


Project Acronym	**Fed4FIRE**
Project Title	**Federation for FIRE**
Instrument	**Large scale integrating project (IP)**
Call identifier	**FP7-ICT-2011-8**
Project number	**318389**
Project website	**www.fed4fire.eu**

MS31 - First design specification for facilities

Work package	WP3
Task(s)	T3.2, T3.3, T3.4
Due date	31/03/2013
Submission date	31/03/2013
Milestone lead	Timur Friedman (UPMC)
Version	1.0
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Abstract	This is the implementation plan for WP3 testbeds for cycle 1 of Fed4Fire.

Keywords	

Nature of the deliverable	R	Report	X
	P	Prototype	
	D	Demonstrator	
	O	Other	
Dissemination level	PU	Public	X
	PP	Restricted to other programme participants (including the Commission)	
	RE	Restricted to a group specified by the consortium (including the Commision)	
	CO	Confidential, only for members of the consortium (including the Commission)	

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Executive Summary

This document is the first milestone for WP3 (Infrastructures) of Fed4FIRE. The objectives of WP3 are the following ones:

1. to identify the Infrastructures community and its main players
2. to gather and analyze the requirements of the community and make this information available to WP2 (Architecture) as well as the "vertical" WPs 5, 6, and 7
3. to perform all necessary modifications to Fed4FIRE's Infrastructures community facilities and tools so as to implement the common functionality defined by the WPs 5 6, and 7
4. to carry out a limited number of additional developments, specific to the Infrastructures community, to promote federation

This milestone is concerned by the design specifications that will be ready for each facility in the first development cycle of the Fed4FIRE federation, which spans month 1 to month 26. Thus, it is closely related to the third of the above-mentioned objectives, actually defining the plan that corresponds with the necessary modifications to the WP3 testbeds. In this capacity it reflects the work that is carried out in tasks 3.2, 3.3, and 3.4 of WP3 in terms of implementation, testing, deployment, and operation phases for the infrastructures community. These specifications can be summarized in the following table:

	PLE	iLab.t	OFELIA	NITOS	NET-MODE	KOREN	NORBIT
Expose testbed through SFA	Yes	Yes	Yes VMs, Maybe OF	Yes	Yes	Yes	Yes
Develop specific MySlice plugins	Yes	Yes	Maybe for OF	Yes	No	Yes	Yes
Extend GetVersion struct with testbed info	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Extend GetVersion struct with tools info	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interact with the Future Reservation broker	Maybe	Maybe	No	Yes	No	No	Yes
Adoption of SFA Wrapper	No	No	No	Partially	No	Yes	Part-ially
Adoption of OMF6	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Provide facility monitoring OML stream	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Provide infrastructure monitoring OML stream	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Deploy OML for experiment measurement	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Deploy an identity provider	Yes	Yes	Maybe	Yes	Yes	No	Yes

compliant with SFA and X.509 certificates							
Provide own root certificate to the certificate directory	Yes	Yes	See above	Yes	Yes	No	Yes
Automatically download root certificates of Fed4FIRE partners from the certificate directory	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Acronyms and Abbreviations

AM	Aggregate Manager
API	Application Programming Interface
ASN	Autonomous System Number
DB	Database
DHT	Distributed hash table
FRCP	Federated Resource Control Protocol
IP	Internet Protocol
NEPI	Network Experiment Programming Interface
NRPE	Nagios Remote Plugin Executor
OMF	cOntrol and Management Framework
OML	OMF Meauserment LIbrary
PLE	PlanetLab Europe
RC	Resource controller
RSpec	Resources Specification
SFA	Slice-based Federation Architecture
SLA	Service Level Agreement
SSH	Secure Shell
TDMI	TopHat Dedicated Measurement Infrastructure
XML	eXtensible Markup Language

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1 Introduction

One of the goals of Fed4FIRE is to provide a federation of experimentation facilities that will significantly accelerate Future Internet research. The project will develop a demand-driven common federation framework, based on an open architecture and specification. Tools and services supporting dynamic federated identities, access control, and SLA management will increase the trustworthiness of the federation and its facilities. The adoption of the Fed4FIRE common federation framework by the FIRE facilities, the widespread usage by both academic and industrial experimenters, and the strong links with other national and international initiatives such as the FI-PPP, will pave the way to sustainability towards Horizon 2020.

The main purpose of this document is to describe the facility specifications as a first step towards integration and testing, as driven by WP2, in the first development cycle for achieving the aforementioned goal. For this task, it relies on the Fed4FIRE architecture that was previously defined in D2.1 “First Federation Architecture” [1] and specified in detail in D5.1 [2], D6.1 [3] and D7.1 [4], all entitled “Detailed specifications for first cycle ready”.

This document serves as a report and has a very clear structure. Each chapter describes the design specifications for each Fed4FIRE facility. In particular, the document is organized as follows: Chapter 2 concerns PlanetLab Europe, Chapter 3 concerns Virtual Wall and w-iLab.t, Chapter 4 concerns the OFELIA testbeds, Chapter 5 concerns NITOS, Chapter 6 concerns NETMODE, Chapter 7 concerns KOREN and Chapter 8 concerns NORBIT.

2 PlanetLab Europe

PlanetLab Europe is the European portion of the publicly available PlanetLab testbed and is a part of the OneLab experimental facility.

PlanetLab, established in 2002, is a global network of computers available as a testbed for computer networking and distributed systems research. As of December 2011, PlanetLab was composed of 1024 nodes at 530 sites worldwide. Each research project runs a "slice" that gives experimenters access to a virtual machine on each node attached to that slice. See the PLE statistics page for more details: http://onelab.eu/index.php/testbeds/onelab-testbeds/planetlab-europe/ple-statistics.html.

Accounts are available to persons affiliated with corporations and universities that host PlanetLab nodes. Those who join PlanetLab Europe have access to the entire system. They also participate in the initiatives built around PlanetLab in Europe.

PlanetLab members actively participate in developing tools for the greater good of the community, and as a result each user has a wide choice of tools to use in order to complete regular slice maintenance tasks.

There are a number of free, public services that have been deployed on PlanetLab, including CoDeeN, the Coral Content Distribution Network, and Open DHT.

PlanetLab Europe operates under the direction of Timur Friedman of UPMC Sorbonne Universités, working in collaboration with the Institut National de Recherche en Informatique et en Automatique (INRIA).

PlanetLab Europe and OneLab

PlanetLab Europe is a key testbed within the OneLab experimental facility for Future Internet technologies. OneLab is extending PlanetLab Europe into new environments, beyond the classic wired internet. OneLab is deepening PlanetLab Europe by incorporating new monitoring tools. OneLab is federating PlanetLab Europe, both with other PlanetLabs worldwide and with other types of testbeds.

The OneLab experimental facility is funded by several different research projects, including OpenLab and NOVI within the European Commission's FIRE Unit, along with national and international projects F-Lab, FIT and FIBRE.

2.1 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section 'Requirements for testbeds' in D5.1

2.1.1 Interwork with portal

PlanetLab Europe will be exposed through SFA, using SFA Wrap. PLE is contributing to the core development of MySlice. PLE will contribute to plug-ins development to expose specific features through MySlice.

The goal is the integration of PlanetLab Europe within MySlice.

2.1.2 Testbed directory

PlanetLab Europe will be exposed through SFA, and will extend the XML-struct returned by the GetVersion API call as defined in [2].

PlanetLab Europe will also provide the AM endpoint address to the operator of the Testbed Directory.

2.1.3 Tool directory

PlanetLab Europe will be exposed through SFA, and will extend the XML-struct returned by the GetVersion API call as defined in [2].

2.1.4 Interact with the Future Reservation Broker

In cycle 2 we will extend the SFA interface with the extensions needed for the Broker, and it will be natively built in the AM. In cycle 1 a prototype might be ready.

2.1.5 Adoption of SFA Wrapper

Not applicable here since PlanetLab Europe already has an SFA interface.

2.1.6 Adoption of OMF 6.0

In PlanetLab Europe the means of interacting with one's slivers is through ssh. In addition, a slice can optionally be created as 'OMF-Friendly', in which case it is possible to control its related slivers through an OMF Experiment Controller. For the moment PLE supports OMF 5.3. At this point we still consider this 'specific' though there is a need to standardize the messaging system, so that other tools (e.g., NEPI) could use that same channel to interact with resources, and thus the current implementation can be deemed as OMF-specific. PLE will deploy OMF 6.0, the latest version of OMF. Until now there is no stable release of OMF 6.0 (Currently in beta). PLE already supports OMF 6.0 beta release. It has been deployed to PLE nodes for testing purpose and it worked without problems. As soon as OMF 6 stable version will be released, it will be deployed on PLE.

2.1.7 Front-end tools

In PlanetLab Europe SFA clients such as Flack, SFI, and Omni will be supported.

2.2 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 of [3].

2.2.1 Facility Monitoring

PlanetLab Europe uses a separate tool, but tailored for PlanetLab deployments, named MyOps, which allows implementing escalation policies. For example, if one site has a node down, first, messages are sent to the technical contact, then to the PI, and after a while the site loses some of its capabilities (fewer slices). All this workflow is entirely automated under MyOps, which also provides raw data on the status of nodes – see http://planetlab.eu/monitor/site.

MyOps information is planned to be exported in an OML stream, possibly by use of collectd.

2.2.2 Infrastructure Monitoring

PlanetLab Europe uses Nagios Core 3 together with the NRPE plugin for monitoring all the nodes and services that play an important role in the functionality of the testbed.

Nagios information is planned to be exported in an OML stream.

2.2.3 Experiment Monitoring

PlanetLab Europe uses TopHat to aggregate measurement sources such as TDMI and others. One difficulty encountered by the PlanetLab Europe operations team was that the potentially very useful data gathered by MyOps are not easily accessible through an API or other query-based techniques, and so MyOps does not lend itself to the creation of a gateway so as to be made available through TopHat. There clearly was a need for both: (1) aggregating data about nodes from various places (MyOps being one, CoMon slicestat being another one, and we found quite a few other sources of potentially high interest), and (2) providing a decent querying interface to these data. In a first step, we leveraged the internal 'tags' mechanism right in the MyPLC DB to extend it with such external data. In a federated world, and in particular with respect to MySlice, it might make sense to design a separate tool for hosting this aggregated data.

Regarding monitoring of experimentation metrics, OML is considered to be a suitable candidate to deploy, and, thus, will be deployed in PlanetLab Europe. From a user point of view, TopHat will be used to query the OML database through a specific gateway, which has to be developed.

The metrics that are measured and therefore will also be supported in the Fed4FIRE experiment monitoring OML stream are:

- TopHat
  - traceroute measurements between each pair of PlanetLab nodes
  - For each IP hop, we could provide more information (ASN, country, hostname, etc.).
- CoMon slicestat data (http://codeen.cs.princeton.edu/slicestat/)
  - Slice name
  - Slice context id
  - CPU consumption (%)
  - Physical memory consumption (%)
  - Physical memory consumption (in KB)
  - Virtual memory consumption (in KB)
  - Number of processes
  - Average sending bandwidth for last 1 min (in Kbps)
  - Average sending bandwidth for last 5 min (in Kbps)
  - Average sending bandwidth for last 15 min (in Kbps)
  - Average receiving bandwidth for last 1 min (in Kbps)
  - Average receiving bandwidth for last 5 min (in Kbps)
  - Average receiving bandwidth for last 15 min (in Kbps)
  - Local IP address of this node
  - Number of active processes - that is, processes using the CPU cycle at the moment

2.3 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of [4].

2.3.1 Identity Provider

PlanetLab Europe supports X.509 certificate identity authentication. Thus, not much effort will be required to implement certificate-based user identity management, and to integrate it with existing functionality.

2.3.2 Certificate Directory

PlanetLab Europe will hand over their self-signed root certificate to the certificate directory and will also fetch the other certificates to trust them.

2.3.3 Rules-based Authorisation

As mentioned in [4], this is kept outside of cycle 1.

2.4 Expected Status for PlanetLab Europe at end of Cycle 1

We summarize the expected status as follows:

- PLE at the end of Cycle 1 will be SFA compliant and will have a reservation system fully integrated with OMF v6.
- PLE will have a working plugin in MySlice for reserving resources.
- The 'GetVersion' call of the SFA will be extended such that it will include information regarding the testbed and its tools
- PLE will have ready a monitoring solution for the infrastructure based on OML.

2.5 Integration Issues for PlanetLab Europe

The most difficult integrations are:

- Creating plugins for MySlice

3 Virtual Wall and w-iLab.t

3.1 High level design choices

The Virtual Wall and w-iLab.t testbeds will run the emulab software optionally combined with OMF for experiment control and OML for measurements. (NEPI will be supported if integration is successful).
Emulab will support SFA GENI AMv2 and AMv3 APIs with GENI RSpecs v3.
The SFA interface will be reachable over the public internet on IPv4 while the nodes themselves will be reachable over the public internet (ssh) on IPv6.

3.2 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section 'Requirements for testbeds' in D5.1

3.2.1 Interwork with Portal

- Expose testbed through SFA: yes, AM APIv2 and AM APIv3 with GENI RSpecs v3
- Specific plugin for MySlice portal: targeting a Java webstart application for topology creation, visualizer for w-iLab.t sensor testbed

3.2.2 Testbed directory

- Expose testbed through SFA: yes
- GetVersion call will be extended
- The AM of the virtual wall and the AM of the w-iLab.t will have a public IPv4 address

3.2.3 Tool directory

- Expose testbed through SFA: yes
- GetVersion call will be extended with tools supported.

3.2.4 Interact with the Future Reservation broker

In cycle 2 we will extend the SFA interface with the extensions needed for the Broker, and it will be natively built in the AM. In cycle 1 a prototype might be ready.

3.2.5 Adoption of SFA Wrapper

Not applicable here since both testbeds already have an SFA interface through Emulab.

3.2.6 Adoption of FRCP

The Virtual Wall and w-iLab.t will deploy OMF v6 experiment and resource controllers on top of emulab (which will be used for discovery and provisioning).

3.2.7 Front-end tools

Flack and omni will be supported and validated as SFA tools to the virtual wall and w-iLab.t testbeds.

Other GENI AM compliant tools will work also.

3.3 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 (Mehani, et al., 2013).

- For facility and infrastructure monitoring, the virtual wall and w-iLab.t testbed will deploy Zabbix. A prototype of OML instrumentation should be available and iMinds will adopt it to its own testbeds.
- Experimenter measurement: OML will be deployed on top of the testbeds

3.4 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of (Taylor, et al., 2013).

3.4.1 Identity provider

The Virtual Wall and w-iLab.t testbed will also provide an identity provider compliant with SFA and X.509 certificates. (emulab based)

3.4.2 Certificate directory

The Virtual Wall and w-iLab.t testbed will hand over their self-signed root certificate to the certificate directory and will also fetch the other certificates to trust them.

3.4.3 Rules based authorization

3.5 Expected Status for Testbeds Virtual Wall and w-iLab.t at end of Cycle 1

The Virtual Wall and w-iLab.t testbeds will be integrated similarly in the federation both based on emulab with OMF/OML on top.

What will certainly be supported in cycle 1, phase 1:

- SFA interfaces with extension on GetVersion for testbed and tool directory
- Identity providers
- Zabbix facility monitoring and the needed OMF measurement points for this
- Trust of root certificates of other identity providers in the federation
- OMFv6 experiment control
- OML experiment measurements
- Flack and omni SFA client tools (other SFA tools which are SFA compliant will work also, but iMinds will test those two explicitly.

What will maybe be supported in cycle 1, phase 1:

- Zabbix infrastructure monitoring

- FRCP for NEPI

What will maybe be supported in cycle 1, phase 2:

- Reservation extension in SFA (for use by the broker)
- Data access through Tophat
- Plugins for MySlice for topology creation and w-iLab.t visualization

3.6 Integration Issues for Testbeds Virtual Wall and w-iLab.t

The most difficult integrations are:

- Implementing a reservation system in the testbeds
- Creating plugins for MySlice
- Infrastructure monitoring

4 OFELIA Testbeds

This refers to the **University of Bristol** (UNIVBRIS) and **i2CAT** OFELIA islands. UNIVBRIS and i2CAT OFELIA testbeds comprise OpenFlow-capable L2 switches and servers with virtual machines that act as traffic sources and sinks. UNIVBRIS also has OpenFlow-capable Reconfigurable Optical Add/Drop Multiplexers (ROADMs) but these resources will not be available for integration in cycle 1.

4.1 High level design choices

OFELIA islands will provide OpenFlow switches and virtual machines as traffic end-points. The recent release of OMF 6.0 with support for OpenFlow resources should facilitate the optional integration of OMF for experiment control. However, this is currently dependent on the ability to use OMF 6.0 in its current state or if there are requirements for further adaptations to match OFELIA testbeds.

On a design level what it is going to be done regarding SFA implementation is to develop a custom wrapper based on the SFAwraper implementation.

i2CAT and UNIVBRIS OFELIA testbeds currently allow users to implement measurement functionalities by leveraging existing OpenFlow Controller methods. Optional OML support for measurement is currently being investigated (The plan is to confirm if OML was upgraded to support OpenFlow measurements with the release of OMF 6.0).

4.2 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section 'Requirements for testbeds' in D5.1

4.2.1 Interwork with Portal

- Expose testbed through SFA: Yes, an SFA adaptation for OCF is being developed based on SFAwrapper.
- Specific plugin for MySlice portal: Yes, but will first use existing MySlice tabular representation. Target is to enable graphical topology presentation of OpenFlow switches

4.2.2 Testbed directory

- Expose testbed through SFA: Yes, the XML-struct returned by the GetVersion API call will be extended as defined in [2].
- i2CAT and UNIVBRIS will also provide the AMs endpoint addressess to the operator of the testbed Directory.

4.2.3 Tool directory

- Expose testbed through SFA: Yes
- i2CAT and UNIVBRIS will provide a list of the tools available on our testbeds to the tool directory.

4.2.4 Interact with the Future Reservation broker

- There are no plans to support this in cycle 1 of Fed4FIRE.

4.2.5 Adoption of SFA Wrapper

- Due to its particular control framework, the OCF, a customized SFA wrapper for OFELIA testbeds will be used in cycle 1 but will migrate to AMsoil based SFA implementations in the future.

4.2.6 Adoption of FRCP

- This is to be done through the adoption of OMF 6.0. The feasibility of this adoption is dependent on how OpenFlow resources are supported by it. This needs further investigation since OMF 6.0 has just been released a few days ago.

4.2.7 Front-end tools

- OFELIA testbeds have the Expedient frontend but will have support for OMNI. Furthermore, in a future when all the AMs will be based on AMsoil, all the APIs supported by AMsoil (GENI v3, SFA…) would be also supported by our AMs.

4.3 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 of [3].

- OFELIA testbeds use Zenoss for facility and infrastructure monitoring. The integration of OML with Zenoss is currently being actively investigated. As there are plans for an OML skeleton for Fed4FIRE testbeds using Zabbix, it is desired that a similar skeleton be implemented for OFELIA testbeds to also adapt to OML.
- OFELIA testbeds currently allow experimenter monitoring based on metrics collection available in OpenFlow Controllers. The integration of OML for experimenter monitoring will be investigated. Specifically, with the recent release of OMF 6.0 with support for OpenFlow resources, OFELIA testbeds will confirm if OML also has been upgraded with support for OpenFlow measurements.

4.4 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of [4].

4.4.1 Identity provider

The current identity system is based on the LDAP protocol. To allow local OFELIA users to gain access to the other testbeds within the Fed4FIRE federation, they should be given an appropriate identity using SFA X.509 certificates. This can be done in two ways: by providing our own identity provider (e.g. as part of the to be adopted AMSoil), or by utilizing the central Fed4FIRE identity provider to provide these credentials to the OFELIA local users. At the moment some further investigation is needed to identify the best strategy, but one way or the other, local OFELIA users will receive the needed identity to authenticate themselves as valid Fed4FIRE users on the other testbeds of the federation.

4.4.2 Certificate directory

The root certificates of the other testbeds will be retrieved from the certificate directory in order to be able to authenticate valid Fed4FIRE users.

4.4.3 Rules based authorization

OCF has a Policy Engine, which uses the pyPELib library [**Error! Reference source not found.**], which allows establishing a rule based authorization mechanism for the requests for virtual machines resources. At the moment WP7 has not yet made any decisions or recommendations regarding the preferred mechanisms for rules based authorization. Instead, WP7 is currently exploring the different technical possibilities to define and implement this aspect of the federation, intending to define a detailed strategy for development and deployment of rules based authorization in cycle 2. During this current exploration, the OFELIA testbeds will provide their experience previously gained with pyPELib.

4.5 Expected Status for OFELIA Testbeds at end of Cycle 1

What will certainly be supported in cycle 1, phase 1:

- SFA interfaces for VT AMs.
- Trust of root certificates of other identity providers in the federation.

What will maybe be supported in cycle 1, phase 1:

- SFA interfaces for OF AMs.
- Facility and Infrastructure monitoring with OML. This could be either via OML integration with Zenoss or using OML with collectd monitoring. The use of collectd and OML as alternative will be discussed with NICTA.
- OMF 6.0 experiment control. This is dependent on how the support for OpenFlow resources of OFELIA testbeds is supported in the current state of OMF 6.0.
- OML experiment monitoring, similarly dependent on support for OpenFlow experiment measurements.

What will maybe be supported in cycle 1, phase 2:

- Plugins for MySlice for graphical representation of OFELIA topologies and visualization of switch connectivity.

4.6 Integration Issues for OFELIA Testbeds

At the following list the main issues we have found regarding the SFA integration and the SFA wrapper extension are listed:

1 - Understanding the Architecture

2 - Understand what the code says about the architecture (Class Generic, sfaServer, assigning credentials ...)
3 - Configure Apache server (there was no clear documentation)
4 - Lack of "cookbook" to implement a driver for SFA Wrap
5 – Lots of class Inheritance in the RSpecs, drivers, flavors...
6 - Lack of templates for RSpecs (no template or items created by the VMS for example)
7 - Lack of documentation, OpenSfa is good but does not give the depth that is needed.
8 - Lack of external explanations, such standards HRN with which designated authorities, slices, nodes.

Also we have to deal with the following tasks:

- Creating plugins for MySlice
- Integrating OML for facility and infrastructure monitoring

5 NITOS

5.1 High level design choices

NITOS testbed will update its software to OMF v6 along with the NITOS Scheduler which is integrated as a new entity in OMF and is called “Broker”. Furthermore it will update its SFA AM from that of the Generic SFA Wrapper’s to the native OMF SFA AM which will be part of the “Broker”.

5.2 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section ‘Requirements for testbeds’ in D5.1 [2]

5.2.1 Interwork with Portal

Expose testbed through SFA: Yes, The “Broker” will expose the AM v3 API with RSpecs v2 extended with reservation information
MySlice plugin: Yes, a plugin for reserving resources through the “Broker” will be implemented. The target is to be as generic as possible such that the other testbeds could use it.

5.2.2 Testbed directory

Expose testbed through SFA: Yes as mentioned in 5.2.1
Extend the SFA call GetVersion: Yes, this call will be extended in the “Broker” SFA layer.
NITOS AM runs on static public IPv4

5.2.3 Tool directory

Expose testbed through SFA: Yes as mentioned in 5.2.1
Extend the SFA call GetVersion: Yes
Informational section for the developers will be created in the Wiki with the release of the “Broker”

5.2.4 Interact with the Future Reservation broker

SFA enabled with a scheduling solution: Yes, NITOS will have a local deployment of the “Broker” which will act as a local reservation system. Furthermore the local deployment will be able to interact with the central Future Reservation Broker.

5.2.5 Adoption of SFA Wrapper

Yes, since the “Broker” will already expose the AM API, there is no need for specific testbed driver. We only need to hook the AM API with the rest of the components which is the registry and probably the slice manager.

5.2.6 Adoption of FRCP

Yes as part of the OMF v6 that will be adopted by NITOS.

5.2.7 Front-end tools

SFA clients like sfi will be supported.

5.3 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 of [3]

- Facility and Infrastructure monitoring: NITOS will adopt collectd as a monitoring solution.
- Experiment measurement: NITOS will be using OML for collecting measurements in the experiments
- Data access: Will make OML databases accessible through Top-Hat

5.4 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of [4].

5.4.1 Identity provider

An Identity provider with SFA X.509 certificates will be supported.

5.4.2 Certificate directory

NITOS will be able to interact with the Certificate directory in order to upload its own certificate and fetching all the other testbeds' certificates.

5.4.3 Rules based authorization

As mentioned in [4], this is kept outside of cycle 1.

5.5 Expected Status for NITOS at end of Cycle 1

- NITOS at the end of Cycle 1 will be SFA compliant and will have a reservation system fully integrated with OMF v6.
- It will have a working plugin in MySlice for reserving resources.
- The 'GetVersion' call of the SFA will be extended such that it will include information regarding the testbed and its tools
- It will have ready a monitoring solution for the infrastructure based on OML.

5.6 Integration Issues for NITOS

The most difficult part will be the integration of the "Broker" and the extended RSpecs to MySlice and the reservation plugin. In order to be fully operational coordination between UTH, UPMC and probably INRIA is needed. We are planning to develop the reservation plugin and the reservation rspecs and try to integrate them in MySlice with the support of UPMC and INRIA.

6 NETMODE

6.1 High level design choices

The NETMODE wireless testbed is managed by the OMF framework (the current version is OMF-5.4, but we plan to install OMF-6.0 in the following days). NETMODE testbed will provide an SFA interface via the OMF-6.0 framework which supports SFA AM v2 RSpecs + reservation info.

6.2 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section 'Requirements for testbeds' in D5.1 [2].

6.2.1 Interwork with Portal

- Expose testbed through SFA: yes, AM APIv3 with RSpecs v2 + reservation info

6.2.2 Testbed directory

- Expose testbed through SFA: yes
- GetVersion call will be extended

6.2.3 Tool directory

- Expose testbed through SFA: yes
- GetVersion call will be extended with tools supported.

6.2.4 Interact with the Future Reservation broker

In cycle 2 there will be an extension that will implement the communication of testbed's reservation broker (within OMF-6.0) with the central Future Reservation Broker (hierarchical use).

6.2.5 Adoption of SFA Wrapper

Not applicable here since the testbed will have an SFA interface through OMF-6.0.

6.2.6 Adoption of FRCP

NETMODE testbed will deploy OMF-6.0 experiment and resource controllers.

6.2.7 Front-end tools

NETMODE will support all SFA tools mentioned in D5.1 [2] (MySlice based Fed4FIRE portal, Flack, OMNI, SFI), since they should all support exactly the same SFA API.

6.3 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 of [3].

- For facility and infrastructure monitoring, NETMODE testbed will deploy Nagios/Zabbix. A plugin for exporting monitoring information to a central OML repository will be available from WP6 and NETMODE testbed will adopt it.
- Experimenter measurements: OML will be deployed on NETMODE testbed

6.4 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of [4].

6.4.1 Identity provider

An Identity provider with SFA X.509 certificates will be supported.

6.4.2 Certificate directory

NETMODE testbed will upload its root certificate to the certificate directory and will also fetch the other certificates to trust them.

6.4.3 Rules based authorization

As mentioned in [4], this is kept outside of cycle 1.

6.5 Expected Status for NETMODE Testbed at end of Cycle 1

What will certainly be supported in cycle 1, phase 1:

- Nagios/Zabbix facility monitoring
- Trust of root certificates of other identity providers in the federation
- OMFv6 experiment control
- OML experiment measurements

What will maybe be supported in cycle 1, phase 1:

- Nagios/Zabbix infrastructure monitoring and the needed plugin to export to central OML repository
- SFA interfaces with extension on GetVersion for testbed and tool directory

What will maybe be supported in cycle 1, phase 2:

- Communication of testbed's reservation broker with the central Future Reservation Broker (hierarchical use)

6.6 Integration Issues for NETMODE Testbed

The most difficult integrations are:

- Implementing the interaction of testbed's reservation system with the Future Reservation Broker
- Implementing Infrastructure monitoring

7 KOREN

KOREN (KOrea advanced REsearch Network) is a non-profit testbed network infrastructure established for facilitating research and development and international joint research cooperation. It provides five KOREN islands interconnected with dedicated lambda (light path). Each KOREN island comprises OpenFlow-capable L2 switches, servers with virtual machines and Juniper switch that is attached to WDM (Wave Division Multiplexing) switch. Juniper switch is a gateway to dynamic circuit network (also acknowledged as ION or Autobahn) that provides the on-demand WAN connectivity.

7.1 High level design choices

KOREN island will provide OpenFlow switches, virtual machines and on-demand WAN connectivity with DCN. KOREN will also deploy OMF 6.0 on its testbed. OMF 6.0 with support for OpenFlow resources should facilitate the optional integration of OMF for experiment control.

On a design level what it is going to be done regarding SFA implementation is to develop a custom wrapper based on the SFAwraper implementation. Optional support for measurement is currently being investigated is the integration with Zabbix and OML with KOREN infrastructure.

7.2 Design specifications in relation to WP5

The design specifications in this section are defined based on the imposed requirements as described in the section 'Requirements for testbeds' in D5.1

7.2.1 Interwork with Portal

- Expose testbed through SFA: Yes, an SFA adaptation for OCF is being developed based on SFAwrapper.
- Specific plugin for MySlice portal: Yes. KOREN will add graphical topology presentation of OpenFlow switches in multiple islands and their overlay (DCN) connectivity.

7.2.2 Testbed directory

- Expose testbed through SFA: Yes
- KOREN will provide a list of the tools available on our testbeds to the tool directory.
- KOREN AM will have a public IPv4 address

7.2.3 Tool directory

- Expose testbed through SFA: Yes
- GetVersion call will be extended with tools supported.

7.2.4 Interact with the Future Reservation broker

- There are no plans to support this in cycle 1 of Fed4FIRE.

7.2.5 Adoption of SFA Wrapper

- A customized SFA wrapper for KOREN testbed will be used in cycle 1. But we would migrate to OMF-6.0 based SFA interface in future.

7.2.6 Adoption of FRCP

- This is to be done through the adoption of OMF 6.0. The feasibility of this adoption is dependent on how OpenFlow resources are supported by it. This needs further investigation since OMF 6.0 has just been released a few days ago.

7.2.7 Front-end tools

- KOREN will support all SFA tools mentioned in D5.1 [2] (MySlice based Fed4FIRE portal, Flack, OMNI, SFI), since they should all support exactly the same SFA API.

7.3 Design specifications in relation to WP6

The design specifications in this section are defined based on table 8 of (Mehani, et al., 2013).

- KOREN will deploy Zabbix for infrastructure monitoring.
- KOREN currently supports basic monitoring functions with PerfSonar. As KOREN will adopt OMF 6.0 in future, it would consider the integration of OML for experimenter monitoring.

7.4 Design specifications in relation to WP7

The design specifications in this section are defined based on section 5 of (Taylor, et al., 2013).

7.4.1 Identity provider

The current identity system is based on the user ID and the password. To allow local users to gain access to the other testbeds within the Fed4FIRE federation, they should be given an appropriate identity using SFA X.509 certificates. For cycle 1, KOREN will rely for this on the central Fed4FIRE identity provider

7.4.2 Certificate directory

The root certificates of the other testbeds will be retrieved from the certificate directory in order to be able to authenticate valid Fed4FIRE users.

7.4.3 Rules based authorization

As mentioned in [4], this is kept outside of cycle 1.

7.5 Expected Status for KOREN Testbed at end of Cycle 1

What will certainly be supported in cycle 1, phase 1:

- SFA interfaces for VT AMs.
- SFA interfaces for FOAM.
- Trust of root certificates of other identity providers in the federation.

What will maybe be supported in cycle 1, phase 1:

- SFA interfaces for KOREN AMs.
- Facility and Infrastructure monitoring with OML.

- OMF 6.0 experiment control. This is dependent on how the support for OpenFlow resources of KOREN testbed is supported in the current state of OMF 6.0.
- OML experiment monitoring, similarly dependent on support for OpenFlow experiment measurements.

What will maybe be supported in cycle 1, phase 2:

- Plugins for MySlice for graphical representation of KOREN islands and visualization of their WAN connectivity.

7.6 Integration Issues for KOREN

The most difficult integrations are:

- Creating visualization plugins for MySlice
- Deployment of OMF/OML

8 NORBIT

8.1 High level design choices

NORBIT is characterized by a high number of similarities with the NITOS testbed in terms of testbed management software. They are both entirely managed by OMF6, which is in fact being developed in close collaboration between the NITOS and NORBIT teams.

Therefore it is appropriate to state that regarding Fed4FIRE integration, NORBIT will approach this in identical the same manner as NITOS. For the corresponding NORBIT details we therefore refer to chapter 5.

9 Conclusion

This document has outlined the plan for integrating Fed4FIRE facility federation into Fed4FIRE. The information given concerns the design specifications that will be ready for each facility in the first development cycle of the Fed4FIRE federation, which spans month 1 to month 26. Thus, it reflects the work that is carried out in tasks 3.2, 3.3, and 3.4 of WP3 in terms of implementation, testing, deployment, and operation phases for the infrastructures community. It can be summarized as follows:

Table 1: Summary of integration plans of the different testbeds for cycle 1

	PLE	iLab.t	OFELIA	NITOS	NET-MODE	KOREN	NORBIT
Expose testbed through SFA	Yes	Yes	Yes VMs, Maybe OF	Yes	Yes	Yes	Yes
Develop specific MySlice plugins	Yes	Yes	Maybe for OF	Yes	No	Yes	Yes
Extend GetVersion struct with testbed info	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Extend GetVersion struct with tools info	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Interact with the Future Reservation broker	Maybe	Maybe	No	Yes	No	No	Yes
Adoption of SFA Wrapper	No	No	No	Partially	No	Yes	Part-ially
Adoption of OMF6	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Provide facility monitoring OML stream	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Provide infrastructure monitoring OML stream	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Deploy OML for experiment measurement	Yes	Yes	Maybe	Yes	Yes	Maybe	Yes
Deploy an identity provider compliant with SFA and X.509 certificates	Yes	Yes	Maybe	Yes	Yes	No	Yes
Provide own root certificate to the certificate directory	Yes	Yes	See above	Yes	Yes	No	Yes
Automatically download root certificates of Fed4FIRE partners from the certificate directory	Yes	Yes	Yes	Yes	Yes	Yes	Yes

10 References

[1] Vermeulen, B., Vandenberghe, W., Leonard, T., Friedman, T., Schreiner, F., Kavoussanakis, K., et al. (2012). *D2.1 – First federation architecture.* Fed4FIRE

[2] Vandenberghe, W., Baron, L., Bermudo, C., Vico, A., Stavropoulos, D., Larabi, A. M., et al. (2013). *D5.1 Detailed specifications for first cycle ready.* Fed4FIRE.

[3] Mehani, O., Jourjon, G., Al-Hazmi, Y., Vandenberghe, W., Stavropoulos, D., Lanza, J., et al. (2013). *D6.1 Detailed specifications for first cycle ready.* Fed4FIRE.

[4] Taylor, S., Leonard, T., Boniface, M., Androulidakis, G., Pouli, V., Baron, L., et al. (2013). *D7.1 Detailed specifications for first cycle ready.* Fed4FIRE.