1st OpenLab plugfest report

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ABSTRACT

This document reports on the outcome of the first OpenLab plugfest, during which the ability of cross-testbed tools to function on multiple testbeds have been evaluated.

1. INTRODUCTION

This document summarizes the outcomes of the first OpenLab plugfest [1], organized in the UPMC premises in Paris, between the 23rd and 25th of January 2013. It builds on [3], and was open to participants from across the FIRE community, as well the GENI community and others.

The interoperability trials (also known as "bake-offs" or "plugfests"), organized at Months 18 and 27 of the OpenLab project are the occasions at which progress is assessed. They serve a dual objective. Within the project, they are the opportunity to obtain a status of the advancement of the integration and inform the various scientific workpackages. Beyond this, they represent an opportunity to disseminate achievements and work in progress in the different related projects, as well as foster collaboration, and adoption and reuse of the solutions developed and proposed in each of them.

A major objective of such events is to enable a set of experiment control tools that are currently used in just one or a limited set of testbed environments to operate across multiple testbeds. This will make it possible to define an experiment once and rerun it in different environments: either multiple real-world environments, such as multiple wireless testbeds, each with their own particularities; or a range of real-world, emulated, and simulated environments, allowing different mixes of uncontrolled and controlled environmental parameters. These enhancements will allow for greater repeatability and comparability of experiments.

The degree of interoperability of experiment controllers – their ability to function across multiple testbeds – has been testbed and the outcome is described in this report. Although experiment controllers are the main focus, some aspects of the control plane as well as testbed-specific technologies are also covered, since it is equally important for further interoperability and repeatability.

The event was organized during 2 and a half days, and welcomed 38 participants from 13 institutions and 8 countries, spanning the following ongoing projects: OpenLab, FED4FIRE, FIT Equipex, F-Lab and NOVI (see Section A). It was divided in two parts. Since it was the first event of the kind, the first day was dedicated to acquiring some knowledge about the work realized by the different partners that were invited to give tutorials (for components of interest for the federation), or shorter presentation or demos about their tools, progress or integration results (see Section B). It was then decided to organize the remaining two days around a set discussion sessions (morning of day 2), and more or less formal working groups (four thematic sessions were organized about those four topics that gathered a critical mass of people – SFA, OMF/OMF, MySlice, and NEPI –, to benefit from the presence of their main contributors.

The minutes of the discussions sessions – *Interoperability of experiment controllers* and *Integration of measurement systems* – are presented respectively in Sections 2 and 3. They are important in that they structure and give directions for the different working groups.

2. INTEROPERABILITY OF EXPERIMENT CONTROLLERS

2.1 Overview

Figure 1 gives an overview of the different entities that we are dealing with in this section. On the right side we have the different testbeds providing resources to the federation. On the left side, we find the various user-facing tools that provide control over the federation. The vision here is the one of interoperabilityi, with multiple (though limited) entry points to the federation. The idea is to support a small set of tools, covering the needs and required functionalities of the different testbed user communities.

In order to allow an interoperable communication between the tools and the testbeds, avoiding the N by N scalability issue, federated control framework have been proposed for both the control plane – SFA – and for the experimental plane – OMF[1]. They are represented in the middle of the picture. The third brick has to deal with measurements, and it is currently not specified. This aspect will be discussed in Section 3.

2.2 Control plane management through SFA

SFA adoption status

It has been decided in the project to adopt the SFA architecture to provide the federation with a means of authenticating and authorizing users, and allowing them to

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[1]Currently, there is an ongoing effort to standardize the protocols behind the OMF component, under the nme FRCP, *Federated Resources Control Protocol*

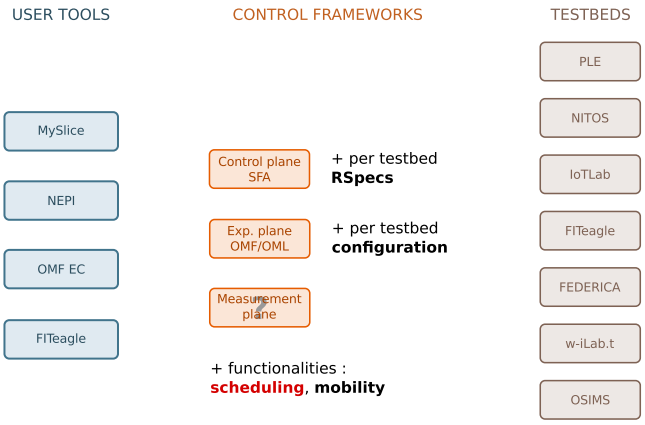

Figure 1: Interoperability of experiment controllers: an overview

Testbed	Status	Software	Notes
PLE	✓	SFAWrap	scheduling OK
NITOS	✓	SFAWrap	scheduling OK
w-iLab.t	not yet	ProtoGENI	
FITeagle	✓	SFAWrap	
OSIMS	✓	SFAWrap	
FIT/IoTLAB	✓	SFAWrap	scheduling OK
FEDERICA	✓	SFAWrap	
VirtualWall	✓	ProtoGENI	

Table 1: Implementation status of SFA on the different testbeds

browse and reserve resources to form a slice, or an experiment. We report in Table2.2 the status of this effort for different testbeds, both within (upper part) and outside the OpenLab project. The software used for bringing this functionality to the platform is also indicated.

SFA proposes a distributed and secure thin waist for allowing a global federation of testbeds. As such, it does not take into account testbed specifics, which are dealt with in an upper layer, in the form of resource specifications (RSpecs), which currently take the form of XML documents with a given structure. There are as many instances of such document formats as there are different testbeds, in order to account for the differences in properties.

This makes it necessary for the different user tools to deal with each one version in order to properly interpret and present the information to the user[2].

Still, for the top level of the document, or for common functionalities such as scheduling or mobility, it is possible to converge towards a common representation. This is what has been done so far by three testbeds which all have reservation functionalities: NITOS, IoTLAB – formerly SensLAB – and PLE. All three testbeds propose a common representation format in the RSpecs, despite the heterogeneity of their

[2]In the Fed4FIRE project, a new proposal for RSpecs, based on a standard RDF container, and well-defined semantics will overcome such issues, which will only put as a requirement the knowledge of the semantic, and will otherwise allow for a default best-effort treatment.

Testbed	Status	Notes
PLE	✓	scheduling OK, demo
NITOS	✓	scheduling OK, demo
w-iLab.t	n/a	n/a
FITeagle	!	in progress, to test
OSIMS	!	tested soon
FIT/IoTLAB	✓	scheduling OK, demo
FEDERICA	!	to be tested
VirtualWall	!	to be testbed

Table 2: Testbed support status in MySlice for SFA

Testbed	Status	Notes
PLE	✓	can be make more stable
NITOS	✓	native
w-iLab.t	✓	native
FITeagle	planned	
OSIMS	no	
FIT/IoTLAB	✓	scheduling OK
FEDERICA	no	
VirtualWall	✓	native

Table 3: Implementation status of OMF on the different testbeds

underlying schedulers (homemade for PLE and NITOS, a wrapper for OAR in the IoTLAB case). This simplifies the support of scheduling in user tools.

Testbed support status in MySlice (SFA)

The status of various testbed support in MySlice is presented in Table 2.2.

Testbed support status in NEPI (SFA)

While NEPI already provide a set of testbed adapters, the support of new testbeds through SFA is being done through MySlice (either through the integration of the core library and relevant gateways, or by calls to the API).

Testbed support status in OMF EC (SFA)

To the best of our knowledge, OMF Experiment Controller does not support or plan to support SFA interfaces.

2.3 Experimental plane management through OMF

At the different of SFA, we are in a situation where the solution has to date not been agreed by all testbeds, which some other ones are native OMF. Current status is reported in Table 2.3[3].

OMF adoption status

Like in the previous case with SFA, OMF presents a standard interface, and testbed specificities represented with various configuration options. A smooth support by user tools (especially in GUIs) is then again dependent on the support of these options.

Testbed support status in MySlice (OMF)

[3]At the time of writing this report, a new version – OMFv6 – is being released which might have some impact or influence on its adoption. Also, the underlying protocol is being proposed as a standard, under the name FRCP (Federated Resources Control Protocol).

MySlice currently has no support for experiment control, and instead relies on third party tools, such as NEPI, for experiment control. The handover between MySlice and NEPI has been the object of one working group since it involves agreeing on how to pass the data between tools, as well as avoiding multiple authentications from the user.

Testbed support status in NEPI (OMF)

OMF support in NEPI is in development and has been the object of a working group.

Testbed support status in OMF EC (OMF)

OMF is the native control framework for the OMF Experiment Controller. The interface with the different testbeds is realized through OEDL (ruby) scripts.

3. INTEGRATION OF MEASUREMENT SYSTEMS

3.1 Overview

We are now focusing our attention on the *measurement plane* brick that was not considered previously in Figure 1. There is currently no federated control framework specialized for measurements, such as SFA and OMF for respectively the control and experimental planes. It is the purpose of this section to discuss about possible realization of such a component, that would accommodate measurement and monitoring needs of the different testbeds and user communities, as well as possibly integrate external types of measurements platforms.

3.2 Towards a measurement plane interface ?

Three types of measurements sources can be identified:

- **testbed measurements**: these are measurements and monitoring information produced by the testbed. They generally provide some data about the testbed resources or its substrate (eg. wireless signals from the NITOS testbed);
- **third-party platforms**: third party platform can give various types of measurements, which can also belong the testbed substrate. This is for example the case of the public internet on which PlanetLab is deployed (any source of Internet measurements), or simply because those platforms are running on top of a testbed (eg. CoMon for monitoring system information about PlanetLab);
- **user-defined measurements**: while not being made public, those are the measurements collected by the user for its own experiment purpose (eg. through OML, or traces in NEPI).

The challenge here comes from the diversity of sources and measurements to be accommodated, since the measurement integration layer has to reach a balance between uniformity (for tractability purposes) and heterogeneity (the value of measurements): multiple API and data formats; archived vs on-demand measurements; etc. The adopted solution has to propose a convenient query and transport protocol, and integrate well in user tools to support the various stages of an experiment. Finally, it might require the support of authentication and authorization solutions (as it is being done in the context of testbed federation).

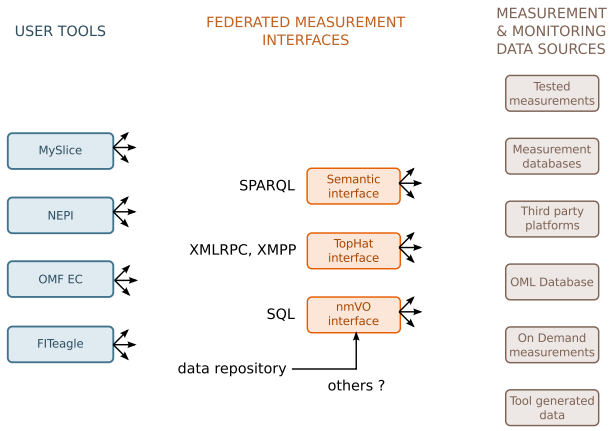

Figure 2: Integration of the different measurement systems

3.3 Candidate components and their status

Figure 2 represents various classes of data sources on the left, covering various data sources and services available and required by experiments on federated testbeds. The same set of users tools as considered before is represented on the right. Finally, the set of candidate solutions is displayed in the middle.

This report won't enter much into the details of those solutions and of the different data sources as it is the object of [2], which will be due soon after this report.

3.4 Integration status of measurements in user tools

Integration of measurements in user tools is currently limited. MySlice embeds some information aggregated by Topat during the slice creating phase, allowing user to select resources according to a wide range of criteria about testbeds resources and measurement about the substrate. It also allows users to trigger on-demand measurements trough its API during an experiment, or to retrieve past and archived measurements. NEPI is also currently considering the integration of Topat measurements, and this is the object on ongoing discussions.

4. FUTURE DIRECTIONS

The objective of the plugfest was the opportunity to assess the advancement of the integration of the various components developed and deployed in many major projects involved in the federation of networking testbeds. The agenda made it possible that people get informed of the current context, and at the same time benefit from the colocation of many technical people that can best inform about the various tools. This allowed to solve several technical issues but also think on how future directions can be made more consistent with the project objectives, and leave the event having the basic knowledge, eventually the software deployed and knowing how to progress.

We had very positive feedback about this plugfest, and especially about the working group sessions, which gives

many incentives to organize future such events. Suggestions include less time dedicated to presentations – possibly lightning talks to give updates about the progression –, a theme and an objective that should be reached at the end, and potentially some coding sessions.

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5. REFERENCES

[1] Openlab plugfest website, 2013.

[2] Yahya Al-Hazmi, Alexander Willner, Tom Pfeiffer, Jordan Augé, Marc-Olivier Buob, Alina Quereilhac, Lucia Guevgeozian, Sándor Laki, János Szüle, and József Stéger. Interoperability of tools and data repositories. Technical report, 2013.

[3] Alina Quereilhac, Alexander Willner, Yahya Al-Hazmi, Christos Tranoris, Pieter Becue, Vincent Sercu, Jordan Augé, Thierry Rakotoarivelo, Andras Gulyas, Gergely Biczok, and Papagianni Chrysa. Experimental plane – experiment controllers. Technical report, 2012.

APPENDIX

A. LIST OF PARTICIPANTS

Name	Institution	Country
Jordan Augé	UPMC	FR
Sandrine Avakian	INRIA	FR
Susanna Avessta	UPMC	FR
Loïc Baron	UPMC	FR
Pieter Becue	iMinds	BE
Kostas Choumas	UTH	GR
Christoph Dwertmann	NICTA	AU
Timur Friedman	UPMC	FR
Anthony Garcia	INRIA	FR
Lucia Guevgeozian	INRIA	FR
Stefan Harder	TUB	DE
Mohamed Larabi	INRIA	FR
Giuseppe Lettieri	UNIPI	IT
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Thiago Abreu	UCBL/Lyon	FR
Nguyen Nghi	UCBL/Lyon	FR
Stefan Covaci	TUB	DE

B. TECHNICAL AGENDA

The full version of the agenda including the different presentations is available online: `http://openlab-plugfest.npafi.org`.

DAY 1 - Wednesday, January 23rd: TUTORIALS, PRESENTATIONS, DEMOS

09H30 - 10H00	*Welcome coffee (25-26/105)*
10H00 - 10H10	Introduction (Jordan Augé, UPMC)

Components (approx. 30 min talks and 10 min discussion).

10H10 - 10H50	**SFA & SFAWrap tutorial** (Mohamed Amine Larabi, INRIA) slides (PPT)
10H50 - 11H30	**MySlice tutorial** (Jordan Augé, Loïc Baron, UPMC) slides (part 1) (PDF) video (part 2) (OGV) slides (part 3) (PDF)
11H30 - 12H10	**NEPI tutorial** (Alina Quereilhac, INRIA) slides (PDF)

Integration efforts (approx. 15 min talks/demos and 10 min discussion).

12H10 - 12H30	**NEPI/OMF integration** (Julien Tribino, Alina Quereilhac, INRIA; Pieter Becue, iMinds) *No slides yet!*
12H30 - 14H00	*Lunch (@ L'Ardoise - Jussieu Campus)*
14H00 - 14H25	**NEPI/MySlice integration** (Lucia Guevgeozian, INRIA) slides (ODP)
14H25 - 14H50	**FITeagle/MySlice integration** (Stefan Harder, Mitja Nikolaus, TUB) slides (PPT)
14H50 - 15H15	**IoT-LABR, Integration of SFA, OMF/OML, MySlice** (Frédéric Saint-Marcel, Sandrina Avakian, Anthony Garcia, INRIA) slides (PPT)
15H15 - 15H40	**How to run mobile experiments @ iMinds w-iLab.t** (Vincent Sercu and Pieter Becue, iMinds) slides (PPT)
15H40 - 16H05	**NOVI Services to Control, Manage and Monitor Virtual Testbeds in SFA-enabled Platforms** (József Stéger, ELTE) *No slides yet!*
16H05 - 16H40	*Coffee Break (25-26/105)*
16H40 - 17H05	**Making NITOS SFA-compliant - NITOS Scheduler** (Harris Niavis, UTH) slides (PPT)
17H05 - 17H30	**Building an OMF 6 Resource Controller for OpenFlow support** (Kostas Choumas, UTH) slides (PPT)
17H30 - 18H00	Preparation of working groups

DAY 2 - Thursday, January 24th : WORKING GROUPS

09H00 - 09H30	*Welcome coffee*
09H30 - 12H30	**Working groups & discussion sessions**: • 09H30 - 11H00 : interoperability of experiment controllers • 11H00 - 12H30 : integration of measurement systems

12H30 - 14H00	*Lunch (@ L'Ardoise - Jussieu Campus)*
14H00 - 16H00	**Working groups (continued)** - Main topics: MySlice, NEPI, OMF/OML
16H00 - 16H30	*Coffee Break*
16H30 - 18H00	**Working groups (continued)** - Main topics: MySlice, NEPI, OMF/OML

DAY 3 - Friday, January 25th : WORKING GROUPS & WRAP-UP

09H00 - 09H30	*Welcome coffee*
09H30 - 11H30	**Working groups (continued)**
11H30 - 12H30	**Wrap up session**