



FEDERATED TEST-BEDS FOR LARGE-SCALE INFRASTRUCTURE EXPERIMENTS FELIX EU-JP

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Abstract

This document presents a comprehensive report of all dissemination and standardization activities that were executed by the FELIX consortium during the second year of the project. It reports on all events, conferences and generally the internal and external communication activities developed by the project to increase awareness in the FIRE community and beyond, including presentations at standardization meetings.

Excecutive Summary

In the FELIX project, WP5 is responsible for ensuring maximum impact for the project outputs through dissemination and standardisation of the produced results. WP5 is aiming at organizing and maintaining the project workspace for collaboration, influencing the standardisation efforts for federated SDN infrastructures, and assuring visibility of the project and its results to the research community and third parties.

This deliverable provides a report of the dissemination and standardisation activities carried out by the partners during the second year.

Based on the successful results of the first year in terms of communication activities and outreach, the dissemination activities of the second year of the project have been targeted to consolidate project awareness in the wide audience of the academic, research and industrial communities interested in large-scale experimental research infrastructures in Europe, Japan and around the world. The project partners have continued publishing the project results in scientific journals and conferences, and participated in events like workshops, panel discussions, etc. Effort has been put also in maintaining and enriching the project website.

Work on standardisation continued also during the second year, consolidating the key role of FELIX as driver of innovative discussion items in Open Grid Forum Network Service Interface WG (OGF NSI WG).

1 Introduction

The document introduces the FELIX Dissemination and Standardization activities of the first year of the project. Chapter 2 of this deliverable presents Dissemination activities of FELIX project. The activities include providing FELIX public web site, publications, talks and posters at various meetings. The chapter also explains Internal Dissemination, including meetings and remote calls within the project. The Chapter 3 summarizes standardization activities at OGF NSI-WG.

2 Dissemination

2.1 External dissemination actions

2.1.1 Website

The goal of the FELIX website (<http://www.ict-felix.eu>) is to serve as main public information point for all news, events, publications and information about the project status and plans. Four main sections are defined in the structure of the website:

- *Press*: which shows up to date information on the highlights of the FELIX project (news and events).
- *Publications*: which contains downloadable access to the work package official public deliverables and to the FELIX presentations.
- *Partners*: which summarizes the list of FELIX partners and related contact persons.
- *About*: which gives a brief overview of the project and its goals.

During this second year the FELIX project website has been updated in most of its sections and, particularly, in the news section, to give public visibility of the latest project dissemination activities and participation to events.

2.1.1.1 Home page

The FELIX website homepage gives a quick overview of the project. It is mainly composed of several sub-spaces with different information and hooks to deepening child pages:

- a short summary on key FELIX objectives and goals, to introduce the visitor to the project research
- three linked pictures to the main activities of the project: Architecture, Test-beds and Experiments.
- a snapshot of the last announcements published on the website

FEDERATED TEST-BEDS FOR LARGE-SCALE INFRASTRUCTURE EXPERIMENTS

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Workshop 24 March 2015
Brussels
An Internet Playground for European Businesses
CI-FIRE 2nd Industry Workshop
Co-hosted by ANI/FIRE, FUSION
and the Broker Service of the IRI ICT Cities
AMPLIFIRE FUSION

CI-FIRE 2nd Industry Forum, 24 March 2015, Brussels

FELIX objective is to allow users to build their own virtual slices using resources of remote Future Internet facilities. To do so FELIX will:

- produce a FELIX federation framework,
- build an European-Japanese test-bed infrastructure and,
- validate the above with real use cases execution.

FELIX, in comparison to other state-of-the-art initiatives, integrates into one framework all features to perform multi-domain distributed resources management with on-demand provisioning. The project is not limited to single resources type or technology, but rather integrates various type of resources to offer world-wide services.

ARCHITECTURE TEST-BEDS EXPERIMENTS

The Architecture diagram shows a flow from FELIX SPACE to Configure Slice, then to Island A, B, and C, then to Control Slice, and finally to USER SPACE. The Test-Beds diagram shows a map of Europe and Japan with logos for FELIA, PSN, RISE, SURF, NET, and JGN-X. The Experiments diagram shows two SDN/NSI Resources connected to Data Centers.

Figure 2.1: FELIX home page

2.1.1.2 News and Events

Several pages of news and events information are available on the FELIX website. It gives visitors an overview of what is happening inside the project and where to attend public presentations, conferences, meetings, etc.

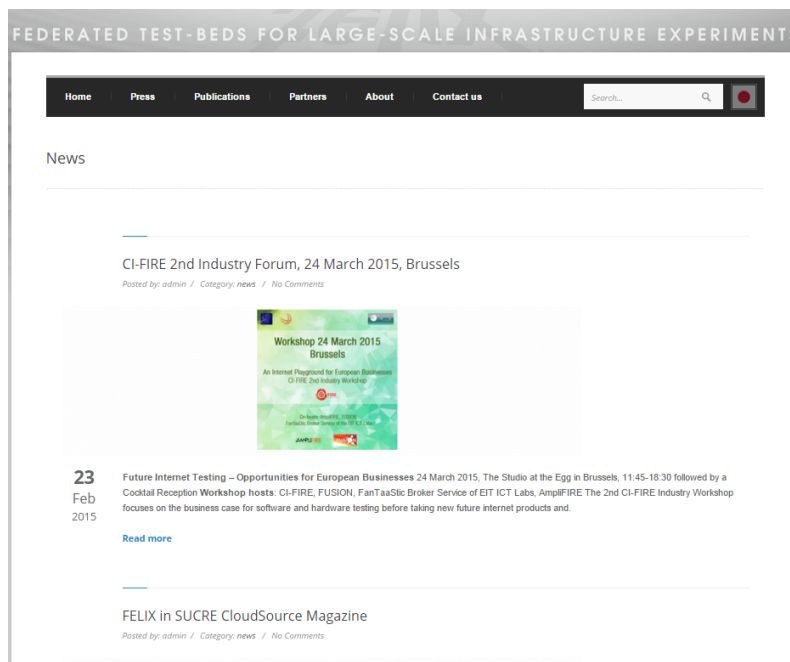


Figure 2.2: FELIX news page

2.1.1.3 Deliverables and Publications

These pages show the list of deliverables that have been submitted during the execution of the project. Moreover, in this section the visitor can easily find information on the public presentations and publications that have been produced by members of the project.

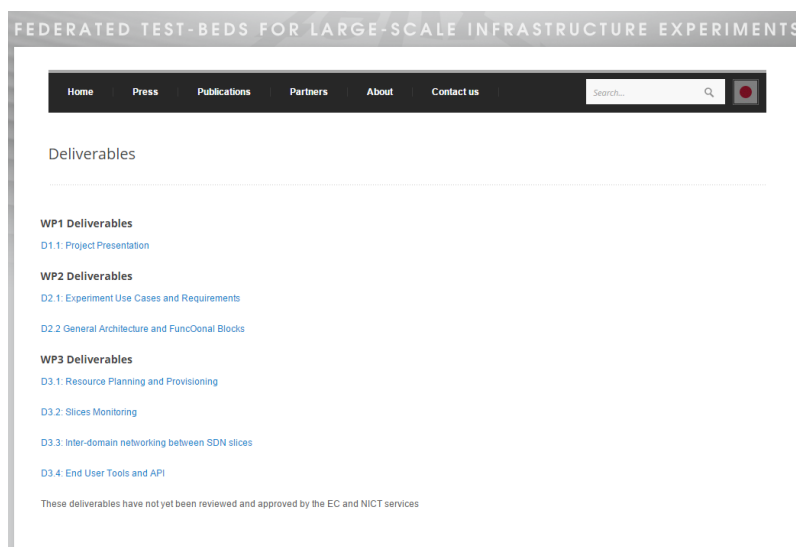


Figure 2.3: FELIX deliverables page

During Y2, the Publications section has been extended with the Software site where the first FELIX software release can be downloaded. Currently, four packages are available:

- Resource Planning and Provisioning
- Slice Monitoring
- Inter-domain networking between SDN slices
- End User Tools and API

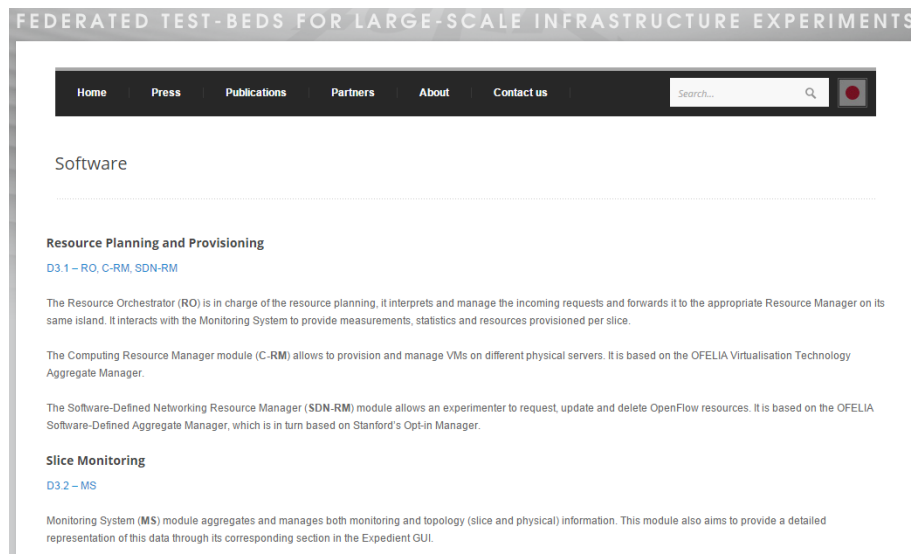


Figure 2.4: FELIX software page

Those packages contain a complete and functional part of the FELIX framework. They are also supplied with documentation which is in the form of an official project deliverable document. The documentation contains introduction to functionality as well as internal component descriptions and deployment information/instructions.

2.1.1.4 Website statistics

In order to analyse the FELIX website activity a web statistics tool was installed. The sections below present some statistics collected from April 2014 to March 2015, which mark the start and end dates of the second year of the FELIX project.

Unique Guests

A unique guest is a person or a computer that has made at least one hit on one page of the web site during the specified period. If the guest makes several visits during this period, they are counted only once. Visitors are tracked by IP address, so if multiple users are accessing the site from the same IP, they are counted as a single unique guest. The period shown on the graph is by default one month.

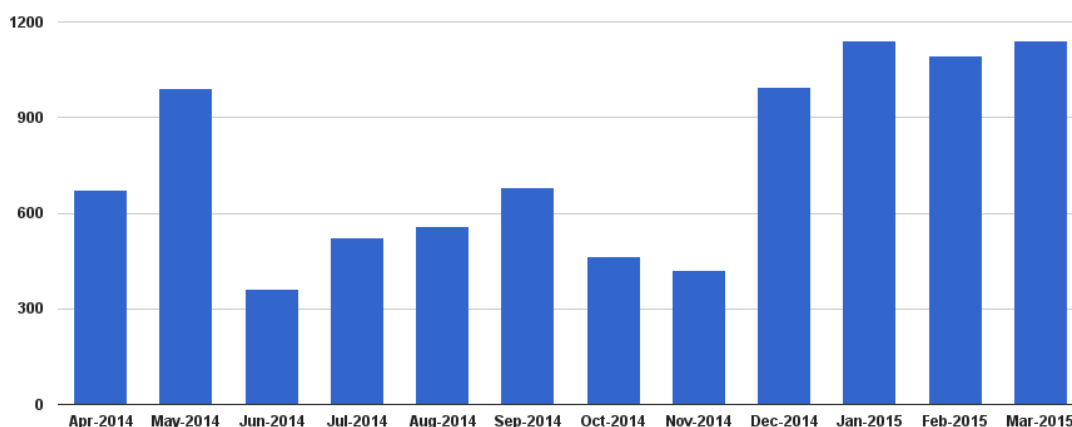


Figure 2.5: Unique guests

Visits

Definition of a “visit” is a user activity on a website over specified period of time – in this case it is one hour. During that period, all activity (requesting many pages) results in one visit.

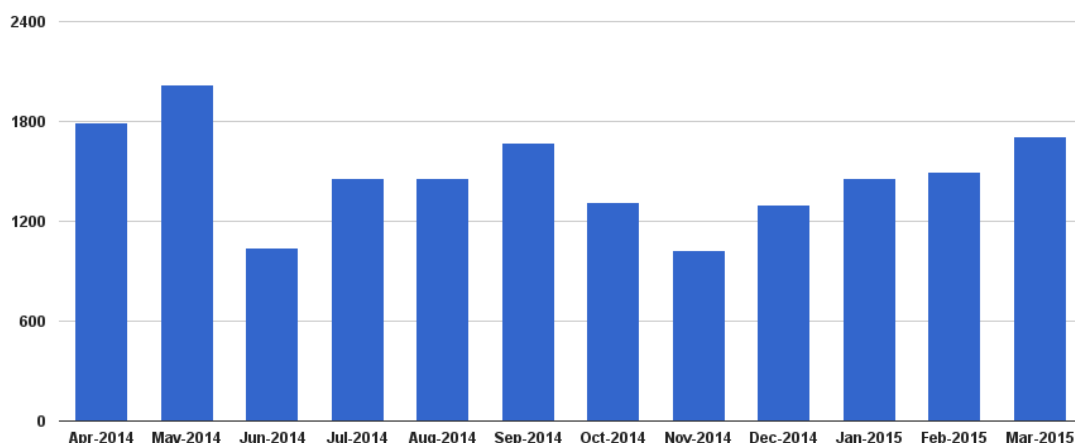


Figure 2.6: Website visits

Average pages per visit

This represents the number of "pages" viewed by visitors. "Pages" are only the HTML and PHP files, not images or other files requested as a result of loading a "page".

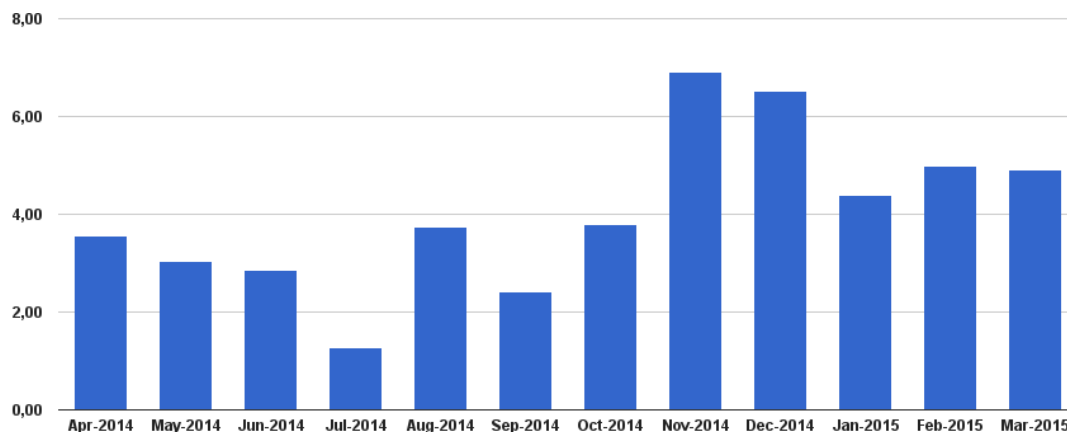


Figure 2.7: Average pages per visit

Trend analysis

The comparison of website statistics between Y1 and Y2 show a consolidated increasing trend of unique guests getting information about the project (+273%) and similar superb results in total number of visits (+230%). It is worth noting that the increased number of visits also correspond to a more focused search for specific contents (most likely known or references by other sources) which is reflected in the average 4 pages ca accessed per each visit (-34% with respect to Y1). Origin of the visitors is spread among mostly Europe, Japan and USA, and peaks of visits from a continent correspond to major events during which the partners have presented project results or informed about the project research. Though this second year shows a general trend of increasing interest towards project, it is worth noting that Y1 statistics presented in D5.1 could cover only 9 months (from July 2013 -- when the project website was made public -- up until March 2014), while statistics presented in this document for Y2 a full 12 months period.

	Y1	Y2	Variation
Total unique guests	2426	9038	+273%
Total number of visits	5369	17739	+230%
Total average pages per visit	6,08	4,03	-34%

Table 2.1: FELIX website statistics

2.1.2 Publications

The FELIX project has been active in the international community also during the year 2, through a number of presentations and submissions of papers in international conferences, workshops and events. Focus of this second year has been to consolidate with journal papers the architecture design contents delivered during the first year. Moreover, the major focus on implementation during Y2 has led to concentrate dissemination efforts to the more relevant and impacting efforts. Continuing the successful collaboration established from the beginning of the project, large part of the FELIX publications and presentations in Y2 have been collaborative efforts

by several partners, in some cases combining and orchestrating work across WPs. A detailed list of papers and presentations produced in the second year of the project is reported in the list below.

- April 2014
 - Conference paper, R. Takano, A. Takefusa, H. Nakada, S. Yanagita, T. Kudoh, "**Iris: An Inter-cloud Resource Integration System for Elastic Cloud Data Centers**", INSTICC CLOSER2014, *Published*
- June 2014
 - Conference poster, G. Carrozzo, R. Monno, B. Belter, R. Krzywania, K. Pentikousis, M. Broadbent, T. Kudoh, A. Takefusa, A. Vico-Oton, C. Fernandez, B. Puype, J. Tanaka, "**Large-scale SDN experiments in federated environments: The FELIX use-cases for EU-Japan collaboration on SDN**", 5th International Conference on Smart Communications in Network Technologies (SACONET), Vilanova i la Geltru, Spain, *Published*
- July 2014
 - Presentation, T. Kudoh, "**Global scale experiments over federated testbeds: Control, tools and applications**", 6th New Generation Network Symposium, *Presented*
- Aug. 2014
 - Presentation, J. Tanaka, "**Inter-domain SDN with NSI (Network Service Interface)**", APAN 38th meeting, *Presented*
- Sept. 2014
 - Conference paper, Umar Toseef, Adel Zaalouk, Tom Rothe, Matthew Broadbent, and Kostas Pentikousis, "**C-BAS: Certificate-based AAA for SDN Experimental Facilities**", EWSDN 2014, Budapest, Hungary, *Published*
 - Presentation, Umar Toseef and Kostas Pentikousis, "**SDN Experimentation Facilities and Tools**", MON-AMI 2014, Wuerzburg, Germany, *Presented*
- Oct. 2014
 - Presentation, B. Belter, T. Kudoh, "**SDN-based Experimental Platform in Europe and Japan for validation of new applications and services**", 5th EU-Japan Symposium in ICT Research and Innovation, *Presented*
 - Presentation, T. Kudoh, B. Belter, "**A common framework for federated SDN Future Internet testbeds across Europe and Japan**", 5th EU-Japan Symposium in ICT Research and Innovation, *Presented*
 - Journal paper, G. Carrozzo, R. Monno, B. Belter, R. Krzywania, K. Pentikousis, M. Broadbent, T. Kudoh, A. Takefusa, A. Vico-Oton, C. Fernandez, B. Puype, J. Tanaka, "**A recursive orchestration and control framework for largescale, federated SDN experiments: the FELIX architecture and use cases**", International Journal of Parallel, Emergent and Distributed Systems, *Waiting for publication*
- Nov. 2014
 - Magazine, B. Belter, G. Carrozzo, "**FELIX research and infrastructure**", SUCRE CloudSource Magazine article about FELIX -- CloudSource Magazine Issue 4 (<http://issuu.com/sucreprject/docs/suc-re-issue-4-full-update/0>), *Published*

- March 2015
 - Conference booth, G. Carrozzo, B. Belter, "**High quality media streaming experiments over long distance federated SDN and NSI-controlled networks between Europe and Japan**", EUCNC 2015 exhibition, *Submitted*
 - Invited talk, B. Belter, "**FELIX framework for interconnecting SDN testbeds**", Internet2 International OpenFlow/SDN Testbeds, Miami (USA), remote presentation, *Presented*
 - Presentation, J. Tanaka, "**FELIX : Federation of SDN Testbeds between Europe and Japan**", APAN 39th meeting, *Presented*
- June 2015
 - Conference paper, Umar Toseef and Kostas Pentikousis, "**Implementation of C-BAS: Certificate-based AAA for SDN Experimental Facilities**", IEEE NCCA 2014, Munich Germany, *In preparation*

2.1.3 Open source code

FELIX opened the current software code to the public once the main WP3 deliverables have been released at the end of January 2015. The software project, called “FELIX”, is hosted at GitHub under the I2CAT organization with public open access by every user (<https://github.com/dana-i2cat/felix>). FELIX has leveraged the tooling already available in GitHub to setup an infrastructure to support the initial community of users and developers around FELIX.

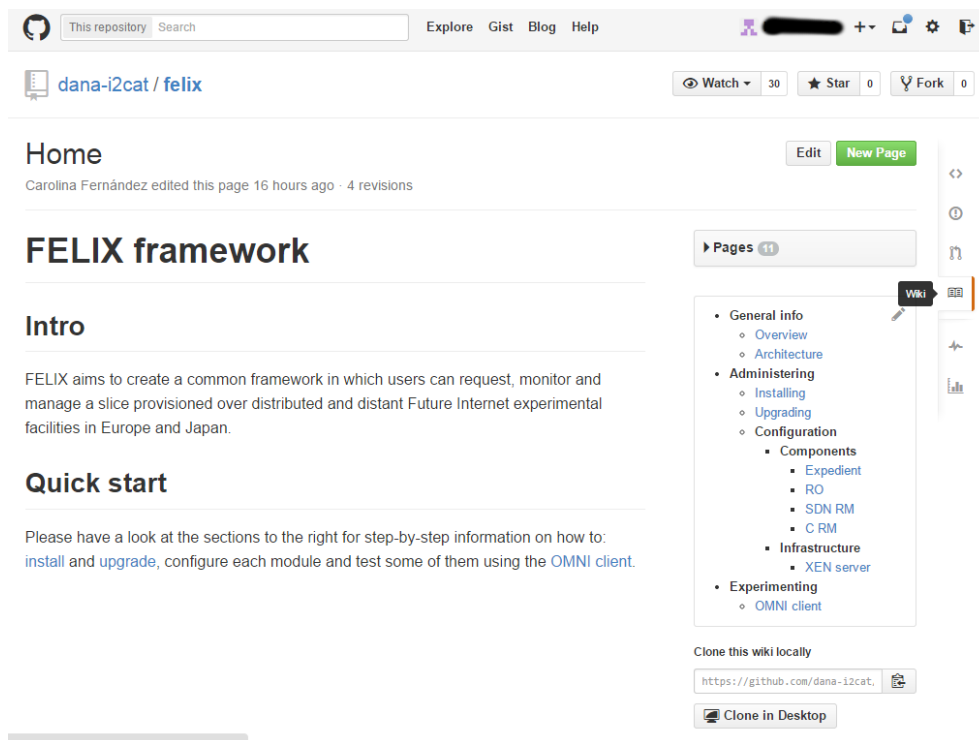


Figure 2.8: FELIX GitHub wiki page.

FELIX developers from within the consortium continue to work on the public repository, thus making the availability of fixes and refinements to the components functionalities rapidly available to the community.

Users can download the software and follow the installation instructions in the FELIX GitHub wiki (<https://github.com/dana-i2cat/felix/wiki>) in order to get a working FELIX implementation for Resource Orchestrator and the various Resource Managers. The documentation on the GitHub wiki is intended to serve as complement to the detailed instructions and design explanations contained in the official deliverables released by WP3. The open FELIX site on GitHub also features an issue tracker where users can submit bug or feature requests.

Developers can clone the FELIX repository and browse/edit the code using their favourite development environments. The procedures for accepting contributions from external users are still not officially established within the consortium, being the major focus at the time of writing on the realization of use cases and demonstration of the full framework stack. Should issues and request emerge from external parties in this transitory period, those will be analysed and decision taken on a case-by-case basis.

The license set for this code is APACHE 2.0, which has been evaluated by all the partners as a good solution for the type of code to be published and its potential use in FIRE communities around the world.

2.1.4 Events

The FELIX consortium has continued to be active in disseminating project results and FELIX researchers participated to several events worldwide also during Y2. While this first year of the project was focused on creating awareness of FELIX topics, use-cases and architecture, the second year has been dedicated to consolidate the promotion of these assets and correlate them to ongoing software developments and test-bed construction. The third year will complement this strategy with live demonstrations. participation to events has been selected to keep focus on the key project discussions and activities, above all waiting for mature software results to be used for demos and evaluations.

The following table provides a list of events attended by FELIX members, showing the kind of activity performed during these events.

Event	Place	Date	Activity
EUCNC 2014	Bologna (Italy)	23-26 June 2014	Poster and conference
6th New Generation Network Symposium	Tokyo (Japan)	29-30 July 2014	Booth
SuperComputing 2014	New Orleans (US)	17-20 November 2014	Booth
OGF-42 NSI-WG Meeting	Washington D.C. (US)	25-27 March 2015	Presentation

Table 2.2: FELIX events.

The project is planning a booth for demo at next EUCNC 2015 (Paris-FR, July 2015), as well as potential second demo at EWSDN 2015 (Bilbao-PT, Sept. 2015). Negotiation and evaluations are ongoing to possibly set up a FELIX demo space also in selected days at the EXPO Milano 2015 (<http://www.expo2015.org/>) as joint effort of Japanese and European partners.

2.1.5 Partnerships with other projects

The preliminary contacts established during the first year with the GN3plus-MOTE and the SUCRE projects have slowly progressed during the second year, mostly in the direction of the SUCRE Support action. In particular, FELIX has presented project achievements in an article released in the 4th Issue of the CloudSource Magazine, coordinated by SUCRE team. On the GN3plus-MOTE project no specific follow up action has been agreed during Y2, and the MOTE project is ending on March 2015 thus further reducing opportunities for continued liaisons.

New liaisons might be launched once the new H2020 FIRE+ project will get into full speed of activities, being most of the just started in Q1-2015.

2.1.6 Posters

A second detailed version of the FELIX poster has been elaborated for the EUCNC2014 conference, where it has been discussed with a number of interested researchers fascinated by the potentials of SDN infrastructure for their experiments.

The new poster provides an overview of the main FELIX architecture components, the role of resource orchestrator and resource managers, the key use cases to be demonstrated soon.

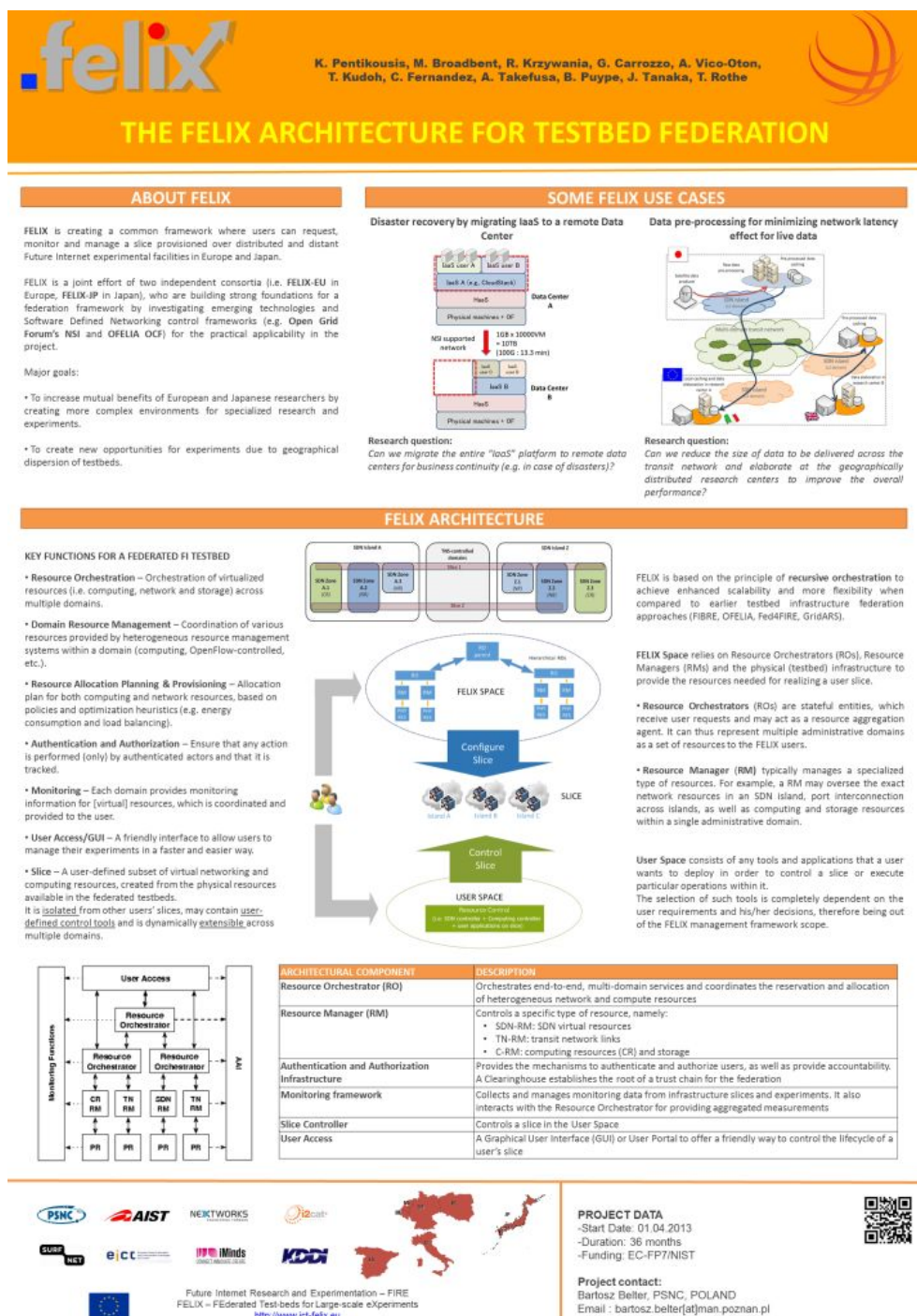


Figure 2.9: FELIX poster presented at EUCNC 2014, Bologna-IT.

2.1.7 FELIX within FIRE

FELIX has continued to participate to the Future Internet Research and Experimentation (FIRE) coordination and concertation initiatives called by the European Commission also during the second year. In particular, the project has contributed through the European coordinator to the production of FIRE publicity material (i.e. contribution to FIRE newsletters). It is likely the launch of the new FIRE+ projects recently funded through the H2020 framework program will give new stimulus to the concertation activities and actions, to which the FELIX consortium is ready to participate.

2.2 Internal dissemination and networking

2.2.1 Internal communication

Internal communication among partners for design discussions and data collection has continued to be managed mainly through the project wiki. The wiki has also been used as primary tool for editing deliverables in a collaborative 2.0 way, generating the final documents automatically from wiki pages.

For other communications, work package members have continued to use project mailing list and the skype live chat for more rapid notifications.

Both tools are hosted and operated by PSNC on their servers, and services are fully accessible to FELIX partners.

2.2.2 Face-to-face and remote meetings

In order to coordinate the development work in WP3 and the infrastructure interconnection discussions in WP4, two face to face meetings and one remote full day meeting have been organized during Y2. In addition to face to face and virtual meetings, the partners have actively participated to weekly conference calls (2hrs long, with a first part dedicated to software development discussions, and a second part for general project information and required actions) through which it has been possible to coordinate the overall software development activities and monitor progress against planned deliverables and milestones. The following table summarizes meetings organized during the second year of FELIX.

Meeting	Date	Venue	Purpose
5th FELIX Meeting	16-18 July 2014	Berlin, DE, hosted by EICT	In-depth implementation meeting
FELIX Virtual Meeting	30 October 2014	videoconference	In-depth implementation meeting
6th FELIX Meeting	4-6 February 2015	Tokyo, JP, hosted by KDDI	In-depth implementation meeting

Table 2.3: FELIX project meetings.

2.2.2.1 5th FELIX Meeting

The 5th FELIX meeting was held on 16-18 July 2014 in Berlin-DE at EICT premises. The meeting was focused on development work and particularly on

- User Authentication and Authorization in FELIX Architecture
- Federation API for test-bed user-agents
- Interaction of users with the set of FELIX RMs and RO
- FELIX Stitching Entity RM

All the partners were represented at the meeting and actively participated to discussions and sessions.



Figure 2.10: 5th FELIX meeting, discussion at the whiteboard.

2.2.2.2 6th FELIX Meeting

The 6th FELIX meeting was held on 4-6 February 2015 in Tokyo-JP at KDDI premises. The meeting was organized after the release of the main WP3 deliverables (D3.1, D3.2, D3.3 and D3.4) to

- consolidate the open source FELIX repository,
- prepare the federated infrastructure and demonstrations for Y3
- plan the next software development features required by the implementation of specific use cases.

All the partners were represented at the meeting and actively participated to discussions and sessions.



Figure 2.11: 6th FELIX meeting, discussion at the whiteboard.



Figure 2.12: 6th FELIX meeting, group.

3 Standardization

During the first months of the project, the consortium has analyzed some of the Standards Developing Organizations (SDOs) most relevant for the FELIX technical areas, with particular reference to Software Defined Networking (SDN) architectures, OpenFlow (OF) protocol and Network Service Interface (NSI) framework, tools and protocols. The objective of this analysis is to guarantee the compliance of the FELIX technical approach with the most recent standardization results and, where possible, to contribute in the promotion of selected project outcomes in key SDOs like Open Grid Forum (OGF) and Internet Engineering/Research Task Force (IETF/IRTF).

The main target for the project standardization activities is OGF and, in particular, the NSI Working Group (OGF NSI-WG) where many of the FELIX partners are active (AIST, PSNC, KDDI) and Tomohiro Kudoh (AIST) is chair of the NSI-WG. The FELIX project has been already represented in some of the NSI-WG meetings, as detailed in the following section.

The other possible direction of FELIX standardization activities is related to SDN architectures. In this area, active standardization effort is currently ongoing in ONF (Open Networking Forum), in IETF (e.g. on I2RS and Service Function Chaining WGs) and IRTF (e.g. on SDN Research Group), and in ETSI (e.g. on Network Functions Virtualization). IETF and IRTF seem the most suitable SDOs to promote FELIX results about the SDN topics; the consortium is still investigating a possible strategy to address the most relevant IRTF/IETF RGs and WGs (e.g. submitting dedicated Internet Drafts), possibly in cooperation with external partners already active in the area.

Organization	Working Groups	Relevance for FELIX	FELIX representation
OGF	NSI WORKING GROUP	High	AIST, PSNC, KDDI
IRTF	SDN RESEARCH GROUP	Medium	EICT, NXW (plans)

Table 3.1: FELIX Standardization

3.1 FELIX activities in OGF NSI WG

During Year 2, FELIX partners continued steering the OGF-NSI Working Group activities with AIST team led by T. Kudoh, and participated to the WG sessions organized in the framework of OGF. The main area of activity covered through FELIX in OGF NSI WG has continued to be related to possible extensions of the NSI framework for the support of:

- virtual network or non-network (computer and storage) resources;
- different kind of behavior (proactive and reactive);
- federation model;
- disjoint multiple paths creations (MPTCP and protection);
- authentication

The table below summarizes the presentations made at OGF NSI-WG.

Date	Title	Partner	Destination	Relationship Document
July 2014	Future Functionality of NSI	AIST	OGF NSI-WG meeting Atlanta (USA)	NSI Connection Service
March 2015	FELIX AAA and Future Functionality of NSI	EICT, AIST	OGF NSI-WG meeting Washington (USA)	NSI Connection Service

Table 3.2: OGF Standardization

The reduced number of meetings is mostly due to an increasing slowing down of OGF meeting schedule, probably due to the emergence of other fora on SDN and NFV.

3.2 Other fora

Though FELIX works on SDN, the main focus of the project is on the deployment of SDN control tools in FIRE infrastructures more than the development of new tools. On the contrary, the potential impact of project results on NSI WG agenda could be higher and better received by the community. Consequently, the consortium intends to proceed on NSI WG activities also during Y3 and adding in parallel other standardization initiatives around specific architecture artifacts once validate by experimentation. In particular, there are plans for Y3 to target a potential contribution to IRTF SDN RG between the end of 2015 and the first quarter of 2016.

Acronyms

AAA	Authentication, Authorization and Accounting
AM	Aggregate Managers
APAN	Asia Pacific Advanced Network
API	Application Programming Interface
C RM	Compute and storage Resource Manager
DWDM	Dense Wavelength Division Multiplexing
ETSI	European Telecommunications Standards Institute
EWSDN	European Workshop on Software Defined Networks
f2f	face to face
FIA	Future Internet Assembly
FIBRE	Future Internet Testbeds Experimentation between Brazil and Europe
FIRE	Future Internet Research & Experimentation
GENI	Global Environment for Network Innovations
GLIF	Global Lambda Integrated Facility
HaaS	Hardware as a Service
I2RS	Interface to the Routing System
IEICE	Institute of Electronics, Information and Communication Engineers
IETF	Internet Engineering Task Force
IPOP	International Conference on IP + Optical Network
IRTF	Internet Research Task Force
ITRC	JSPS 163rd Committee on Internet Technology
JSPS	Japan Society for the Promotion of Science
NML	Network Mark-up Language
NREN	National Research and Education Network
NSI	Network Services Interface
NSI CS	NSI Connection Service
OCF	OFELIA Control Framework
OF	OpenFlow
OFELIA	OpenFlow in Europe: Linking Infrastructure and Applications

OGF Open Grid Forum

QoE Quality of Experience

RM Resource Manager

RO Resource Orchestrator

SDN Software Defined Networking

SDO Standards Developing Organization

TERENA Trans-European Research and Education Networking Association

TN RM Transit Network Resource Manager