



TMA Conference 2019

**Proceedings of the 3rd Network Traffic
Measurement and Analysis Conference**

Paris, France, June 19-21, 2019

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2019 IFIP/IEEE Network Traffic Measurement and Analysis Conference (TMA CONFERENCE 2019). TMA 2019 will be held 19-21 June 2019 in Paris, France.

**Editors: Stefano Secci, Isabelle Chrisment, Marco Fiore,
Lionel Tabourier, and Keun-Woo Lim**

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2 CHAIR’S WELCOME

The surging demand for bandwidth and the increasing heterogeneity of services are posing substantial new challenges in networking. Emerging paradigms based on the softwarization, virtualization, cloudification of the network infrastructures are fostering exciting changes in the ways we build and manage such systems. In particular, they force us to re-think traffic measurement and analysis across the whole stack, from the physical layer up to applications in the Cloud. **The Third edition of the Network Traffic Measurement and Analysis Conference (TMA 2019)** focused 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 2019 also tackled traditional measurement topics, such as traffic classification, anomaly detection, network performance evaluation and traffic analysis.

The technical program of TMA 2019 included 24 papers, selected among 65 high-quality submissions from researchers working at institutions in 25 different countries worldwide, and representing a record figure for the venue. Accepted papers were selected through a rigorous review process, with at least three (but more often four) reviews per paper, followed by an online discussion phase. 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 Session on Hands-on Network Traffic Measurement and Analysis**, a **Demo Session**, as well as a **PhD School Student Posters Session**.

TMA 2019 hosted three joint events: the **2nd TMA Experts Summit**, the **3rd Workshop on Mobile Network Measurement (MNM)**, and the **9th 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 renowned researchers worldwide on different aspects of network measurement and analysis, including Artificial Intelligence and Machine Learning for networks, SDN/NFV, mobile metadata analysis, mobile and IoT systems, QoE, and Cyber-security. The list of speakers included **Cristel Pelsser** (Professor at the University of Strasbourg, France), **Steve Uhlig** (Professor at Queen Mary University of London, UK), **Mark Crovella** (Professor at Boston University, USA), **Francis Bach** (researcher at Inria and adjunct Professor at Ecole Normale Supérieure, France), **David Choffnes** (Professor at Northeastern University, USA), **Sandra Scott-Hayward** (Assistant Professor at Queen’s University Belfast, UK), and **Aline Viana** (Research Scientist at Inria, France).

TMA 2019 featured three exciting talks from recognized researchers and practitioners in network measurements:

Network monitoring in the age of “deep” network programmability
Laurent Vanbever (ETH Zürich, Switzerland)

Machine Learning for Data Streams
Albert Bifet (Telecom Paris, France)

Put a Tiger in Your Tank: What benefits can hardware bring to intelligent network operation?
Dario Rossi (Huawei Technologies, France).

TMA 2019 delivered a **Best Paper Award** (“*TNT, Watch me Explode: A Light in the Dark for Revealing MPLS Tunnels*”, by Yves Vanaubel, Jean-Romain Luttringer, Pascal Mérindol, Jean-Jacques Pansiot, Benoit Donnet), a **Best Student Poster Award** (“*BGP hijacking classification*”, by Shinyoung Cho) and a **Best Demo Award** (“*Autonomous IoT Device Identification Prototype*”, by Nesrine Ammar, Ludovic Noirie, Sébastien Tixeuil), in all cases providing a monetary award of EUR 500 besides the corresponding recognition. A **Best Open Dataset Award** (“*Inferring Netflix User Experience from Broadband Network Measurement*”, by Sharat Chandra Madanapalli, Hassan Habibi Gharakheili, Vijay Sivaraman) was also delivered to spotlight a paper making its original experimental datasets open to the research community.

Three top papers from the main conference were invited for **fast tracking at the IEEE Transactions on Network and Service Management journal**.

Overall, we consider that **TMA 2019 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.

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Cnam (France)

Isabelle Chrisment
Loria (France)

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CNR (Italy)

TMA 2019 General Chair and Program Chairs.

3 TMA CONFERENCE 2019 ORGANIZATION

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5 TMA TECHNICAL PROGRAM

5.1 TMA Conference Program

Session I : Inter-domain affairs: outages, geolocation and trust across AS

Chocolatine: Outage Detection for Internet Background

Radiation 1-8

Andreas Guillot, Romain Fontugne, Philipp Winter, Pascal Merindol, Alistair King, Alberto Dainotti, Cristel Pelsser

Geo-locating BGP prefixes

9-16

Philipp Winter, Ramakrishna Padmanabhan, Alistair King, and Alberto Dainotti

Filtering the Noise to Reveal Inter-Domain Lies

17-24

Julian Martin Del Fiore, Pascal Merindol, Valerio Persico, Cristel Pelsser, and Antonio Pescape

BGP hijacking classification

25-32

Shinyoung Cho, Romain Fontugne Kenjiro Cho, Alberto Dainotti, and Phillipa Gill

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The ODDness of Webpages

33-40

Marcin Furtak and Mike P. Wittie

Inferring Netflix User Experience from Broadband Network Measurement (Best Open Dataset Award)

41-48

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Comparative Analysis of Adult Video Streaming Services: Characteristics and Workload

49-56

Raymond Yu, Callan Christophersen, Yo-Der Song, and Aniket Mahanti

Inferring the Deployment of Top Domains over Public Clouds using DNS Data

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Quentin Jacquemart, Clement Pigout, and Guillaume Urvoy-Keller

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Subnet Inference WISE-ly 73-80

Jean-Francois Grailet and Benoit Donnet (University of Liege)

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Clairvoyant Networks 89-96

Cheng Jin, Cristian Lumezanu, Zhi-Li Zhang, and Haifeng Chen

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Tackling Mobile Traffic Critical Path Analysis With Passive and Active Measurements 105-112

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Stefan Neumeier, Ermias Walelgne, Vaibhav Bajpai, Jorg Ott, and Christian Facchi

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Matt Calder, Xun Fan, and Liang Zhu

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Fangye Tang and Israat Haque

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Carlos Lopez, Daniel Morato, Eduardo Magana, and Mikel Izal

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Thomas Kobber Panum, Rene Rydhof Hansen, and Jens Myrup Pedersen

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Belma Turkovic, Fernando A. Kuipers, and Steve Uhlig

A Bottom-Up Investigation of the Transport-Layer Ossification 169-176
Korian Edeline and Benoit Donnet

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Jan Ruth, Ike Kunze, and Oliver Hohlfeld

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Edward Oakes, Jeffery Kline, Aaron Cahn, Keith Funkhouser, and Paul Barford

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Leonardo Linguaglossa, Fabien Geyer, Wenqin Shao, Frank Brockners, and Georg Carle

Autonomous IoT Device Identification Prototype (Best Demo Award) 195-196
Nesrine Ammar, Ludovic Noirie, and Sebastien Tixeuil

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Yekta Turk, Engin Zeydan, Fatih Mercimek, and Engin Danisman

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Sarah Wassermann, Michael Seufert, Pedro Casas, Li Gang, and Kuang Li

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5.2 MNM Workshop Program

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*Arcangela Rago, Giuseppe Piro, Hoang Duy Trinh, Gennaro Boggia, Paolo
Dini*

**Reducing Consumed Data Volume in Bandwidth Measurements via
a Machine Learning Approach** 215-220
*Christian Maier, Peter Dorfinger, Jia Lei Du, Sven Gschweidl, Johannes
Lusak*

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