



# FIRE Workshop on Measurements and Measurements Tools

Aalborg (Denmark) - May 9, 2012

FIRE thematic workshop collocated with the FIA conference, Aalborg (Denmark), May 7 - 11, 2012  
<http://www.future-internet.eu/home/future-internet-assembly/aalborg-may-2012.html>

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## DESCRIPTION

**Measurements and measurement tools** will be key elements in the operation and management of future network infrastructures, at the equipment and network **performance monitoring** level but also in support of **higher-level control** functionality such as on-line analysis and diagnostic. These tools also play a fundamental role in **measurement-based experimental research** relying on the experimental evaluation and benchmarking of project outcomes including protocols, systems, etc., by means of reliable and verifiable tools.

This workshop aims at presenting current developments on measurements and measurement tools in **research projects within FIRE** (Future Internet Research and Experimentation) initiative of the EU 7th Framework Programme (FP7). Speakers from 9 different FIRE projects will present their current needs and developments on measurements and associated tools in the context of experimental research in the areas of wireless/sensor networks, informatic-centric networking, large scale experimental facilities, OpenFlow-enabled networks and Internet. The expected outcomes of this workshop are: i) identify what can be performed/reached by means of **cooperation between projects** from a directory of tools accessible to the FIRE community at large up to the joint development of tools, under which conditions, etc., and ii) determine **needs and document best practices** in tools development for measurement-based experimental research.

This workshop is organized by the **EULER research project** as part of the FIRE activities in the Future Internet Assembly (FIA) conference in Aalborg (May 7 - 11, 2012). The EULER project, a 3-year STREP part of the FIRE initiative, aims at investigating new routing paradigms so as to design, develop, and validate experimentally a distributed and dynamic routing scheme suitable for the future Internet and its evolution (<http://www.euler-fire-project.eu>).

## REGISTRATION

Attendees must follow the **FIA Aalborg conference registration guidelines** available at <http://www.fi-aalborg.eu/index.php/registration>. Please, choose "Registration fee for Future Internet Week" and "EULER sessions" in order to guarantee enough sites in the room. The 50€ fee includes free access to the Future Internet Week on May 7 - 9, 2012 (all workshops and sessions) and lunches & coffee breaks during the days of the program.

## VENUE

**Aalborg Congress & Culture Center**. Europa Plads 4, 9000 Aalborg, Denmark.

## ORGANIZING COMMITTEE AND CONTACT

**Davide Careglio** (Universitat Politècnica de Catalunya, Spain), [careglio@ac.upc.edu](mailto:careglio@ac.upc.edu)

**Dimitri Papadimitriou** (Alcatel-Lucent Bell Labs, Belgium), [dimitri.papadimitriou@alcatel-lucent.com](mailto:dimitri.papadimitriou@alcatel-lucent.com)

## ACKNOWLEDGEMENTS

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## PROGRAM

**09:20** Welcome

**09:30 Introduction and motivation of the workshop topic**

Dimitri Papadimitriou (Alcatel-Lucent Bell Labs - ALBL, Belgium), EULER project

**10:00 Session 1**

Session chair: Davide Careglio (Universitat Politècnica de Catalunya - UPC, Spain), EULER project

*Experimental performance evaluation of sensor-based networking for energy efficiency in smart buildings*

Sotiris Nikolettseas (Research Academic Computer Technology Institute - RACTI, Greece), HOBNET project

**10:30** Coffee break

**11:00** Session 1 (continuation)

*Metrics and measurement tools for assessing the channel condition in a wireless experimentation environment*

Ingrid Moerman (Interdisciplinary Institute for Broadband Technology - IBBT, Belgium), CREW project

*Methods and tools for temporal Web analytics*

Marc Spaniol (Max-Planck-Institut für Informatik - MPI-INF, Germany), LAWA project

*Metrics and measurement tools needs in Information-Centric Networking and CONVERGENCE in particular*

Nicola Blefari Melazzi (University of Rome "Tor Vergata", Italy), CONVERGENCE project

**12:30** Lunch break

**13:30 Session 2**

Session chair: Josep Lluís Marzo (Universitat de Girona - UdG, Spain), EULER project

*Metrics and measurement tools needs in OpenFlow and OFELIA in particular*

Hagen Woesner (European Center for Inf. & Communication Technologies - EICT, Germany), OFELIA project

*Delivers control and experimental plane middleware to facilitate early use of its large scale shared experimental facility by researchers*

Anastasius Gavras (Eurescom, Germany), OpenLab project

*Metrics and measurement tools for distributed and adaptive routing algorithms*

Dimitri Papadimitriou (Alcatel-Lucent Bell Labs - ALBL, Belgium), EULER project

**14:50** Coffee break

**15:20 Session 3**

*Measurements and measurement tools in OpenLab*

Javier Aracil (Universidad Autónoma de Madrid - UAM, España), OpenLab project

*NOVI's experience in monitoring tools and measurements*

József Stéger (Eötvös Loránd University - ELTE, Hungary), NOVI project

*NITOS: Methods and measurement tools for experimentation on wireless testbeds*

Thanasis Korakis (Centre for Research and Technology Hellas - CERTH, Greece), CONECT project

**16:00** Round table

**17:00** Concluding session

**17:15** End of the workshop

For additional information see FIRE wiki: <http://bit.ly/HbAxLW>

## PRESENTATION ABSTRACTS

### SESSION 1 (10:00 – 12:30)

***Experimental performance evaluation of sensor-based networking for energy efficiency in smart buildings***  
**Sotiris Nikolettseas (Research Academic Computer Technology Institute - RACTI, Greece), HOBNET project**

This talk presents experimentation methodologies, test-beds and tools developed in the context of the FIRE/HOBNET project for smart/green buildings via IPv6 sensor networking. The problems addressed relate to key distributed computing primitives (such as data propagation, tracking) as well as specialized application commissioning (such as garden watering, CO<sub>2</sub> monitoring). Towards better convergence and integration of collected measurements a REST architecture is adopted. Also, for experimental research, repositories of key networking components (reference topologies, traffic patterns, energy models, mobility profiles, protocol families and performance metrics and trade-offs) are developed.

***Metrics and measurement tools for assessing the channel condition in a wireless experimentation environment***  
**Ingrid Moerman (Interdisciplinary Institute for Broadband Technology - IBBT, Belgium), CREW project**

Novel wireless solutions, in particular new cognitive radio and networking concepts, require a rigorous experimental validation prior to uptake in wireless standards and commercial products. Wireless experimentation is very challenging, as experiments may be impaired by unwanted/uncontrolled interfering signals in the wireless environment. Within CREW a benchmarking methodology is developed to support the experimenter in getting more reliable and comparable results when executing their experiments. In this talk we will focus on a method for measuring the channel occupation during a wireless experiment. First we will explain how we can measure and score the channel condition in a wireless experimentation environment. Next we will show that the metrics for the channel condition can be used at the same time (1) to validate the performance of cognitive wireless solutions in ISM bands and (2) to improve the efficiency of wireless experiments.

***Methods and tools for temporal Web analytics***

**Marc Spaniol (Max-Planck-Institut für Informatik - MPI-INF, Germany), LAWA project**

The LAWA project develops methods and tools for temporal Web analytics. The focus of developments is semantic and structural analytics of time-versioned textual Web contents. In particular, we are developing methods that enable entity detection and tracking along the time axis as well as temporal studies of large (Web) graphs. To this end, we also prepare a reference data set and will provide analytics services.

***Metrics and measurement tools needs in Information-Centric Networking and CONVERGENCE in particular***  
**Nicola Blefari Melazzi (University of Rome "Tor Vergata", Italy), CONVERGENCE project**

This talk first introduces Information-Centric Networking (ICN), a new paradigm in which the network layer provides users with contents, instead of providing communication channels between hosts, and is aware of content identifiers. Then it presents the needs on measurements required by this approach in general and by the project CONVERGENCE in particular. ICN is significantly different with respect to the current networking architecture, and poses several new requirements to measurements, which have to be performed both in the current network (to understand some of its aspects useful for the design of ICN) and possibly in the new one.

### SESSION 2 (13:30 – 14:50)

***Delivers control and experimental plane middleware to facilitate early use of its large scale shared experimental facility by researchers***

**Anastasius Gavras (Eurescom, Germany), OpenLab project**

OpenLab delivers control and experimental plane middleware to facilitate early use of its large scale shared experimental facility by future Internet researchers. Interoperability of testbeds at several levels is the main challenge of the technical work of the project. A key objective is to provide experimenters the testbed environments they need, including the tools to manage their experiments and measurement results. OpenLab has conducted an open call for experiments and is currently integrating the accepted experiments according to the capabilities of the testbeds and is ensuring the availability of the tools to run the experiments and assess the results. This presentation will focus in parts on the different requirements for measurements and measurement tools to support the researchers in their work.

### ***Metrics and measurement tools needs in OpenFlow and OFELIA in particular***

**Hagen Woesner (European Center for Inf. & Communication Technologies - EICT, Germany), OFELIA project**

The core idea of OpenFlow and in a wider sense the new paradigm of “software defined networks” is the separation of control, forwarding and processing of data. Performance evaluation of such networks has to look into details of switch internals that were not visible before, but also requires different tools for measurement. This talk introduces the available tools in the OFELIA testbed and demonstrates live access to a traffic generator/testing environment available inside the federation of OpenFlow-enabled campus islands that OFELIA is growing.

### ***Metrics and measurement tools for distributed and adaptive routing algorithms***

**Dimitri Papadimitriou (Alcatel-Lucent Bell Labs - ALBL, Belgium), EULER project**

In the ICT domain, measurement is classically oriented to the verification process of the designed function set and their expectedly met performance objectives by the experimental corpus being an engineered artefact, a prototype, etc. When the scale of the real environment becomes difficult to reproduce (the Internet being the best examples) and the number of states together with their dynamics are themselves difficult to model ("how to model and quantify uncertainty"), a new approach shall be considered: simplify the experimental corpus (introduce abstraction) while maintaining its functionality and reproduce significant environmental phenomena derived from measurements of the actual environment. The EULER project in its investigation of adaptive and distributed routing models - alternative to policy-based path-vector routing - is confronted to this situation: there is no Internet scale facility where routing schemes can be experimented before being deployed. In this context, this talk will detail the proposed methodology, the measurement tools being developed in order to derive representative environmental conditions, and the verification means that have been elaborated to enable wide-scale experiments.

## **SESSION 3 (15:20 – 16:00)**

### ***Measurements and measurement tools in OpenLab***

**Javier Aracil (Universidad Autónoma de Madrid - UAM, España), OpenLab project**

This talk provides an overview of the measurement tools developed within Openlab, with special emphasis in the integration of several heterogeneous data formats within a common user interface. The talk summarizes the main concerns when dealing with many different measurement tools for the different testbeds present in OpenLab. As a possible solution, the use of ontologies provides an umbrella under which federation of the measurement tools becomes feasible. In this regard, the talk presents the measurements ontology developed within MOMENT and OpenLab, along with the standardization efforts.

### ***NOVI's experience in monitoring tools and measurements***

**József Stéger (Eötvös Loránd University - ELTE, Hungary), NOVI project**

The FP7 STREP project NOVI develops control, management and monitoring planes in order to allow the federation of various test beds, consisting of heterogeneous virtual resources. Monitoring and measurements of federated testbeds is of primary importance not only to allow other service components to make intelligent decisions, but it is also very valuable for the end-users. This talk focuses on the monitoring service component of NOVI, and it will be shown that with the use of monitoring ontology a wide range of monitoring tools, metrics and databases can be easily integrated in the NOVI monitoring framework.

### ***NITOS: Methods and measurement tools for experimentation on wireless testbeds***

**Thanasis Korakis (Centre for Research and Technology Hellas - CERTH, Greece), CONECT project**

NITOS is a publicly accessible wireless testbed featuring WiFi-enabled nodes, USRP boards, cameras and various types of sensors, while it is currently also being extended with WiMAX, LTE and 3G femtocell components. In the EU project CONECT, NITOS is widely used for the implementation and experimentation evaluation of packet level cooperative approaches, from the MAC to the application layer. To cope with the heterogeneous set of measurements in these experimentation efforts, we use the OML measurement framework adopted from the EU project Openlab. OML is based on customizable measurement points inside applications running on the resources and provides a well-structured solution for capturing, processing, storing and visualizing measurements. Experimentation on cooperative networks, taking place in CONECT, exploits this framework, in order to benchmark different architectures tested on NITOS. The existence of USRP boards with spectrum sensing capabilities offers the capability of capturing the state of the wireless medium during an experiment and is extremely important for understanding the dynamics of cooperative networks implementation.