorithms* by Giovanni Neglia; Damiano Carra; Mingdong Feng; Vaishnav Janardhan; Pietro Michiardi; Dimitra Tsigkari
*Asymptotically Exact TTL-Approximations of the Cache Replacement Algorithms LRU(m) and $k$-LRU* by Nicolas Gast; Benny Van Houdt

12:20 – 13:45 Lunch
Wednesday 14th September, 2016 (cont.)

13:45 – 15:15  **Session 5: Demo Session**

*Demo: Resilient Integration of Distributed High-Performance Zones into the BelWue Network Using OpenFlow* by Mark Schmidt; Robert Finze; Daniel Reutter; Michael Menth

*Demonstrating a Personalized Secure-By-Default Bring Your Own Device Solution Based on Software Defined Networking* by Steffen Gebert; Thomas Zinner; Nicholas Gray; Raphael Durner; Claas Lorenz; Stanislav Lange

*Demonstrating Context-Aware Services in the MobilityFirst Future Internet Architecture* by Francesco Bronzino; Dipankar Raychaudhuri; Ivan Seskar

*jLISP: An Open, Modular and Extensible Java-Based LISP Implementation* by Andreas Stockmayer; Mark Schmidt; Michael Menth

*Network as a Service – A Demo on 5G Network Slicing* by Rastin Pries; Hans-Jochen Morper; Nandor Galambosi; Michael Jarschel

15:15 – 15:45  **Coffee break**

15:45 – 17:05  **Session 6.A: Softwarization**

*Sector: TCAM Space Aware Routing on SDN* by Sai Qian Zhang; Qi Zhang; Ali Tizghadam; Byungchul Park; Hadi Bannazadeh; Alberto Leon-Garcia; Raouf Boutaba

*Port Based Capacity Extensions (PBCEs): Improving SDNs Flow Table Scalability* by Robert Bauer; Martina Zitterbart

*Performance Modeling of Softwarized Network Functions Using Discrete-Time Analysis* by Steffen Gebert; Thomas Zinner; Stanislav Lange; Christian Schwartz; Phuoc Tran-Gia

19:00 – 23:00  **Social Event**
Thursday 15th September, 2016

09:00 – 10:00 Keynote by Eitan Altman (INRIA Sophia Antipolis, France)
Dynamic Games for Analyzing Competition in the Internet

10:00 – 10:30 Full Demo 3: LiveTalk: A Framework for Collaborative Browser-Based Replicated-Computation Applications by Matthew Hemmings; Daniel Ingalls; Robert Krahn; Rick McGeer; Glenn Ricart; Marko Röder; Ulrike Stege

10:30 – 11:00 Coffee break

11:00 – 12:20 Session 7.A: Measurements
IntegraTag: a Framework for High-Fidelity Web Client Measurement by Charles Thomas; Jeff Kline; Paul Barford
CLUE: Clustering for Mining Web URLs by Andrea Morichetta; Enrico Bocchi; Hassan Metwalley; Marco Mellia
Testing for Traffic Differentiation with ChkDiff: The Downstream Case by Riccardo Ravaioli; Guillaume Urvoy-Keller; Chadi Barakat

Session 7.B: Caching
ModelGraft: Accurate, Scalable, and Flexible Performance Evaluation of General Cache Networks by Michele Tortelli; Dario Rossi; Emilio Leonardi
Distributed Algorithms for Content Caching in Mobile Backhaul Networks by Valentino Pacifici; Sladana Jošilo; György Dán
Performance Evaluation for New Web Caching Strategies Combining LRU with Score Based Object Selection by Gerhard Hasslinger; Kostas Ntougias; Frank Hasslinger; Oliver Hohlfeld

12:20 – 13:45 Lunch

13:45 – 15:15 Session 8: Virtualization
A Power Efficient and Robust Virtual Network Functions Placement Problem by Antonio Marotta; Andreas J. Kassler
Elastic Network Service Provisioning with VNF Auctioning by Mathis Obadia; Mathieu Bouet; Vania Conan; Luigi Iannone; Jean-Louis Rougier

15:15 – 15:45 Closing Session
Workshop on Programmability for Cloud Networks and Applications (PROCON)

Monday 12th September, 2016

11:00 – 12:00  **Keynote** by Robert Birke (IBM Research – Zurich, Switzerland)
*Ensuring Performance in the Virtual Environment*

12:00 – 12:30  **ZOOM: Lightweight SDN-based Elephant Detection** by Steffen Gebert; Stefan Geißler; Thomas Zinner; Anh Nguyen-Ngoc; Stanislav Lange; Phuoc Tran-Gia

12:30 – 13:00  Short Lunch & Coffee Break

13:00 – 14:30  **A Novel Reconfigurable-by-Design Highly Distributed Applications Development Paradigm Over Programmable Infrastructure** by Panagiotis Gouvas; Constantinos Vassilakis; Eleni Fotopoulou; Anastasios Zafeiropoulos

*On the Necessity of Accounting for Resiliency in SFC* by Ghada Moualla; Thierry Turletti; Mathieu Bouet; Damien Saucez

**Automated Decision Making Methods for the Multi-objective Optimization Task of Cloud Service Placement** by Michael Seufert; Stanislav Lange; Markus Meixner

14:30 – 15:00  Coffee Break

15:00 – 15:30  Invited Demonstration & Live Talk: *An SDN/NFV Telco Operator Platform for Multipoint Video Live Streaming: Design and Prototyping* by Giovanni Schembra; Marcello Natale Melita

15:30 – 16:30  **OpenVolcano: An Open-Source Software Platform for Fog Computing** by Roberto Bruschi; Paolo Lago; Guerino Lamanna; Chiara Lombardo; Sergio Mangialardi

*An Analytical Model to Design Processor Sharing for SDN/NFV Nodes* by Giuseppe Faraci; Alfio Lombardo; Giovanni Schembra

16:30 – 16:45  Closing
2016 International Workshop on Quality of Experience Centric Management (QCMa)n

Friday 16th September, 2016

09:00 – 10:00 **Keynote** by Alexander Raake (TU Ilmenau, Germany)
*What’s the Number? Monitoring IP-based Video with Standardized QoE Models*

10:00 – 10:30 *Multi-Agent Systems for Personalized QoE-Management* by Amro Najjar; Xavier Serpaggi; Christophe Gravier; Olivier Boissier

10:30 – 11:00 Coffee Break

11:00 – 12:30 *YouTube Can Do Better: Getting the Most Out of Video Adaptation* by Christian Moldovan; Christian Sieber; Poul Heegaard; Wolfgang Kellerer; Tobias Hoßfeld
*Towards a Framework for Comparing Application-Network Interaction Mechanisms* by Susanna Schwarzmann; Thomas Zinner; Ognjen Dobrijević
*Impact of Variances on the QoE in Video Streaming* by Christian Moldovan; Tobias Hoßfeld

12:30 – 13:30 Lunch

13:30 – 14:00 *Application-Aware Infrastructure Clustering for Cloud Service Placement to Enhance User QoE* by Dmitrii Chemodanov; Prasad Calyam

14:00 – 14:40 Short Paper: *Insensitivity to Network Delay: Minecraft Gaming Experience of Casual Gamers* by Oliver Hohlfeld; Hannes Fiedler; Enric Pujol; Dennis Guse
Short Paper: *Correlating QoE and Technical Parameters of an SAP System in an Enterprise Environment* by Kathrin Borchert; Matthias Hirth; Thomas Zinner; Decebal Constantin Mocanu

14:40 – 15:00 Coffee Break

15:00 – 16:00 Panel: *What Are Challenges in Managing the QoE of the Upcoming Wave of Immersive Media-rich Applications?*

16:00 – 16:15 Closing
ITC 28 Sponsors

The International Advisory Committee (IAC) of the ITC has decided to offer a number of travel grants that will be available to support full-time students for attending ITC 28. The IAC financially supports three prestigious awards for ITC 28: Best Paper Award, Best Student Paper Award, Best Demo Award.

Silver Sponsor

Bronze Sponsor

Bronze Sponsor

Technical Sponsors

ITC 28 is technically co-sponsored by IEEE Communications Society (IEEE ComSoc) and the Information Technology Society within VDE (ITG VDE), and in-cooperation with ACM SIGCOMM.

ITG