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# Leone

From global measurements to local management



## Report on the Dagstuhl Seminar 13472 Global Measurement Framework

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<b>PP</b>	Restricted to other programme participants (including the Commission Services)	
<b>RE</b>	Restricted to bodies determined by the Leone project	
<b>CO</b>	Confidential to Leone project and Commission Services	



## ABSTRACT

This report provides a brief summary of the Dagstuhl seminar on the Global Measurement Framework. Technical information is available on the Dagstuhl website <http://www.dagstuhl.de/13472>, and we foresee an article to be published on the findings.

## ABOUT THE PROJECT

**Project Coordinator:** Philip Eardley, BT

**Technical Manager:** Sam Crawford, SamKnows

**Start date of project:** November 1st 2012

**Duration:** 30 months

## ABOUT THE DOCUMENT

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## Document Revision History

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## Executive Summary

The Leone project organized a Schloss Dagstuhl seminar on “Global Measurement Framework”. It was held from 17<sup>th</sup> – 20<sup>th</sup> November 2013 in Dagstuhl, Germany.

During the seminar we discussed two main issues. Firstly, what are the challenges of building a large-scale measurement capability? – including what standards do we need to define, how do we manage ‘big data’ and how do we handle privacy issues. Secondly, how could such a capability could be used by ISPs, regulators and end users?

Excellent discussions took place between 27 experts from operators, vendors, regulators and academics, and we also agreed some next steps.

The seminar is our promised “Scientific workshop”. One of the five organisers is part of the FCC and another is part of the mPlane project – we are grateful for their help to make the workshop successful.

## Purpose of the Seminar

The Internet has a history of unexpected and often unpredictable behaviors due to manifold interactions of thousands of networks, and billions of components and devices and users. The resulting complexity requires measurements to understand how the network is performing, to observe how it is evolving, and to determine where failures or degradations occur. Especially with constantly evolving applications and their interaction paradigms, new phenomena occur and need to be factored into operations and management: one example is the substantial effort going into defining interfaces to assist peer-to-peer applications so that the amount of cross-ISP traffic is reduced. Measurements thus form an integral part of network operator tool sets to keep the net up and running.

But measurements are equally important for the research community to understand network traffic as well as protocol and application dynamics and their evolution. And they assist in quantifying application and (access) network performance and thus provide a tool for end users and regulators to monitor operators and their service level agreements. Tools such as *speedtest.net* have become widely used for individual measurements and basic ISP rating. Measurement service providers such as *SamKnows* offer networks of probes, i.e., separate devices or embedded software on access routers, for continuous background measurements at the end users. They can also assist regulators in their work. Finally, associations such as CAIDA ([www.caida.org](http://www.caida.org)) and their associated projects offer measurement data and tools, mainly targeted at the research community.

Recently interest in Internet measurements has grown as activities such as these show: in the research community (such as the projects *Leone* and *mPlane*); in industry and standards forums (such as the *large-scale measurement of broadband performance* working group in the IETF), and the *Broadband access service attributes and performance metrics* activity WT-304 in the Broadband Forum); and those by regulators (for example, Ofcom and the US Federal Communications Commission publish regular reports on UK and US fixed-line broadband performance, and the FCC has recently launched a mobile performance measurement project). All this indicates a demand to improve Internet measurements in many respects, including:

- improving the expressiveness of measurement metrics, beyond throughput, loss rate, and RTT - so that the actual application-specific user *quality of experience* can be assessed;
- expanding the reach, scale, and diversity of measurements and the corresponding data analysis to obtain a more comprehensive view on the performance of networks and applications;
- structuring the otherwise mostly disconnected measurement activities to allow interfacing between them and/or providing defined methods to access them, for both carrying out measurements and accessing measurement results, whether offline or in real-time;
- providing ways to better instrument and more broadly utilize measurement infrastructure, inside operators, for end users, and at third parties.

This Dagstuhl seminar was to assist the community to achieve these goals. It brought together researchers from industry, academia, and regulators across continents and across different backgrounds to discuss the state of the art in measurements and their exploitation, measurement and analysis techniques, privacy and anonymization. The aim was also to identify and initiate the next steps towards a coherent global measurement framework for the Internet.

## Agenda

The seminar ran for 2.5 days, with participants arriving on Sunday evening and leaving on Wednesday afternoon, so that the full 2.5 days were available for discussion. Aided by two panels to seed the discussion, a substantial amount of time was devoted to group work on the different topics. Leisurely get-togethers in the evening and an evening event on Tuesday (sponsored by Leone and mPlane) further fostered also informal interactions throughout the seminar.

Day 0	Evening	Informal opening and discussion
Day 1: Creating the global measure- ment platform	Morning	Welcome and organization Introduction of participants (1-2min each, <i>one slide each</i> ) Invited panel talks on today's measurement infrastructures <ul style="list-style-type: none"> <li>• Arthur Berger (Akamai)</li> <li>• Benoit Claise (Cisco)</li> <li>• Sam Crawford (SamKnows)</li> <li>• Daniel Karrenberg (RIPE)</li> </ul>
	Afternoon	Group discussion I: Creating the global measurement platform <ul style="list-style-type: none"> <li>• Latency measurements</li> <li>• Infrastructure and interfaces</li> <li>• Privacy</li> <li>• Doing it wrong: worst practices</li> </ul>
	Evening	Informal continuation and group summary preparation
Day 2: Using the platform	Morning	Presentation and discussion of group findings Invited panel talks and discussion on the regulator, operator, and user views and on applications using measurement data <ul style="list-style-type: none"> <li>• Al Morton (AT&amp;T)</li> <li>• Henning Schulzrinne (Columbia University, FCC)</li> <li>• Andrea Soppera (BT)</li> <li>• Fabian Bustamente (Northwestern University)</li> </ul>
	Afternoon	Group discussion II: Using the global measurement platform <ul style="list-style-type: none"> <li>• operator and regulator use cases</li> <li>• end user use cases</li> <li>• data analysis</li> </ul>
	Evening	Event and Informal discussions
Day 3	Morning	Presentation and discussion of group results II Discussion of next steps: a summary paper to be written and published in ACM Computer Communications Review
	Afternoon	Conclusion and Seminar observations

The seminar was very well received and virtually all participants would be excited to join another one in, e.g., two years' time.

## Participants

Saba Ahsan, Aalto University  
Vaibhav Bajpai, Jacobs University Bremen  
Arthur W. Berger, Akamai Technologies  
Ernst Biersack, EURECOM - Biot  
Trevor Burbridge, BT Research  
Fabian E. Bustamante, Northwestern University  
Pedro Casas, FZ Telekommunikation Wien  
Benoit Claise, CISCO Systems Belgium  
Sam Crawford, SamKnows Ltd. - London  
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Mirja Kuehlewind, Universität Stuttgart  
Abdelkader Lahmadi, INRIA - Nancy - Grand Est  
Jukka Manner, Aalto University  
Marco Mellia, Polytechnic University of Torino  
Al Morton, AT&T - Middletown  
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Dario Rossi, Télécom Paris Tech  
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Henning Schulzrinne, Columbia University  
Andrea Soppera, BT Research  
Anna Sperotto, University of Twente  
Burkhard Stiller, Universität Zürich  
Tivadar Szemethy, Netvisor - Budapest  
Brian Trammell, ETH Zürich



## Organizers

The seminar was jointly organized by the EC FP7 projects Leone (Philip Eardley, Jörg Ott, Jürgen Schönwälder) and mPlane (Marco Mellia) in cooperation with Henning Schulzrinne, with additional members of Leone (Marcelo Bagnulo, Olivier Bonaventure, Sam Crawford) contributing to the preparation. The proposal preparation, participant selection, and the organization before the seminar and on-site were jointly done by all organizers. Jörg Ott served as the “lead organizer” and thus as the primary contact for the interaction with the Dagstuhl staff.

## Results

The results of the work groups are documented on the seminar material page. An article is in preparation to summarize those results (to be published in 2014).

The official Dagstuhl web page for this seminar is at: <http://www.dagstuhl.de/13472/>