



TMA Conference 2018

Proceedings of the 2nd Network Traffic  
Measurement and Analysis Conference

Vienna, Austria, June 26-29, 2018

ISBN: 978-3-903176-09-6

## Contents

<b>1</b>	<b>CHAIR’S WELCOME</b>	<b>3</b>
<b>2</b>	<b>TMA CONFERENCE 2018 ORGANIZATION</b>	<b>5</b>
<b>3</b>	<b>MNM WORKSHOP 2018 ORGANIZATION</b>	<b>7</b>
<b>4</b>	<b>TMA TECHNICAL PROGRAM</b>	<b>8</b>
4.1	TMA Conference Program . . . . .	8
4.2	MNM Workshop Program . . . . .	11

# 1 CHAIR’S WELCOME

As we witness the explosion of demand for bandwidth and exciting changes in the ways we do networking brought about by SDN, virtualization, cloud, IoT and ubiquitous broadband wireless, we are facing new challenges in measurement and analysis across the entire network stack, from the physical layer up to applications and services in the cloud. The Network Traffic Measurement and Analysis Conference, **TMA Conference**, focuses on improving the practice or application of measurements, across the entire network stack up to the application layer, with an emphasis on new areas of network communication such as Software-Defined Networks, Cloud services, Content Distribution Networks, Social Networks, mobile applications and data centers. TMA Conference 2018 also tackles traditional measurement topics, such as traffic classification, anomaly detection, network performance evaluation and traffic analysis.

**TMA Conference 2018 accepted 22 technical papers out of 56**, high-quality submissions. The paper review process included an evaluation phase by PC members, followed by an online discussion and a subsequent shepherding phase on selected papers. The resulting program features a variety of high-quality papers focusing on different aspects of network measurement and analysis, including traffic analysis, data analytics, mobile measurement, content and application measurement, as well as network characterization. This year, the main program also included a **special technical session on *Hands-on Network Traffic Measurement and Analysis***, as well as a ***Demos and PhD School Student Posters*** session.

TMA Conference 2018 hosted three events: the first **TMA Experts Summit**, the second edition of the **workshop on Mobile Network Measurement (MNM)**, and the **8th TMA PhD school**, started back in 2010 and recognized as the most important PhD school in network measurement and analysis topics today. The **TMA Experts Summit** consisted of a full-day event featuring keynotes from renown researchers worldwide on different aspects of network measurement and analysis (e.g., Artificial Intelligence and Machine Learning, Blockchain and Cryptocurrency, SDN/NFV, IoT, QoE, Cyber-security, etc.). The list of speakers included **Anja Feldmann** (Max Planck Institute for Informatics), **Edo Liberty** (AWS and Amazon AI Labs), **Bruce Maggs** (Akamai Technologies and Duke University), **Felipe Huici** (NEC Europe Labs), **J r mie Leguay** (Huawei Technologies), **Fabi n Bustamante** (Northwestern University), **Tobias Hofffeld** (University of W rzburg), **Georgios Smaragdakis** (TU-Berlin and MIT), **Bernhard Haslhofer** (AIT’s Digital Insight Lab) and **Gerardo Rubino** (INRIA).

The conference featured three exciting talks from recognized researchers and practitioners in network measurements, including:

**Mergeable Summaries and the Data Sketches Library**

Edo Liberty (AWS and Amazon AI Labs)

**Network Research and Falling Trees**

Fabián Bustamante (Northwestern University)

**Seeing Things: Measuring IoT, IPv6, and Privacy**

David Plonka (Akamai Technologies)

To provide an educational experience by introducing students to a review process and to subsequently train the next generation of program committee (PC) members, the **TMA Conference 2018 TPC ran a shadow PC**, with great success and feedback from the participating members.

TMA Conference 2018 delivered a **best paper award**, a **best open dataset award** and a **best demo award**, in all cases providing a monetary award of EUR 500 besides the corresponding recognition. Three top papers from the main conference were invited for **fast tracking at the IEEE Transactions on Network and Service Management journal**.

**TMA Conference 2018 has been a great success**, and we hope that all attendees have enjoyed the excellent technical program and found a nice and constructive environment to discuss on new ideas and upcoming challenges to tackle within the scope of TMA.

**Pedro Casas**  
AIT Vienna

**Nur Zincir-Heywood**  
Dalhousie University

**Amogh Dhamdhare**  
CAIDA UC San Diego

TMA Conference 2018 general chair and program chairs.

## 2 TMA CONFERENCE 2018 ORGANIZATION

### General Chair

Pedro Casas, *AIT Austrian Institute of Technology, Austria*

### Program Chairs

Nur Zincir-Heywood, *Dalhousie University, Canada*

Amogh Dhamdhere, *CAIDA UC San Diego, USA*

### Program Committee

Riyad Alshammari, *KSAU-HS, Saudi Arabia*

Isabel Amigo, *IMT Atlantique, France*

Vaibhav Bajpai, *TU Munich, Germany*

Anna Brunstrom, *Karlstadt University, Sweden*

Cristina Cano, *Universitat Oberta de Catalunya, Spain*

Valentín Carela-Español, *Talaia Networks, Spain*

Niklas Carlsson, *University of Linköping, Sweden*

Damiano Carra, *University of Verona, Italy*

Pavel Celeda, *Masaryk University, Czech Republic*

Sandip Chakraborty, *Indian Institute of Technology-Kharagpur, India*

Rocky Chang, *The Hong Kong Polytechnic University, Hong Kong*

Kenjiro Cho, *IJ Research Lab, Japan*

Isabelle Chrisment, *Université de Lorraine, France*

Alberto Dainotti, *CAIDA UC San Diego, USA*

Alessandro D'Alconzo, *AIT Austrian Institute of Technology, Austria*

Fabio D'Andreagiovanni, *CNRS, France*

Benoit Donnet, *Université de Liège, Belgium*

Constantine Dovrolis, *Georgia Tech, USA*

Ram Durairajan, *University of Oregon, USA*

Pierdomenico Fiadino, *EURECAT, Spain*

Alessandro Finamore, *Telefonica Research, Spain*

Lisandro Granville, *Federal University of Rio Grande do Sul, Brazil*

Francesco Gringoli, *University of Brescia, Italy*

Mehmet Gunes, *University of Nevada-Reno, USA*  
Hamed Haddadi, *Imperial College London, UK*  
Dali Kaafar, *NICTA, Australia*  
Sanjit Kaul, *IIT-Delhi, India*  
Matthieu Latapy, *LIP6 – CNRS and UPMC, France*  
Solange Lima, *University of Minho, Portugal*  
Matthew Luckie, *University of Waikato, New Zealand*  
Cristian Lumezanu, *NEC Laboratories America, USA*  
Xiao Luo, *Purdue School of Engineering and Technology – IUPUI, USA*  
Hanan Lutfiyya, *University of Western Ontario, Canada*  
Andra Lutu, *Simula Research Lab, Norway*  
Dwight Makaroff, *University of Saskatchewan, Canada*  
Cristel Pelsser, *University of Strasbourg, France*  
Antonio Pescapè, *University of Napoli - “Federico II”, Italy*  
Stefano Secci, *LIP6, France*  
Georgios Smaragdakis, *TU Berlin/MIT, Germany*  
Gareth Tyson, *Queen Mary University of London, UK*  
Danilo Valerio, *SIEMENS, Austria*  
Narseo Vallina-Rodriguez, *IMDEA Networks, USA*  
Shobha Venkataraman, *AT&T Labs – Research, USA*  
Christina Vlachou, *HP Labs, USA*  
Ibrahim Zincir, *Yasar University, Turkey*

## **Steering Committee**

Pere Barlet-Ros, *UPC BarcelonaTech, Spain*  
Alessio Botta, *University of Napoli Federico II, Italy*  
Christian Callegari, *CNIT, Italy*  
Alberto Dainotti, *CAIDA UC San Diego, USA*  
Emir Halepovic, *AT&T Labs - Research, USA*  
Aniket Mhanti, *University of Auckland, New Zealand*  
Marco Mellia, *Politecnico di Torino, Italy*  
Aiko Pras, *University of Twente, Netherlands*  
Fabio Ricciato, *University of Ljubljana, Slovenia*  
Ramin Sadre, *Université catholique de Louvain, Belgium*  
Sandrine Vaton, *IMT Atlantique, France*

### 3 MNM WORKSHOP 2018 ORGANIZATION

#### Program Chairs

Özgül Alay, *Simula Research Lab, Norway*  
Mirja Kühlewind, *ETH Zurich, Switzerland*

#### Program Committee

Anna Brunstrom, *Karlstad University, Sweden*  
Tobias Bühler, *ETH Zurich, Switzerland*  
Benoit Donnet, *Université de Liège, Belgium*  
Gorry Fairhurst, *University of Aberdeen, UK*  
Simone Ferlin, *IBM, Norway*  
Thomas Fossati, *NOKIA, UK*  
Haakon Lonsethagen, *Telenor Research, Norway*  
Diego Lopez, *Telefonica, Spain*  
Andra Lutu, *Simula Research Laboratory, Norway*  
Vincenzo Mancuso, *IMDEA Networks, Spain*  
Marco Mellia, *Politecnico di Torino, Italy*  
David Ros, *Simula Research Laboratory, Norway*  
Brian Trammell, *ETH Zurich, Switzerland*

## 4 TMA TECHNICAL PROGRAM

### 4.1 TMA Conference Program

#### Session 1: Traffic Analysis

##### **eMIMIC: Estimating HTTP-based Video QoE Metrics from Encrypted Network Traffic**

*Tarun Mangla, Emir Halepovic, Mostafa Ammar, Ellen Zegura*

##### **FlowMon-DPDK: Parsimonious per-flow Software Monitoring at Line Rate**

*Tianzhu Zhang, Leonardo Linguaglossa, Massimo Gallo, Paolo Giaccone, Dario Rossi*

##### **Degree-based Outliers Detection within IP Traffic Modelled as a Link Stream**

*Audrey Wilmet, Tiphaine Viard, Matthieu Latapy, Robin Lamarche-Perrin*

##### **First Look at Data Center Network Conditions Through The Eyes of PTPmesh**

*Diana Andreea Popescu, Andrew W. Moore*

#### Session 2: Data Analytics

##### **Dmap: Automating Domain Name Ecosystem Measurements and Applications**

*Maarten Wullink, Giovane C. M. Moura, Cristian Hesselman*

##### **On the Analysis of Network Measurements through Machine Learning: the Power of the Crowd**

*Pedro Casas*

##### **An Artificial Arms Race: Could it Improve Mobile Malware Detectors?**

*Raphael Bronfman-Nadas, Nur Zincir-Haywood, John T. Jacobs*

##### **Mobile Encrypted Traffic Classification Using Deep Learning**

*Aceto Giuseppe, Domenico Ciunzo, Antonio Montieri, Antonio Pescapè*

#### Session 3: Mobile Measurement

##### **Anycast on the Move: A Look at Mobile Anycast Performance**

*Sarah Wassermann, John P. Rula, Fabián E. Bustamante, Pedro Casas*



**Measurement Analysis of TCP Congestion Control Algorithms in LTE Uplink**

*Ali Parichehreh, Stefan Alfredsson, Anna Brunstrom*

**Measuring Mobile Network Multi-Access for Time-Critical C-ITS Applications**

*Fehmi Ben Abdesslem, Henrik Abrahamsson, Bengt Ahlgren*

**Session 4: Content/Application Measurement**

**Passive Observations of a Large DNS Service: 2.5 Years in the Life of Google**

*Wouter B. de Vries, Roland van Rijswijk-Deij, Pieter-Tjerk de Boer, Aiko Pras*

**A Wrapper for Automatic Measurements with YouTube's Native Android App**

*Michael Seufert, Bernd Zeidler, Florian Wamser, Theodoros Karagkioules, Dimitrios Tsilimantos, Frank Loh, Phuoc Tran-Gia, Stefan Valentin*

**A Second Screen Journey to the Cup: Twitter Dynamics during the Stanley Cup Playoffs**

*Daniel de Leng, Mattias Tiger, Mathias Almquist, Viktor Almquist, Niklas Carlsson*

**Studying the Evolution of Content Providers in the Internet Core**

*Esteban Carisimo, Carlos Selmo, J. Ignacio Alvarez-Hamelin, Amogh Dhamdhere*

**Session 5: Hands-on Network Traffic Measurement and Analysis**

**Tracing Internet Path Transparency**

*Mirja Kühlewind, Michael Walter, Iain R. Learmonth, Brian Trammell*

**Towards Provable Network Traffic Measurement and Analysis via Semi-Labeled Trace Datasets**

*Milan Cermak, Tomas Jirsik, Petr Velan, Jana Komarkova, Stanislav Spacek, Martin Drasar, Tomas Plesnik*

**Comparison of Spectral and Energy Efficiency Metrics using Measurements in a LTE-A Network**

*Sandrine Boumard, Ilkka Harjula, Teemu Kanstren, Seppo J. Rantala*

**Non-parametric Bootstrap Detection of Availability Service Level Objective Violations in Cloud Storage**

*Maurizio Naldi*

**Session 6: Demos**

**App for Dynamic Crowdsourced QoE Studies of HTTP Adaptive Streaming on Mobile Devices**

*Michael Seufert, Nikolas Wehner, Pedro Casas*

**An SDN-based Approach for QoS and Reliability in Overlay Networks**

*Isabel Amigo, Gabriel Gómez Sena, Marwa Chami, Pablo Belzarena*

**Automated VNF Testing with Gym: A Benchmarking Use Case**

*Raphael Vicente Rosa, Christian Esteve Rothenberg*

**An Intelligent Data Visualization Service Platform for Mobile Network Operators**

*Naz Albayrak, Engin Zeydan*

**Distributed Internet Paths Performance Analysis through Machine Learning**

*Sarah Wassermann, Pedro Casas*

**YouTube QoE Monitoring with YoMoApp: A Web-based Data Interface for Researchers**

*Florian Wamser, Nikolas Wehner, Michael Seufert, Pedro Casas, Phuoc Tran-Gia*

**Session 7: Inference of Network Properties**

**Demystifying TCP Initial Window Configurations of Content Distribution Networks**

*Jan R uth, Oliver Hohlfeld*

**Using Crowdsourcing Marketplaces for Network Measurements: The Case of Spoofer**

*Qasim Lone, Mobin Javed, Maciej Korczynski, Hadi Asghari, Matthew Luckie, Michel van Eeten*

**Exploring usable Path MTU in the Internet**

*Ana Custura, Gorry Fairhurst, Iain Learmonth*

## 4.2 MNM Workshop Program

### Session 1: Network QoS and Coverage

#### **Visualizing Mobile Coverage from Repetitive Measurements on Defined Trajectories**

*Chad Jarvis, Cise Midoglu, Andra Lutu, Özgü Alay*

#### **I'm Only Unhappy When It Rains: Forecasting Mobile QoS With Weather Conditions**

*Diego Madariaga, Martín Panza, Javier Bustos-Jimenez*

#### **Deriving Cell Load from RSRQ Measurements**

*Vaclav Raida, Martin Lerch, Philipp Svoboda, Markus Rupp*

### Session 2: Multipath and Application Performance

#### **Connected Vehicles in Cellular Networks: Multi-access versus Single-access Performance**

*Henrik Abrahamsson, Fehmi Ben Abdesslem, Bengt Ahlgren, Anna Brunstrom, Ian Marsh, Mats Bjorkman*

#### **Voice-activated Applications and Multipath TCP: a Good Match?**

*Viet-Hoang Tran, Hajime Tazaki, Quentin De Coninck, Olivier Bonaventure*

#### **A Public Dataset for YouTube's Mobile Streaming Client**

*Theodoros Karagkioules, Dimitrios Tsilimantos, Stefan Valentin, Florian Wamser, Bernd Zeidler, Michael Seufert, Frank Loh, Phuoc Tran-Gia*