



Objective FP7-ICT-2009-5-257448/D-2.6

Future Networks

Project 257448

“SAIL – Scalable and Adaptable Internet Solutions”

D-2.6

(D-A.6) Final report on exploitation and dissemination

Date of preparation: **13-02-28**

Start date of Project: **10-08-01**

Project Coordinator: **Thomas Edwall**

Ericsson AB

Revision: **1.1**

Duration: **13-02-28**

Document Properties:

Document Number:	FP7-ICT-2009-5-257448-SAIL/D2.6
Document Title:	D-A.6: Final report on exploitation and dissemination
Document responsible:	Luis M. Correia (IST-TUL)
Author(s)/editor(s):	Luis M. Correia (IST-TUL), Johan Myrberger (Ericsson Research), Daniel Sebastião (IST-TUL), Benoit Tremblay (Ericsson Research), Thomas Edwall (Ericsson Research), Michael Soellner (Alcatel Lucent), Hannu Flinck (Nokia Siemens Networks), Dirk Kutscher (NEC), Lucian Suciu (France Telecom), Pedro Aranda (Telefónica I+D), João Soares (Portugal Telecom), Bjorn Bjurling (Swedish Institute of Computer Science), Matthias Keller (University of Paderborn), Nan Zhang (Aalto University), Peter Schoo (Fraunhofer), Nick Wainwright (Hewlett-Packard), Susana Perez (Tecnalia), Gerald Kunzmann (DOCOMO), Stephen Farrell (Trinity College Dublin), Roksana Boreli (NICTA), Ramon Agüero (University of Cantabria), Börje Ohlman (Ericsson Research), Paul Perie (Lyatiss), Fetahi Wuhib (Ericsson Research), Paulo Gonçalves (INRIA), Djamel Zeglache (Institut Télécom)
Target Dissemination Level:	PU
Status of the Document:	Final Version
Version	1.1

Production Properties:

Reviewed by:	
---------------------	--

Revision History:

Revision	Date	Issued by	Description
1.0	2013-02-28	Daniel Sebastião	First Complete Version
1.1	2013-02-28	Johan Myrberger	Confidential parts of exploitation tables extracted into separate appendix

This document has been produced in the context of the SAIL Project. The research leading to these results has received funding from the European Community's Seventh Framework Programme ([FP7/2010-2013]) under grant agreement n° 257448. All information in this document is provided "as is" and no guarantee or warranty is given that the information is fit for any particular purpose. The user thereof uses the information at its sole risk and liability. For the avoidance of all doubts, the European Commission has no liability in respect of this document, which is merely representing the authors view.



Document: FP7-ICT-2009-5-257448-SAIL/D2.6

Date: 2013-02-28

Security: Public

Status: Final Version

Version: 1.1

Abstract:

This document provides the detailed results for dissemination and exploitation activities of the project. Special emphasis is given to SAIL-organised dissemination events, i.e., Workshop, Summer School, etc. Furthermore, besides the usual dissemination activities, the project uses social networks as a visibility means as well.

Keywords:

Dissemination. Workshops. Summer School. Conferences. Social Networks. Exploitation.

Table of Contents

1	Introduction	7
2	Dissemination Actions and Their Impact.....	9
2.1	Public Website	9
2.2	Press Release.....	12
2.3	SAIL in the Media.....	12
2.4	Leaflet.....	13
2.5	Newsletter	14
2.6	Publication of Papers in Conferences and Journals	15
2.7	SAIL Workshops	15
2.7.1	Cloud Interoperability Workshop at 8th Concertation meeting	15
2.7.2	Cloud Networking: Technical and Business Challenges, Workshop at FuNeMS 2012	16
2.7.3	Open Connectivity Workshop - MONAMI 2012	17
2.7.4	Dagstuhl seminars	17
2.7.5	SIGCOMM ICN workshops	18
2.7.6	SAIL regulatory workshop on Information-Centric Networking (ICN)	18
2.7.7	SAIL regulatory workshops in Finland and Portugal	18
2.7.8	Workshops at final event.....	19
2.8	Demonstration Events.....	20
2.8.1	Future Networks and Mobile Summit, Berlin July 2012	20
2.8.2	Future Media Distribution Using Information-Centric Networking, Kista February 13, 2013	22
2.9	SAIL Training School	23
2.10	Interaction with other Projects and Fora	24
2.11	Web2.0 Activities.....	24
2.11.1	Sailors Inn – the project blog.....	25
2.11.2	SAIL on YouTube.....	25
2.11.3	SAIL on SlideShare.....	25
2.11.4	SAIL on LinkedIn.....	25
2.11.5	SAIL on Twitter	25
2.11.6	SAIL on Facebook.....	25
2.11.7	SAIL on Google+.....	27
2.12	Open Source Activities	27
3	Exploitation of Results.....	28
3.1	General Approach	28
3.2	Partners' Perspectives	28
4	Conclusion	65
5	References.....	67
	Annex A – Issued Newsletters.....	69
	Annex B – Complete List of Published Papers	73

Executive Summary

SAIL project was developed within the Network of the Future Objective of EU FP7, in the medium- and long-term perspectives. Dissemination and exploitation of results is one of the major tasks for every European project. SAIL is no exception, with dissemination actions from SAIL aimed at communicating project results to a wide audience, fostering the adoption of project results and its impact, facilitating the exchange of information and the interaction not only with other projects but also with activities in industry, academia, and society as a whole. Furthermore, project results were brought to training and education activities as well.

Major results from dissemination activities are presented in this document, including:

- Public website: almost 20 000 unique visitors to the website;
- Press release: two formal press releases has been made;
- SAIL in the Media: several examples of press coverage on SAIL's results;
- Leaflet: 2 500 leaflets have been distributed;
- Newsletter: 6 newsletters issued;
- Publication of papers: almost 100 papers published in conferences and journals;
- SAIL workshops: SAIL has organized several workshops;
- Demo events: two major demo events held by SAIL;
- SAIL training school: more than 50 students attended;
- Web 2.0 activities: SAIL is present at several "web 2.0" websites/networks;
- Open source activities: Several open source material has been developed within the project;

In parallel to dissemination, exploitation of results plays a major role, namely for the major industrial partners, as this has a stronger industrial impact towards product development and standardisation.

Exploitation activities are also addressed in detail, being structured along several dimensions, i.e.: the actor (i.e., industrial and academic), the type (technical improvements or strategic guidelines), and the audience (internally to the consortium and or externally to a wider community). Specific results for each partner are also presented, including as overall end-of-project exploitation statement and alignment with the initial planning.

The exploitation and dissemination in SAIL, involved all partners, the coordination of all these activities being performed within WP-A "ICE – Impact & Collaboration Enabling", more specifically by T-A.3 "Dissemination".

1 Introduction

The motivation of this document is to provide a final overview on all the project dissemination and exploitation results. SAIL provided essential contributions to the Network of the Future Objective of EU FP7 [1], in the medium- and long-term perspectives. Dissemination and exploitation of results is one of the major tasks for every European project. SAIL is no exception, with dissemination actions from SAIL aimed at communicating project results to a wide audience, fostering the adoption of project results and its impact.

The exploitation and dissemination in SAIL, involved all partners, the coordination of all these activities being performed within WP-A “ICE – Impact & Collaboration Enabling”, more specifically by T-A.3 “Dissemination”.

SAIL dissemination activities included “classical” items, (e.g., website, inter-project concertation, scientific publications, workshops and training activities), but also went a step further by using new ways of spreading information (e.g., blogs, social networks, and information upload to websites), [2].

In parallel to dissemination, exploitation of results plays a major role, namely for the major industrial partners, as this has a stronger industrial impact towards product development and standardisation. Exploitation activities of the SAIL consortium were structured along several dimensions, including an overall end-of-project exploitation statement from all partners and alignment with the initial objectives.

Standardisation also plays a key role in the dissemination and exploitation of research results. This is why SAIL has been involved in different standardisation activities. The Final Migration Description [3] provides details on how SAIL has been involved in those activities.

This report is structured into 2 other chapters, besides the final one on conclusions: Chapter 2 presents the dissemination aspects, while Chapter 3 addresses the exploitation perspectives.

2 Dissemination Actions and Their Impact

In this chapter, one presents the dissemination activities that were done in SAIL, and analyses their impact.

2.1 Public Website

The public web site of SAIL, located at www.sail-project.eu, is the main online hub for making the project visible and to publish results to the public.

The web site as a channel is complemented both by “web 2.0” channels, reported in Section 2.11, as well as other online site not owned or controlled by SAIL but where results and other material have been made visible and available.

The web site was launched in the beginning of the SAIL project (August 2010), and will remain online after the project end according to the overall agreement.

The visits and stats presented in this section covers the period from the project start up to, and including, January 2013. A summary of the period is captured in Figure 2.1.



Figure 2.1: Overview of web site traffic.

The statistics reports almost 20 000 unique visitors (18 694), who in all have made close to 32 000 visits and almost 80 000 pageviews.

The visitors are from across the world, with three non-EU countries represented on the top-10 list, Figure 2.2.

Country / Territory	Visits ↓
1. Sweden	3,830
2. United States	2,900
3. India	2,763
4. Germany	2,759
5. Spain	2,159
6. France	2,010
7. (not set)	1,802
8. United Kingdom	1,248
9. China	1,213
10. Portugal	1,029

Figure 2.2: Origin of web site visitors.

The sources of the traffic are highlighted in Figure 2.3. Visits through search engines are almost half of the visits, while direct traffic (visitors typing in the URL or clicking on links in e.g., emails) are the second largest group.

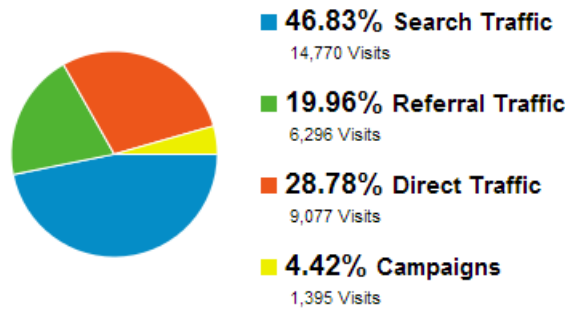


Figure 2.3 Traffic sources

Search traffic is the largest portion, and specific care has been made during the SAIL project to ensure a sufficient visibility in search engines, as Google and similar search tools are a common way of finding more information about topics. The SERP (Search Engine Ranking Position) for a number of search terms are shown in Figure 2.4.

Referral traffic brings around a 5th of the traffic. This is overall a bit lesser than ideal, and despite active efforts to ensure inlinks from external web sites the project could have benefitted from more such traffic in the overall mix. It shall be noted, as seen in Figure 2.5, that three out of the top-6 referral domains represents social (Web 2.0) sites. This is further discussed in Section 2.11.

Domain	Keyword	Google.com
www.sail-project.eu	sail	13
www.sail-project.eu	sail project	1
www.sail-project.eu	sail eu	1
www.sail-project.eu	sail fp7	1
www.sail-project.eu	fp7 sail	1
www.sail-project.eu	project sail	3
www.sail-project.eu	eu sail	1
www.sail-project.eu	fp7	-
www.sail-project.eu	sailors inn	17
www.sail-project.eu	scalable adaptive internet	1
www.sail-project.eu	scalable adaptive internet solutions	1
www.sail-project.eu	scalable internet	125
www.sail-project.eu	adaptive internet	4
www.sail-project.eu	adaptive scalable internet	4
www.sail-project.eu	internet adaptive	-
www.sail-project.eu	internet scalable	24
www.sail-project.eu	internet adaptive scalable	1
www.sail-project.eu	internet scalable adaptive	1
www.sail-project.eu	sail newsletter	1
www.sail-project.eu	newsletter sail	2
www.sail-project.eu	ICT sail	1
www.sail-project.eu	sail ICT	2
www.sail-project.eu	sail eu fp7	1

Figure 2.4: SERP for some search terms

Source
1. facebook.com
2. linkedin.com
3. search.mywebsearch.com
4. cordis.europa.eu
5. internal.ericsson.com
6. t.co

Figure 2.5: Top referral domains

The web site content is a mixture of overall project description as well as publications, deliverables and other results from SAIL and also specific events and news. The web site hosts both “web pages” as well as downloadable documents.

Among the downloadable documents the following 5 deliverables are, as of last project month, the most downloaded. They are all publications from earlier project periods, and thus have accumulated the download volume over a longer time period, Table 2.1.

Table 2.1: Download volume for some deliverables.

Deliverable	Number of hits
D-D.1	2874
D-A.5	2821
D-A.1	2256
D-B.1	2014
D-C.1	1077
D-A.7	1003

2.2 Press Release

During the SAIL project two formal press releases has been made from the project, one in the beginning and one at the end.

These have been distributed via email, targeted to selected media and selected individual journalists. The press releases have also been published on the web site at <http://www.sail-project.eu/category/pressreleases/>.

These press releases have contributed to a number of mentions in the press (see Section 2.3, in which some of the examples are directly related to the press releases and other the result of other interaction with the media).

It shall be noted that simply issuing a press release is not enough to create a news story. News stories most often emerge from other interactions, and press releases are then instrumental to provide material for the journalist to work with.

2.3 SAIL in the Media

SAIL has also made impact in the press. Most of the news appeared when the project started, but there has been some coverage further within the project. The full list of known SAIL appearances in the European press is presented at: <http://www.sail-project.eu/publications/sail-in-the-press/>. Some of the press coverage is presented in Figure 2.6.



Internet do futuro. Vamos vender Wi-Fi a partir de casa

por Ana Rita Guerra, Publicado em 19 de Novembro de 2010

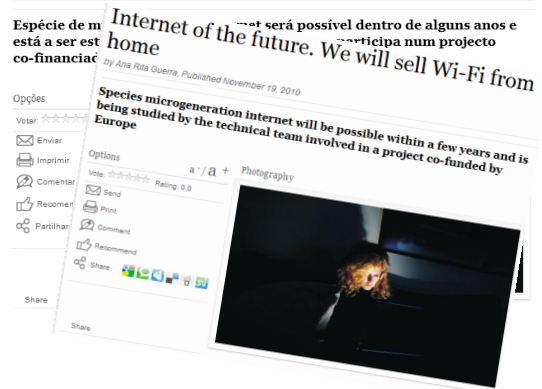


Figure 2.6. Examples of press coverage news for the SAIL project.

2.4 Leaflet

A leaflet, in the format of a sail, has been produced and distributed at events where SAIL has been present, Figure 2.7.

Although the information presented in the leaflet is limited to a brief overview, the value of the leaflet as a “business card”, with further contact information is large. Furthermore, the somewhat unconventional format (a sail) has been found to add to the stickiness.



Figure 2.7. The SAIL leaflet, ready to go.

In total around 2 500 leaflets have been distributed during the lifetime of the SAIL project.

2.5 Newsletter

A regular SAIL Newsletter was issued, presenting the project's progress to the "outside world". It contained several sections: *Editorial*, *Under the Spotlight*, *Inside SAIL*, *Looking Outside*, and *What's Next*. The *Editorial* is produced by the Project Management; *Under the Spotlight* presents in more detail the activities of a given WP (on a rotating basis); *Inside SAIL* gives a short progress report on the main developments of each WP, as well as of the Themes; *Looking Outside* intends to approach activities occurring outside the project, that are in its area of work; finally, *What's Next* brings a record of future incoming events (also in the area of the project).

The Newsletter was distributed electronically, by email, internally to the project, and to all those that show an interest in it. Various direct and indirect mailing lists have been used. The subscription mailing list, where people can sign up from the web site, holds above 100 subscribers (109). The newsletter has also been distributed physically, in a printed format together with the Leaflet, at major events. In total, 6 Issues of the Newsletter were issued:

- Newsletter 1: issued on December 2010.
- Newsletter 2: issued on March 2011.
- Newsletter 3: issued on June 2011.
- Newsletter 4: issued on September 2011.
- Newsletter 5: issued in February 2012.
- Newsletter 6: issued in May 2012.

An example of the Newsletter is presented in Figure 2.8, and all issues of the newsletter can be found in <http://www.sail-project.eu/category/newsletters>.

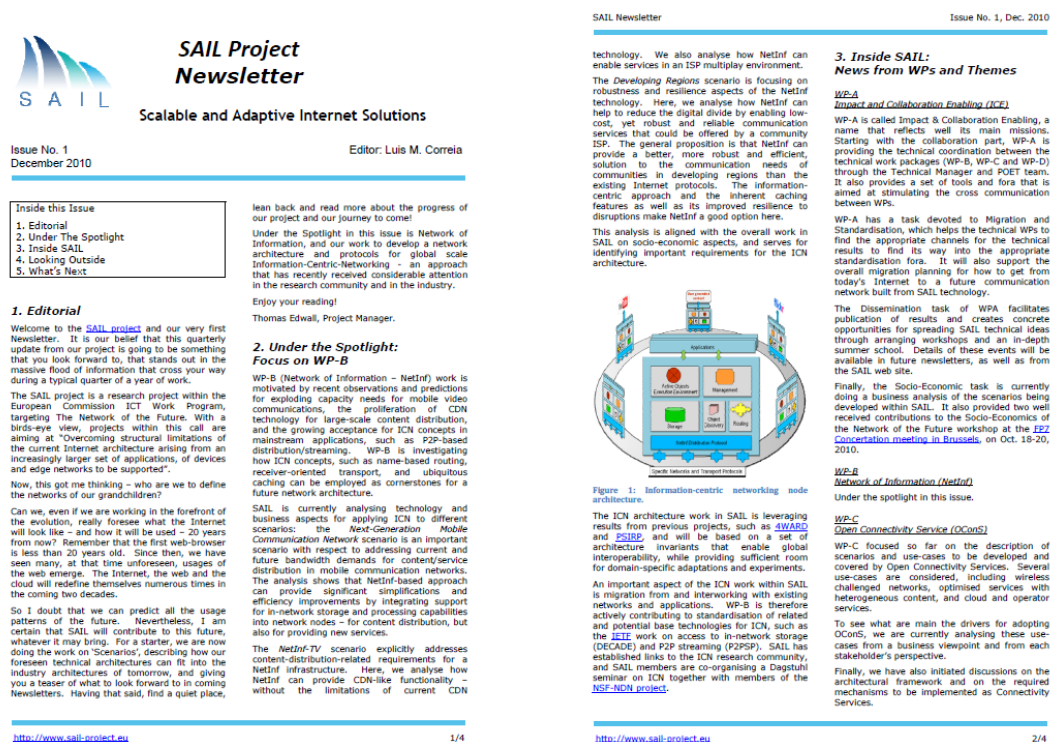


Figure 2.8. 2 page example of the SAIL Newsletter.

2.6 Publication of Papers in Conferences and Journals

Conferences and journals are an important way to disseminate scientific knowledge, and SAIL also followed this approach, by publishing its results. All SAIL partners participated on presenting papers to several conferences and journals.

The results of these contributions have been collected during the lifespan of the project, the majority being identified in the SAIL website at <http://www.sail-project.eu/publications>. Several editions of the major conferences were targeted. In total, until end of January 2013, SAIL had:

- 107 papers accepted in conferences.
- 15 publications accepted to journals, magazines, book chapters and technical reports.

As the project is about to finish, more work is progressing, and 8 papers for conferences and 6 for journals are currently waiting for the review.

Major conferences where papers were presented include: WCNC, PIMRC, GLOBECOM, CLOUDNET, MONAMI, SIGCOMM, WPMC, FUNEMS, ICC, etc. The complete list of papers accepted into conferences can be seen in Annex B – Complete List of Published Papers, in Table B.1.

Regarding journals, the major publications targeted were: IEEE Communications Letters, IEEE Communications Magazine, IEEE Transactions on Network and Service Management, IEICE Transactions on Communications, EURASIP Journal on Wireless Communications and Networking, Ad Hoc Networks Elsevier journal, Mobile Networks and Applications journal, Electronic Communications of the EASST, and the FIA book. The complete list of publications in magazines can be found in Table B.2, and the technical reports can be found in Table B.3.

2.7 SAIL Workshops

SAIL has organised two workshops in relation with Cloud Networking (Concertation meeting and FuNeMS 2012) and a workshop on Open Connectivity Services at the MONAMI 2012 conference. SAIL has also really active in community building by organising and contributing to many workshops on information-centric networks.

2.7.1 Cloud Interoperability Workshop at 8th Concertation meeting

The first organised workshop was part of the 8th Concertation meeting of the Future Internet Cluster. It took place on October 6th 2011 and focus on standardisation of cloud networking.

Four panellists from different research areas participated in the event. The panel consisted of Azimeh Sefidcon from Ericsson Research and CloNe WP-leader in the SAIL project, Patsy Phelan from TSSG, [4] representing the PASSIVE project, [5], Morris Riedel from the Juliech Supercomputing centre, [6], and Strategic director of EMI, [7], and finally Yuri Demchenko, Senior Researcher from the University of Amsterdam, [8], and a researcher for the GEYSERS project, [9]. The discussions were moderated by Benoit Tremblay from Ericsson research and technical manager of the SAIL project.

The discussions highlighted the difficulty to get traction from the industry to identify the key interfaces and develop standards. Large IT players are already providing public interfaces to their clouds and those interfaces are in many cases used as de facto standards. The interoperability and standardisation needs to embrace governance, risk management and compliance. Security is an important aspect to consider both from the enterprise deploying their applications in the cloud as well as for users using the cloud.

The grid community has reached that maturity level of evolving proprietary interfaces to a reduced set of standard ones. However, the workshop also illustrated the difference in

business models for cloud networking and grid computing. While some technologies could be shared between them, they target different business objectives and customers.

A summary of the workshop can be found on the SAIL's blog (<http://www.sail-project.eu/sailorsinn/2011/10/cloud-interoperability-workshop-at-the-fp7-8th-concertation-meeting/>) while the presentations are available on the web site of the Future Networks (http://ec.europa.eu/information_society/events/future_networks/concertation/programme/8th/index_en.htm).

2.7.2 Cloud Networking: Technical and Business Challenges, Workshop at FuNeMS 2012

SAIL co-organised a workshop about cloud networking at the Future Network and Mobile Summit 2012 in Berlin. This workshop addressed the various problems at stake in the area of Cloud Networking, from both a technological and business perspectives. The purpose was to contribute to better understating of the various aspects involved in Cloud Networking, to confront on-going research in this area, and to bring together people from different domains (e.g., researchers, industrials, and providers), so as to become aware of the problems each one faces and redefine the needs.

The workshop was jointly organised by 4 projects: SAIL, GEYSERS [9], EURO-NF [10], and SESERV [11].

The workshop included 7 presentations divided in technological and business challenges. The technological part addressed architecture aspects, dealing with network virtualisation, infrastructure as a service and cross domain infrastructures. It also included resources management, planning and provisioning of IT and optical network resources, performance, and coupling network connectivity and IT services.

The business part addressed non-technical requirements, charging models, services adoption, enterprise market, users communities, regulatory matters, and new business models for providers and operators.

After the presentations, a panel enabled a broader discussion of the topics and an in-depth exchange of viewpoints with the audience. The panel consisted of one representative from each of the co-organising projects: Pascal Vicat-Blanc from Geysers, Mark Fielder from Euro-NF, Burkhard Stiller from SESERV and Benoit Tremblay from SAIL. The discussions were moderated by Thomas Edwall from the SAIL project.

During the discussions the following topics have been raised:

- The management of network resources needs to be as dynamic as the management of computing and storage resources;
- Security and confidentiality are key elements in the success of the deployment of the cloud;
- The costs of using the cloud should be in relation with the quality of the experience of using the cloud;
- To ensure that QoE or SLAs are respected, better measurements must be made of the virtual and underlying infrastructure;
- There are still many regulatory issues mainly when the cloud or the applications deployed need to cross borders;
- The business models the cloud networking need to be clarified.

The presentations and a summary of the panel discussions can be found on the SAIL web site.

2.7.3 Open Connectivity Workshop - MONAMI 2012

The Open Connectivity Services Workshop was held on September, 26th, collocated with the 4th International Conference on Mobile Networks and Management (MONAMI), organised by The Technical University of Hamburg-Harburg. The workshop featured the oral presentation of 7 papers as well as 2 live demonstrations. In general the audience was responsive and interesting discussions took place between the speakers and the people who attended the talks.

The session was divided into two parts; in the first one four papers were presented by researchers who were active in the OConS work package. The people attending the workshop seemed to be rather interested by the approach which was taken. The papers which were presented are enumerated below.

- L. S. Ferreira, L. M. Correia; "Service for Management of Connectivity in Spontaneous Community-Based Wireless Mesh Networks";
- L. Caeiro, F. D. Caeiro, L. M. Correia; "OConS Supported On Demand Radio Resource Allocation for Virtual Connectivity";
- P. Schoo, R. Marx; "Threat Model Based Security Evaluation of Open Connectivity Services";
- L. Diez, O. Mehani, L. Suci, R. Agüero; "Design and Implementation of the Open Connectivity Services Framework".

After the first session and during an extended coffee break, two demonstrations (both coming from the SAIL project) were presented. One was connected to the last paper above, while the second one, coordinated by A. Udugama, showed the integration of OConS and NetInf, with the demonstration entitled: "OConS Multi-path content delivery with NetInf". All the people attending the workshop visited the two demonstrations and showed a high interest on them.

The second session included the presentation of three papers which were not directly related to the SAIL OConS work package, providing the workshop a wider scope. One aspect to be highlighted is that the three papers, which were also describing architectural alternatives, proposed similar ideas as the ones which were coined by the OConS SAIL workpackage. The list of papers which were presented is provided below.

- M. Eckert, T. M. Knoll; "ISAAR (Internet Service quality Assessment and Automatic Reaction) a QoE Monitoring and Enforcement Framework for Internet Services in Mobile Networks";
- T. Zinner, D. Klein, T. Hossfeld - University of Wuerzburg; "User-Centric Network-Application Interaction for Live HD Video Streaming";
- A. de la Oliva, A. Morelli, C. Cicconetti, V. Mancuso, M. Draexler, T. Hentschel, T. Melia, P. Seite; "Denser Networks for the Future Internet, the CROWD Approach".

These papers will be available soon in a magazine published by Springer [12].

2.7.4 Dagstuhl seminars

Dagstuhl seminars are by invitation only and at these seminars we managed to gather most of the influential researchers within the field of ICN.

The first Dagstuhl seminar on *Information-centric Networking* was held in December 2010. Five of the six seminar organizers came from the SAIL project, namely Bengt Ahlgren (SICS), Holger Karl (UPB), Dirk Kutscher (NEC), Börje Ohlman (EAB) and Sara Oueslati (Orange). It was at this seminar the term *Information-centric Networking (ICN)* was agreed and accepted as the term used to denominate this research field which encompasses a number of ICN

approaches, besides NetInf well-known approaches include DONA, CCN/NDN and PSIRP/PURSUIT. For details about the seminar please see [13].

A second Dagstuhl seminar on ICN was arranged September 3-5, 2012 with the title *Information-centric networking – Ready for the real world?*. It was organized by Ali Ghodsi (University of California - Berkeley, US), Börje Ohlman (Ericsson Research - Stockholm, SE), Jörg Ott (Aalto University, FI), and Ignacio Solis (PARC - Palo Alto, US). Topics that were discussed included *ICN applications and services*, *ICN performance* and *Business*, and *legal and deployment issues*. For more information, please visit [14].

2.7.5 SIGCOMM ICN workshops

During the course of the SAIL project Börje Ohlman and Dirk Kutscher has been two of the organizers of a series of ICN workshops at SIGCOMM. The first two were held in 2011 and 2012. A third one has been approved and will be held in 2013. We are now planning for establishing a stand-alone conference on ICN in 2014. We have already established a good contact with ACM and have good reasons to believe that they will sponsor our conference.

SAIL together with NSF's project NDN [15] and the FP7 project PURSUIT [16] arranged an **Information Centric workshop ICN 2011** [17], in conjunction with SIGCOMM 2011 conference [18]. The workshop was the most popular at this year's SIGCOMM with over 80 participants. Very good papers were presented, all major players were represented and there was a great panel debate.

The second workshop on Information-centric Networking - ICN2012 [19], was held at SIGCOMM 2012 [20] which took place in Helsinki, Finland August 13-17, 2012. With over 80 participants it was the second most popular workshop at the conference, beaten only by the workshop on Software Defined Networking (SDN), which is currently the most hyped area in networking research.

The activity members contributed to the arrangements of the SIGCOMM ICN workshop in Helsinki, in August 2012. In particular, Börje Ohlman co-chaired the TPC, and several other were members of the TPC.

The 3rd ACM SIGCOMM Workshop on Information-Centric Networking (ICN 2013) will be held in Hong Kong, China between August 12 and August 16, 2013. For details see [21].

2.7.6 SAIL regulatory workshop on Information-Centric Networking (ICN)

SAIL regulatory workshop on Information-Centric Networking (ICN) was held Stockholm, Sweden, September 2nd 2011. It provided an overview of the current legal and regulatory landscape as well as trends and 'hot' issues. Identified potential conflicts between ICN technology and the current legal and regulatory framework. There were participants from the Swedish Ministry of Enterprise, Energy and Communications, Telia Sonera, SVT (Swedish Television), Swedish Post and Telecom Agency (PTS), ISOC-SE, Netnod, Stiftelsen för Internetinfrastruktur (.SE), Norwegian Post and Telecommunications Authority, Ericsson and SICS. The workshop was organized by Börje Ohlman (EAB) and Bengt Ahlgren (SICS).

2.7.7 SAIL regulatory workshops in Finland and Portugal

Two workshops have been held in Finland (2011 and 2012) with the Finnish regulatory authorities. The first was intended to frame SAIL work in this area, while the last workshop was more a discussion of the findings.

In Portugal (2012) a similar workshop was performed with the regulatory authorities to discuss the SAIL findings.

A separate document is under production to document the relevant workshops, but is not available at the date of writing this.

2.7.8 Workshops at final event

During the event Future Media Distribution using Information Centric Networks a number of workshops was held, of which two were specifically hosted by SAIL.

Regulatory aspects of Future Networks and Future Media Distribution

The workshop focused on the activities and results from SAIL, and together with the participants the implications and further opportunities was discussed. The specific findings were discussed, and a more generic discussion on the need for technology research projects to actively influence future policies. As research projects, and related individuals, are by nature more actively looking at future scenarios, this is in general a source that shall be made (and are made) available for regulatory bodies and policy makers. The workshop was hosted by Johan Myrberger (EAB/SAIL) and Jukka Salo (NSN/SAIL). Participants included industry representative responsible for regulatory interactions (Ericsson), representatives from other research projects (past and present) like EFRAIM [22] and other (from e.g., DACC and Acreo).

Workshop on “How to measure user experience of IP-based media services in relation to business models”

This workshop was organized in a panel from discussion, with participants from TV4, ViaPlay, Ericsson, TeliaSonera, and Qbrick. Everyone could agree that quality of experience is very important as such, and also important to measure. Both content providers and network providers/ISPs have an interest in knowing how the end users perceive the quality of media services. However, none of the actors have access to all desired measurement data. Service providers have, in general, pretty good knowledge about the end-user quality, based on measurements from video clients. But they do not have information about what is causing a problem. Network providers, on the other hand, have possibilities to troubleshoot potential problems, but have less information about the quality of experience. Everyone could agree that there is a potential for sharing information about service quality and known problems and issues. The discussion will continue in the EFRAIM project.

Content demand measurement and estimation workshop

Åke Arvidsson from Ericsson talked about what is that what should be optimized content, the delivery time, location, and the accesses of users or access technology. All of these aspects could be exploited. Problem is how to do it; and if there is a solution does it bring enough gains compared to costs.

Marka Kihl from Lund University presented traffic measurements from two networks (5 000 households and 1 500 households). The measurements cover only the traffic going to the Internet focusing on SVT Play (Swedish IPTV) and Facebook data. The results show little correlation in content for SVT and Facebook.

Manxing Du of Acreo presented a study on YouTube requests and how much Inter-user gain and intra-user gain (same user repeatedly getting the same video) can be achieved. He also showed how caching gain defers between mobile devices and PCs. The results show a significant difference in access patterns for PC and mobile device. Intra-user gain is higher (28% vs. 20%) and intra-user gain is lower (roughly half).

Henrik Abrahamsson from SICS talked about access patterns in a large TV-on-Demand system. According to him top 100 items amount to 50% of the requests on an hourly basis but their share increases during prime time which means that caching makes the biggest difference when it matters most. 2% of the most popular content corresponds to 48% of the requests. Popularity of individual programs differs a lot per category (news, sports, movies, etc.). Rental movies have a distinct access "signature" from reality show or TV news. The results have been published in IMC'12 [23].

After each presentation, the implications to content cacheability were discussed. Facebook case study identified some patterns and similarities among end users, which may be difficult to utilize, though. YouTube case studied the popularity distribution of video clips in different scopes by showing how often the video clips are requested repeatedly by a single person, in the same neighbourhood and in the whole access network. The patterns at each level show that hierarchical caching could be useful. IPTV case demonstrated largest potential efficiency gains. This was largely explained by the limited content catalogue of a TV-on-demand-system and the demand patterns driven by the TV program schedule. Additionally, different program types (e.g., news, movies, reality TV shows) had distinctive demand patterns that can be efficiently utilized in caching decisions if the content type is known. Based on the workshop, demand patterns can easily be identified from different types of Internet traffic but their usefulness for improving the efficiency of media distribution varies significantly among content types.

NetInf Open Source Resources Current Status workshop

The open source NetInf components were presented by Holger Karl. NetInf NiLib that implements the recent protocol specifications (draft-kutscher-icnrg-netinf-proto) and additional UDP and DTN convergence layers are available under Apache License in [24]. NetInf components (e.g., clients, servers, generator, gateway, proxy server etc.) are available in multiple languages (Python, Ruby, Java, PHP, C, Clojure). The level of maturity varies, but Python, Java and C components were used in the last demos. Nilib Python is the most complete suite. Core ni.py library implements semantics of ni URI scheme (soon to be RFC) and is approximately 15K lines of code.

GIN, “hybrid” ICN approach that combines information centric and host centric communication was presented by Vinicio Vercellone [25]. GIN switch is implemented in C language; GIN Dictionary and the management interface are both in PHP. Gin code is also released under Apache 2.0 License.

2.8 Demonstration Events

SAIL demonstrated prototypes resulting from the project at two public events. The first one was the Future Network and Mobile Summit in Berlin where the focus was on demonstrating the *Dynamic Enterprise* scenario, showcasing Cloud Networking with the support of Open Connectivity Services. The second event was co-organised with the EFRAIM project and was held in Kista. The main topic was media distribution and we presented nine demos focused around the *Event with Large Crowd* scenario.

2.8.1 Future Networks and Mobile Summit, Berlin July 2012

The project decided to present the project-wide prototyping and demonstration results in several dedicated public events instead of a single event covering the very broad scope of the whole SAIL project.

The first event was a CloNe-focused public demonstration in cooperation with OConS at the Future Networks and Mobile Summit in Berlin, 4.-6. July 2012. The demonstration in Berlin was presented at a SAIL project booth (Figure 2.9) integrating the contributions of several partners to the scenario of Dynamic Enterprise in order to show Cloud Networking aspects of allocating compute, storage and network resources over multiple domains. The SAIL achievements were successfully presented to the expert community at the conference and the representatives of the EC.

The demonstration scenario, Dynamic Enterprise, showed how virtual infrastructure for running applications can be dynamically deployed over multiple infrastructure service provider

(data centre or network) domains. The demonstration scenario highlighted some key technical elements such as VxDL, decomposition of virtual infrastructure over multiple providers, creation of Flash Network Slice (FNS), delegation, resource management, etc. OConS services have been also used to illustrate elasticity of the FNS over the wide area network (WAN).

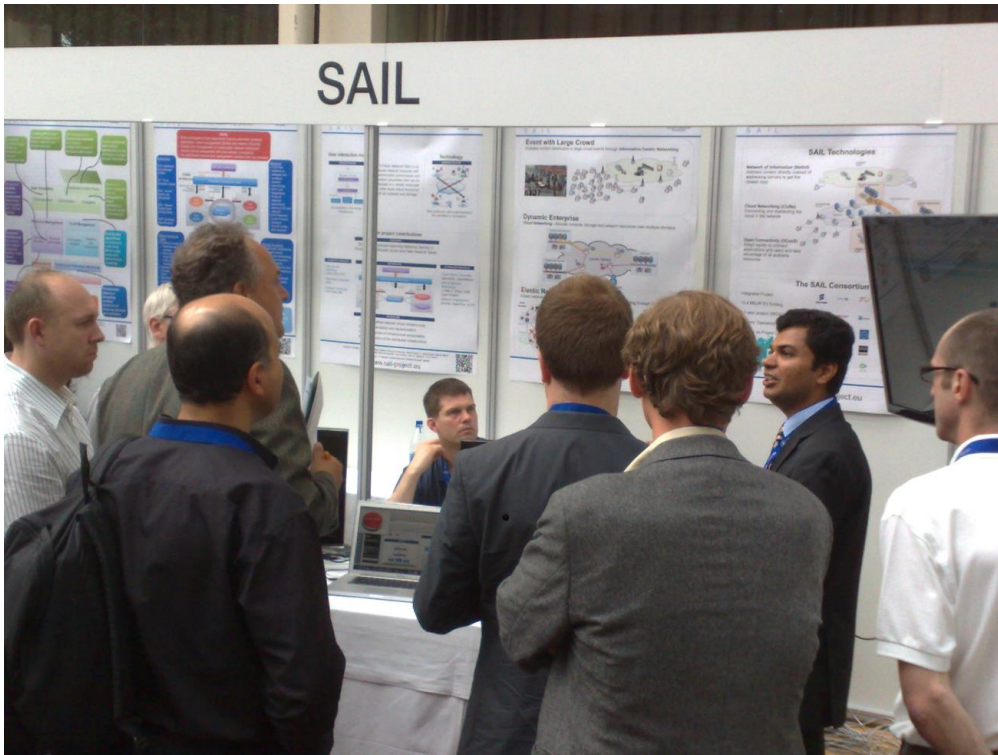


Figure 2.9. SAIL Booth at FuNeMS, July 2012, Berlin.

The main contributions were:

- Inter-domain Flash Network Slice Creation (WP-D): Deploying a European-spanning Webshop Service in minutes using distributed clouds and Flash Network Slices (FNS). A FNS is an elastic network resource with customizable performance and isolation properties that can be allocated in a similar timescale as other basic cloud resources such as compute and storage;
- Link Negotiation Protocol (WP-D): A multi-domain protocol, with support for multiple technologies, for creating virtual links belonging to a virtual infrastructure that span multiple domains (as part of the Distributed Control Plane (DCP) of CloNe);
- Bulk Data Transfers Using In-Network Data Centres (WP-D): places data centres in the core network to enable dynamic deployment of in-network services and reduces the hops required to transfer files between data centres. In-NetDC performs better than Random Store-and-Forward (SnF), End-to-End (E2E) and BitTorrent (BT). It completes bulk file transfers timely in almost all scenarios, which is not achievable through other approaches;
- LibNetVirt: the Network Virtualisation Library (WP-D): Define and develop a control framework for defining and instantiating virtual networks (VNs) with a common interface for multiple technologies, C library with Python wrappers to operate VNs;

- Elastic Networking: Open Connectivity Services (OConS) for Cloud Networking (CloNe) (WP-C): Showing principles of load-dependent resource allocation between application, cloud management (CloNe) and network (OConS); control and management of data paths between distributed remote (cloud) data centers with inter-domain connectivity;
- Dynamic Resource Management (WP-D): A generic resource management system that is based on OpenStack, supporting a number of management objectives such as load balancing, energy efficiency and service differentiation;
- Elastic Video (WP-D): prediction-driven resource provisioning for elastic video-on-demand, implemented via extending the VXDL description language and the CloudWeaver controller.

2.8.2 Future Media Distribution Using Information-Centric Networking, Kista February 13, 2013

SAIL co-organised in collaboration with the Innova project EFRAIM the event *Future Media Distribution using Information Centric Networks* in the Ericsson premises in Kista on February 13, 2013 [27]. The event attracted more than 130 people from the ICT and media community from the Stockholm area, registration was closed two weeks before the event.

The day was packed with presentations, tutorial, workshops and demonstrations. The morning session included a keynote from the major Swedish content broadcaster TV4. This was followed by presentations on the business aspects of content distribution as well as a tutorial on ICN and NetInf in particular. The morning session was concluded with an interesting panel discussion on the maturity of the ICN solutions.

In the afternoon, the participants moved to the Ericsson studio where, after an initial talk on the Networked Society, visitors were free to visit the different demonstration booths or to participate in one of the four parallel workshops. The nine prototypes distributed in seven stations and were organised under the theme *Event with Large Crowd*. Of course, the prototypes that were put in place for this event related to information centric networking, but also to all work-packages in SAIL. The prototypes contributed their share to highlights what is our vision of the future internet: Content, Connectivity and Cloud.

Here is the list of the demonstrated prototypes.

- Event with Large Crowd (EwLC) - physical nodes (WP-B): This prototype implemented a proof-of-concept of the EwLC scenario, showing the actual functioning and benefits of NetInf for content access/distribution in such an environment. It also showed live video streaming over NetInf.
- Event with Large Crowd - emulation framework (WP-B): Same EwLC scenario as above, but running an emulated NetInf network including a significant number of nodes, showing the efficiency gains of using NetInf.
- NetInf Device and nilib: The demo showed (WP-B): 1) A NetInf device, integrating NetInf with DTN, based on the DTN2 reference implementation and the nilib NetInf code, and 2) the nilib code performance.
- Global Information Network (WP-B): The prototype demonstrated the feasibility of the GIN architecture and showed the potential of the ICN paradigm. ICN concepts like name-based routing, ubiquitous caching, improved data availability and content locality were also demonstrated.
- Caching Visualisation (WP-B): This prototype showed a visualisation of how caching works in a hierarchical manner.

- Open Connectivity Services (OConS) Multi-path Content Delivery with NetInf (WP-C): This demonstration showed the benefits of using multi-path connectivity techniques for improving the quality of experience in video content delivery.
- Open Connectivity Services Orchestration and Distributed Mobility Management (WP-C): The demo showed OConS orchestration procedures so as to bring about a dynamic access solution in a mobility scenario by the cooperation of OConS mechanisms.
- Adaptive Deployment of NetInf on SAIL Cloud Networking (CloNe) Infrastructure (WP-D): This demonstration showed integration of SAIL NetInf and CloNe, demonstrating the power of dynamically deploying virtual infrastructures.
- SAIL Cloud Networking Admin Perspective (WP-D): The demo provided the audience an insight to the CloNe service administrator perspective.

2.9 SAIL Training School

The SAIL Summer School [28] took place in Santander, from June 25th to 28th 2012. It attracted a remarkable interest from the community, with more than 50 students attending the 11 lectures and talks, Figure 2.10.

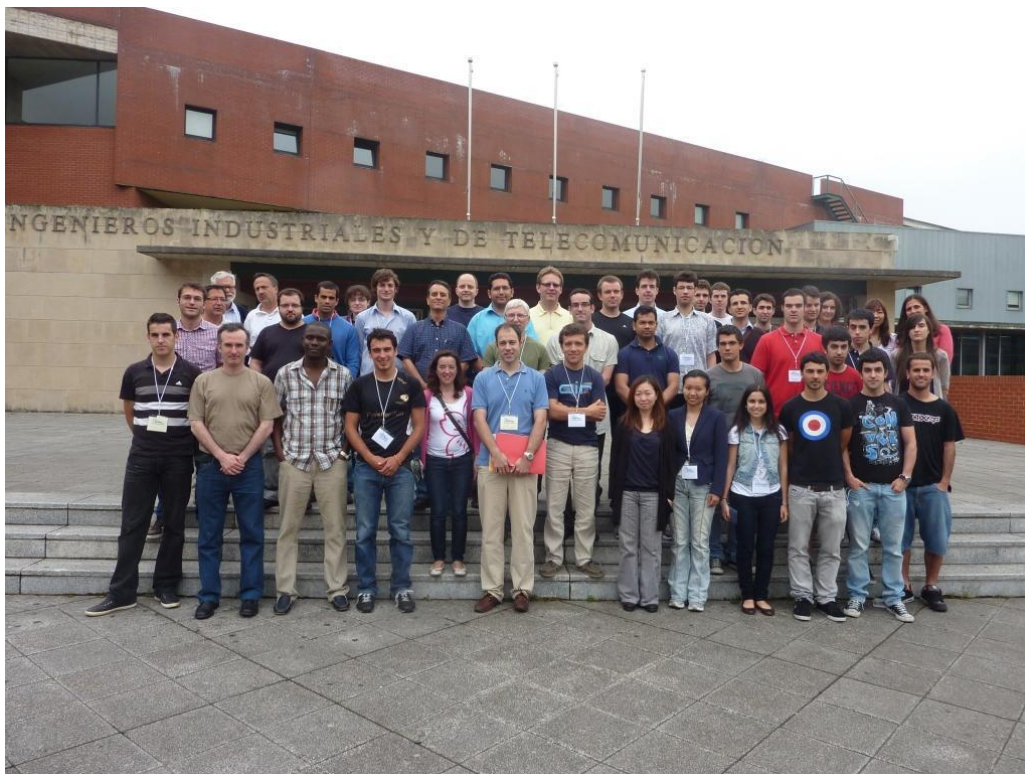


Figure 2.10. SAIL Summer School participants.

The event featured two keynotes; in the first one, Mikael Eriksson-Björling, an expert on consumer behaviour from Ericsson gave his view on the challenges and opportunities of the so-called networked society. To close the week, Prof Luis Muñoz talked about Internet of the Things and the impact of the smart city paradigm, well represented by the platform which is being developed in Santander.

In addition, there were 9 lectures, provided by researchers working in the SAIL project, who provided an insight about the Future Internet, with topics such as virtualization, information-centric networking or connectivity services. A hands-on-session was also organized, and the students had the opportunity to try the OpenStack framework.

Finally, the Summer School also hosted a PhD Work-In-Progress session; after an open call, 10 students were selected to present their on-going work. Two of them were selected to receive an award to the best Work-in-Progress, Mr Rashid Mijumbi (Technical University of Catalunya) for his paper entitled “Autonomic Resource Management in Virtual Networks” and Mr Matthias Keller (University of Paderborn) “Response Time Optimized Cloud Resource Allocation at Multiple Sites”, for his work

All in all, the summer school met the expectations, both scientifically, thanks to the high quality of the lectures, and socially, since it provided the grounds so that 50 students were able to exchange experiences and do networking between them.

The full Summer School Program is available at [28], and most of the lectures and openly available at the SAIL YouTube channel [29].

2.10 Interaction with other Projects and Fora

SAIL actively participated and contributed to the Future Internet Cluster of the Future Networks Concertation meetings organised by the European Commission.

SAIL co-organised two cloud workshops to disseminate results and exchanges ideas with other European projects (see Section 2.7). In a few occasions, we exchanged results and ideas with the Geysers project. The two projects collaborated in the specification of the VXDL language for defining and deploying virtual infrastructures. SAIL also presented the Cloud Networking architecture to the technical board of the Geysers project.

SAIL was also very active in the community building around information-centric networking. SAIL participated actively in the establishment of the ICN research group at IRTF. Two of the three co-chairs are from SAIL. SAIL participated at two occasions at the Dagstuhl seminar. In both occasions, ICN (and NetInf) were the focus of the discussions. SAIL also actively supported the ICN-Workshop at SIGCOMM. This workshop attracted a lot of interests every time it has been presented, receiving an impressive amount of submitted papers.

SAIL actively participated in the Future Internet Assembly events that occurred during the project. Participants in the project contributed papers and participated in panels at meetings in Ghent December 2010, Budapest May 2011 and Aalborg May 2012.

2.11 Web2.0 Activities

In addition to the on-line presence represented by the SAIL public web site (www.sail-project.eu, see Section 2.1), the project have explored and utilized a number of “Web 2.0” or “social” on-line channels.

At the first all-hands SAIL meeting (Stockholm, 2010) a survey was performed to analyse the maturity and readiness of SAIL project members to participate in such “web 2.0” activities. As the potential such channels have different implication on individual participation this helped in the selection of platforms.

All in all, these activities have supported and added to the overall “findability” and visibility of SAIL online. However, the channels could have been more actively used during the lifetime of the project, and in general these type of channels benefits from a higher number of project individuals that engage actively online.

One type of channels are more a “media repository”, and serves to a large degree as a convenient way of managing media such as videos (YouTube) and presentations/document (Slideshare). Other channels are more conversational in their nature, and aims as spurring a dialogue. The channels that the SAIL project explored and utilized are summarized below.

2.11.1 Sailors Inn – the project blog

Hosted at the public domain of SAIL, the blog Sailors Inn (www.sail-project.eu/sailorsinn) aimed to give a more informal view of SAIL, and at the same time contribute to the overall visibility in search engines of SAIL.

2.11.2 SAIL on YouTube

SAIL established a channel on YouTube (<http://www.youtube.com/sailprojecteu>). Early in the project a “webcast” (PowerPoint presentation with voice overlay) was uploaded and had good reach. It has however not been a focus of the project to produce video content in general, neither “voice-overs”, nor moving images.

The SAIL Summer School was documented on video, and the lectures were uploaded to the YouTube channel (in addition to being made available on the internal web site of the project).

2.11.3 SAIL on SlideShare

The SlideShare platform (<http://www.slideshare.net/SAILproject>) has been used to publish some presentations and documents, as a complement to SAIL web site uploads.

The reach of the uploaded presentations has been good (in some cases over 1500 views), and the level of additional project engagement to both produce and publish material on SlideShare is minimal. Thus the recommendation for similar projects is to focus on SlideShare as a channel, potentially also for video content. It is also a good idea to publish all documents on SlideShare in future projects.

2.11.4 SAIL on LinkedIn

A group on LinkedIn (<http://www.linkedin.com/groups?gid=3446751>) was established, with the dual objective to share news items from SAIL and to gather interested individuals. With over 200 members, and a mixture of both SAIL project members and other interested, the group is a good coverage of related individuals. News items from SAIL has been both manually and automatically posted in the group, but as LinkedIn will discontinue support for automatic posting via RSS feeds this will not be an option for future projects.

2.11.5 SAIL on Twitter

SAIL created an account on Twitter (<https://twitter.com/sailproject>), Figure 2.11, to explore this as a conversational channel. The main usage has been during the promotion of the SAIL Summer School, and with the support of a number of other tweeters and twitter-accounts the hash tag #SAILSummerSchool was used.

At the events where SAIL has participated Twitter has not been widely used in general. Some interaction with individuals and other projects was achieved.

2.11.6 SAIL on Facebook

After the initial survey across SAIL project members Facebook was initially not established as a channel. However, as part of the SAIL Summer School pre-promotion it was decided to establish a Facebook page (<https://www.facebook.com/SAILproject>).

Although the Facebook page has only attracted just above 60 “likes” (followers) the resulting visibility is much higher.

Tweets mentioning @SAILproject

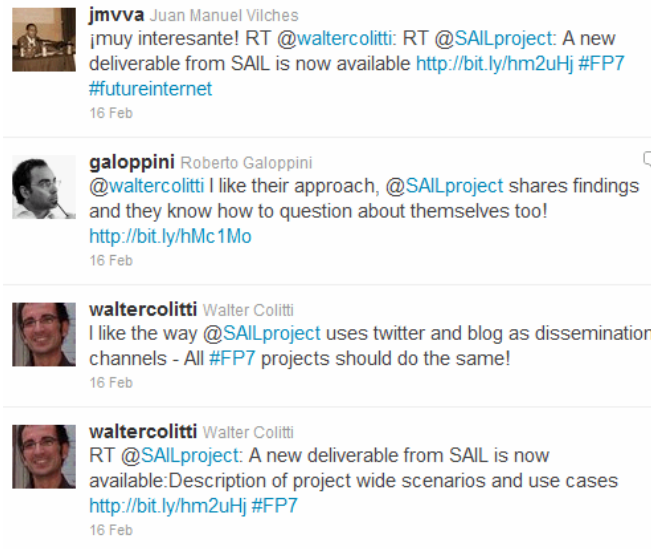


Figure 2.11. Example of tweets mentioning SAIL.

The combination of individuals “sharing, liking and commenting” on posts and the ability to tag images to individual project members have provided a good vehicle to broaden the visibility of SAIL outside the core research community, Figure 2.12.

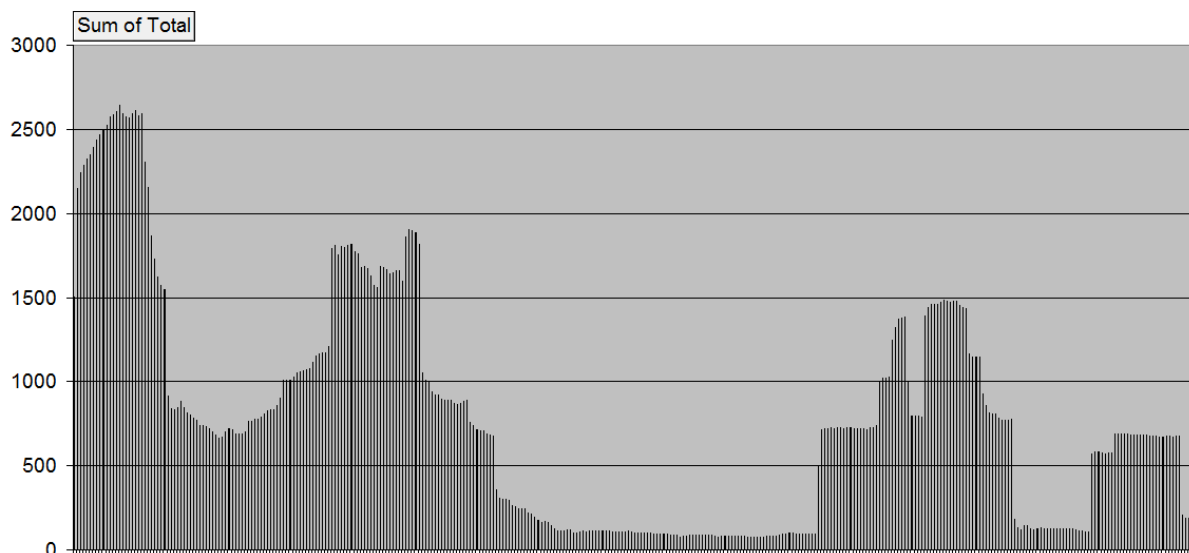


Figure 2.12. Moving 28 days viral reach, daily January 2012-2013

The figure above shows the viral, 28 days, reach for content on the SAIL Facebook page. Even with between 50-60 followers the content have in many cases reach more than 1000 individuals, which in most cases have a direct relationship with one project member.

2.11.7 SAIL on Google+

As Google launched Google+ during the SAIL project period an account/page was created to explore the possibilities (<https://plus.google.com/u/0/115841382142693755714/posts>). The page has been sparsely used, and other channels have been prioritized.

2.12 Open Source Activities

There have been some contributions regarding Open Source in the SAIL technical WPs. The project has previously established some guidelines on Open Source matters [30]. It was identified that the use and/or distribution of Free and Open Source Software has numerous advantages to the project partners, including cost savings, increased productivity and flexibility, increased software reliability and stability, increased visibility and accelerated dissemination, among others. This applies in particular for the use of FOSS in the SAIL project prototyping, experimentation and demonstration activities. Some disadvantages were also identified, the major one being the question of licencing. Major guidelines were identified regarding the use/development of Open Source within the project, and the different licencing options that can be used.

During the project, Open Source software has developed by all the work packages. These contributions include:

- NetInf NI Library (WP-B): This project hosts code and information for various packages implementing or using the Network of Information paradigm, [24];
- libNetVirt (WP-D): Libnetvirt is a library that helps to manage virtual networks abstracting the underlying technology. Only the endpoints to interconnect are required to create the network [31];
- pyocni (WP-D): pyOCNI (Python Open Cloud Networking Interface) is a Python implementation of an extended OCCI with a JSON serialization and a cloud networking extension [32];
- DTN2 BPQ (WP-B): Delay Tolerant Networking reference implementation and related projects [33];
- HURRYwalla (WP-C): An evolved version of the existing project Bytewalla 3 [5]. HURRYwalla covers the whole DTN stack implementation (already present in Bytewalla3), with some added modifications: HURRY replaces PProPHET [6] in routing and BPQ extension is newly created for content publishing and caching, [34];
- HURRY (WP-C): The HURRY (HUman Routines used for Routing) protocol, defines a probabilistic routing approach which infers and benefits from the social behaviour of nodes in disruptive networking environments. HURRY is based on PProPHET but it incorporates the contact duration to the information retrieved from historical encounters among neighbours, so that smarter routing decisions can be made. The implementation of HURRY is included in the open source project (HURRYwalla);
- GIN (WP-B): GIN (Global Information Network) is a hybrid networking architecture for Information-Centric Networks, [25].

3 Exploitation of Results

In this chapter, the exploitation of results is presented.

3.1 General Approach

Exploitation results are very important when evaluating the results from the project dissemination efforts, especially for industrial partners. In order to access all the exploitation results, a template was used. This template includes:

- Overall end-of-project exploitation results;
- General statements on the overall results gathered within the project by the respective partner;
- Alignment between the initial exploitation plan (from the Description of Work [2], and D.A.5 [35]), and the final exploitation results;

The exploitation results from each partner are presented in the following section. Some statements are confidential for partner's business reasons at this stage, and can not be made public at this stage. These are collected in an appendix to this deliverable.

3.2 Partners' Perspectives

Ericsson AB (EAB)

Overall end-of-project exploitation statement

The technical solutions developed in CloNe are providing guidelines for the evolution of the Ericsson cloud proposition. During the project, there has been a continuous knowledge transfer, including key individuals, from the research work done in SAIL and the product development organisation ensuring that the results from SAIL are anchored in the product plans. The SAIL results have greatly influenced the Ericsson message on the *Network Embedded Cloud*.

We intent to carry forward our research activities on the management aspects of the cloud federation, focusing on the integration of cloud and network. It is expected that the continued research on the federated cloud will impact future product direction.

Ericsson will continue its research effort on NetInf and ICN, including the research and standardisation efforts in IRTF. This will ensure an increased maturity of the ICN solutions and their applicability to actual market needs.

We will also evaluate the applicability of NetInf and ICN to other scenarios and uses cases, Internet of things, for example.

Exploitation Table

The exploitation table is presented in Table 3.1. Some exploitation statements are presented.

Table 3.1. Ericsson AB Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improve	Internal	<p>Increased internal competence on key technologies related to cloud networking [on-going]</p> <p>Gain competence on Cloud through hiring of graduate students involved in SAIL. This expertise will be used to</p>

Actor	Type	Target	Public statement	
			strengthen our research activities on cloud. [on-going]	
		External	Decided Ericsson participation to OpenStack based on technology evaluation from research during SAIL. [decision is past but continued participation is planned] Continued NetInf and ICN standardisation effort [on-going]	
	Strategic guidelines	Internal	Assessment of ICN technical and business solution in regards of other technical solutions [on-going]	
		External	Work in SAIL has influenced the key market message on the Network Embedded Cloud [on-going] Evaluation of the business potential of the federated cloud [on-going] Continued research on cloud federation will impact future product direction. [planned]	
	Academic	Technical	Internal	
			External	
Strategic guidelines		Internal		
		External	Continued research effort on NetInf and ICN for content distribution. [on-going] Evaluate the applicability of results from NetInf to other scenarios (e.g.) IoT [planned] Continued research on management of cloud federation. [planned].	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Ericsson is the world leader provider of telecommunication equipment to mobile and fixed network operators globally. As such, Ericsson wants to explore the technical and business aspects of deployment of cloud computing in the operators networks. The broad portfolio of the company leaves many possibilities for actual implementation of SAIL developed solutions on real products. The incremental approach for the development of research in SAIL will facilitate the delivery of concrete results to different units within the company. Ericsson may integrate the solutions developed in SAIL in its products if proved valuable to Ericsson's customers. The SAIL consortium includes many operators that will be able to validate the solutions being developed. The solutions will be likely to impact fixed access and mobile core network equipment, amongst others.

Ericsson intends to perform standardisation of key results whenever deemed suitable. Some of the standardisation forums that are currently investigating cloud computing issues include IETF, Cloud Security Alliance, Open Grid Forum, Open Cloud Consortium, amongst others.

Final Assessment of Alignment:

The exploitation of the SAIL results has exceeded the initial expectations, especially in the Cloud Networking area. The SAIL results in Cloud Networking provided strong guidelines for the Ericsson strategy in the cloud portfolio while contributing to the improvement of the internal competence in this area. CloNe has been presented to key customers at the Mobile World Congress in Barcelona as part of the “*What’s next*” section featuring promising technical solutions. This indicates a strong will to integrate SAIL results in future product plan.

Although Ericsson has not been as involved as expected in cloud standardisation activities, Ericsson is now an active member of the OpenStack consortium and plan to contribute findings through this channel. We are still monitoring other standardisation bodies and will contribute whenever deemed suitable.

Ericsson is very active in the NetInf and ICN standardisation effort, supporting and co-chairing the ICNRG at IRTF and will continue to evolve ICN towards a mature solution ready for Ericsson customers.

Alcatel Lucent (ALU)

Overall end-of-project exploitation statement

The architectural framework in the WP Open Connectivity Services (OConS) and the proof-of-concepts work in SAIL has been the starting point for further prototyping and demonstration activities within ALU that will result in application of the SAIL concepts (re. cloud, virtualization, open networking) in specific future product ecosystems (e.g. mobile access networks), which up to now do not exploit the benefits of these concepts.

The technical topics now discussed under the headline “Software-defined/driven networks (SDN)” [36] or “Application-Based Network Operations (ABNO)” [37] in IRTF/IETF and e.g. the Project “Centralised Processing, Collaborative Radio, Real-time Cloud Computing, Clean RAN System (P-CRAN)” in the Next Generation Mobile Networks Alliance (NGMN) [38] will definitely profit from the approach and achievements made in SAIL as the ALU team is actively contributing to the NGMN activity.

Exploitation Table

The exploitation table is presented in Table 3.2. Some exploitation statements are presented.

Table 3.2. Alcatel Lucent Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvement	Internal	Broaden the application of SAIL (OConS, CloNe) related concepts to other technologies
		External	Higher efficiency and better utilization of deployed network and equipment resources.
	Strategic guidelines	Internal	Increase flexibility and improve time-to-market for introduction of new networking features and services
		External	Increase global competitiveness by cost savings in network deployment and services

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Alcatel-Lucent as one of the leading supplier of network and services solutions worldwide has a vital interest on developing and driving innovative future networks and end-to-end solutions that enable compelling communications services for people at home, at work and on the move as well as for new emerging service providers. Alcatel-Lucent's contributions to SAIL focus on the innovations and advances of open connectivity services (OConS), leveraging the experience and capabilities of a global network infrastructure manufacturer. Therefore, Alcatel-Lucent is committed to coordinate and drive the proof-of-concepts work in SAIL by prototyping and demonstrations and taking project responsibility both for the theme "experimentation and prototyping" as well as the task on evaluation and prototyping in WP-C "Open Connectivity Services". These activities will help to exploit anticipated research results in SAIL, bring them to standardisation, and implement a migration path from today's network to the future network's services and infrastructure equipment.

Final Assessment of Alignment:

The adoption of the new concepts of WP Open Connectivity Services (OConS) by the standardization bodies progressed much slower than previously expected and was more burdened with non-technical considerations, as e.g. SDN is widely seen as a disruptive technology compared to the providers' and vendors' deployed (plain IP) solutions. First achievements in standardization can only be seen at the end of the project, but not only as an impact of SAIL alone. SAIL has been a perfectly fitting part (right time, right topics) of a much broader technology trend in cloud networking, network of information and open networking based on SDN ideas. As a consequence of the slow adoption rate, innovative product solutions based on standardized architectures (e.g. SDN) will probably not be as early widely deployed in the market as originally aimed at (was: 2015).

However SAIL showed also that there is a potential of early exploitation of results, when not relying on a fully standardized system solution, but on open source projects and available components, as well as on application to other fields that were initially not in the main focus (such as mobility).

Nokia Siemens Networks (NSN)

Overall end-of-project exploitation statement

NSN has gained valuable insight and experience of the technological potential as well business and regulatory challenges of Information Centric Networking. The technologies developed in the SAIL project contribute to the tool set of ensuring the healthiness of the network infrastructure in the coming years when the diversity of applications, new types of the terminals and manifold increase of the (mobile) set the scalability requirements to totally new levels.

Exploitation Table

The exploitation table is presented in Table 3.3. Some exploitation statements are presented.

Table 3.3. Nokia Siemens Networks Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvements	Internal	Integration of CDN-like functionality with the underlying network infrastructure through NetInf offers efficiency and savings and enables enhanced operator services. QoE improvements due localized content.
		External	SAIL results are well in line with NSN vision for increased need of capacity, performance and access.
	Strategic guideline	Internal	Ensure healthiness of communication infrastructure through continued improvements
		External	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

In order to ensure sustainability of the networking ecosystem NSN is particularly interested in new architectures and systems that promise scalability benefits with controlled and manageable OPEX costs. This means that OPEX should grow significantly lower than the number of subscribers or traffic volumes. More specifically, media distribution is traditionally done in dedicated networks (e.g. CATV, DVB-T), but also increasingly as an application on IP networks (IPTV). Current mechanisms used for dedicated networks do not scale well in public IP networks. An approach that takes into account the content and the state of the network is needed. NetInf approach with network resident storage provides a basis for the needed efficiency and cost benefits. NSN interest is to develop, evaluate and prototype information centric concepts and tools as part of existing and future network architectures or as additional services.

Nokia Siemens Networks envision a many-fold increase in traffic over the world's networks in the next coming years. Multimedia content will be the main driver of soaring traffic amounts, both in fixed and mobile networks. The traffic amounts will reach unseen levels, requiring new investment in capacity, as well as upgrades to new technology, such as LTE. Yet, the increased traffic will not bring correspondingly higher revenues and, combined with the increased investment needed, will put great pressure on communication ecosystem. In order to ensure sustainability of the networking ecosystem NSN is particularly interested in concretization of the architectures and concepts drafted and experimented in the preceding FP7 projects, namely 4WARD's NetInf architecture and PSIRP's rendezvous subsystem, that both promise substantial scalability benefits with controlled and manageable OPEX costs. This means that OPEX will grow significantly lower than the number of subscribers or traffic volumes.

Information centric networking with its innovative approach of handling and accessing data, by use of in-network storage, collaborative caching and traffic off-loading together with all optical transport system will form the practical basis of the future mega media distribution system. NSN will develop, evaluate and prototype concepts and tools based on NetInf as part of existing and future network architectures with the emphasis on evolvability from current networks. Specifically, NSN sees that the information centric approach of SAIL project paves the way to tighter integration of CDN-like functionality with the underlying network infrastructure. Information centric approach is radically different from the current application overlay approach of the

CDN that are effectively dedicated application silos. Naturally this has significant implications to socio-economics of the whole delivery chain. Even seemingly small changes in the incentive structure, as likely resulting from an information centric architecture, may lead to game-changing effects in the global network business landscape. Therefore, NSN will elaborate the current and future mobile and Internet business models with the focus on their success factors and limitations and identify the potential required regulatory actions. Also, the analysis of the potential charging models in a key concept of the project will be carried out.

Engaging with worldwide community on this early stage of transition is the key to establish a global acceptance of the developed technologies. NSN is actively contributing relevant project results to related working groups of IETF and IRTF, namely DECADE and PPSP working groups. After the architectural components are established in the IETF and the overall architectural validation has proved stability and solid performance gains NSN is willing to bring the results further to 3GPP and ETSI. Naturally, NSN is participating to publishing the project results in the central industrial and academic conferences and fairs.

Final Assessment of Alignment:

Scalability with controlled QoE and cost remains challenging as the traffic growth continues to follow the earlier growth projections especially for mobile data. Therefore new means to improve delivery efficiency and scalability is of utmost importance. Current approaches to match the demand with the cost of delivery capacity, namely caching and Content Delivery Networks (CDN) have their limitations. Caching is a local optimization to improve QoE and to lower transit costs by bringing the content closer to the edge of the network. However, it doesn't take into account SLAs and specific needs from the content provider. CDNs, on the other hand, are meant for primary content and there is a service contract between the CDN operator and the content provider. CDNs, however have very limited visibility into the network topology and the network status information available from access operators. We believe that efficient content delivery mechanisms need to have visibility both into the underlying topology as well as into the content itself to optimize resource usage. Information Centric approach as exemplified by NetInf goes far into this direction. The gained insight of NetInf research is already used on how to efficiently scale content delivery and caching systems.

NetInf has promising openings in the IETF/IRTF that NSN supports but the standardization process is still at very early state to be ready for 3GPP road maps.

The work on business models and regulatory aspects has provided excellent understanding of related non-technological issues (e.g. impact of privacy, location of content storages etc.) that need to be taking into account when technologies like NetInf and CloNe will extend their impact out of local optimizations of a single network domain into inter-operator context.

NSN is planning to continue development of selected parts of these technologies in smaller (nationally) funded research projects focusing on the migration and deployment aspects.

NEC

Overall end-of-project exploitation statement

The results from the SAIL work on NetInf have provided NEC with the ability to understand the feasibility of ICN and its design and implementation options. SAIL has enabled NEC to take an active role in preparing ICN for standardization (through the work in the IRTF ICNRG) and to standardize core ICN components such as the NetInf naming scheme.

The CloNe results have enabled NEC to investigate integrated networking and computing management to support future developments in the area of cloud computing and SDN.

Looking forward, NEC considers leveraging NetInf and CloNe results for future research on mobile communication and SDN.

Exploitation Table

The exploitation table is presented in Table 3.4. Some exploitation statements are presented.

Table 3.4. NEC Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvement	Internal	
		External	Prepare ICN standardization through work in IRTF ICNRG Standardize core ICN components (naming scheme)
	Strategic guidelines	Internal	Leverage NetInf results to assess ICN feasibility and implementation alternatives Leverage CloNe results for informing internal cloud management and SDN developments
		External	
Academic	Technical	Internal	
		External	
	Strategic guidelines	Internal	
		External	Leverage NetInf and CloNe results for future research on mobile communication and SDN

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

NEC being equipment (IT and Network), solution and managed services supplier sees NetInf as a promising approach to enhance our current product offerings in mobile and fixed telecommunication both in terms of functionality and cost. More specifically, the Network of Information work will enable efficient novel content-oriented telco service offerings. NEC will use the results of the projects to either standardize or define NEC's standards strategy of upcoming Future Network standards.

NEC is leading WP-B (NetInf) and sees NetInf as a promising approach to enhance its current product offerings in mobile and fixed telecommunication both in terms of functionality and cost. More specifically, the Network of Information work will enable efficient novel content-oriented telco service offerings. One of the major challenges for building the next-generation mobile communication network will be to address the expected massive increase in capacity demand for applications, such as mobile video. NEC intends to leverage the SAIL results with respect to generalising Content-Distribution-Network concepts, leveraging in-network-storage and intelligent distribution mechanisms in order to meet these demands.

Furthermore, NEC being equipment (IT and Network), solution and managed services supplier expects the cloud networking research in WP-D (CloNe) to play a vital role for creating the next generation cloud infrastructure, where computing and networking resources can be managed in a consistent way. Specifically, NEC expects SAIL to accelerate global standardisation efforts in that area, which will contribute to creating a viable global market for cloud services.

For both Information-Centric Networking and Cloud Networking, NEC is committed to use the results of the project to define NEC's standards strategy of upcoming Future Network standards.

Final Assessment of Alignment:

NEC's current exploitation plans are largely in-line with the initial goals. For NetInf, NEC has substantially driven the NetInf architecture and pre-standardization work and is now assessing the technology for upcoming developments and standardization activities. For CloNe, SAIL results have helped NEC to understand to possibilities and limitations of Cloud Networking in order to plan future activities in this area.

France Telecom (FT Orange)

Overall end-of-project exploitation statement

FT-Orange has gained valuable insight and experience on the Information-Centric Networking area. The technological potential and key trade-offs (in particular about transport, routing and content search) of the technology have been explored by FT-Orange members, and FT-Orange intends to capitalize on these insights for pursuing high quality research on these topics and to participate in standardization efforts on ICN. Additionally, the management of ICN networks has been studied, and leads to internal case studies for several deployment opportunities.

The approach and the results from SAIL OConS have offered to FT-Orange new insights about the network control functions and connectivity services in the Future Internet; thus, the research work done in SAIL OConS helped FT-Orange to advance toward and holistic framework for providing those functions and services in better ways than nowadays (especially in the access network part). FT-Orange intends to capitalize even more on these insights, notably on OConS aspects related to the ONF Software Defined Networking (SDN) controlling framework and to the ETSI Network Functions Virtualisation (NFV) Management & Orchestration WG.

Exploitation Table

The exploitation table is presented in Table 3.5. Some exploitation statements are presented.

Table 3.5. FT-Orange Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvements	Internal	<p>Increased internal competences on key ICN technologies.</p> <p>Assessment of ICN technical solution in regards of other technical solutions.</p> <p>SAIL OConS (specifically the orchestration framework), will improve the network operations by allowing more flexibility and by on-demand establishment of appropriate network</p>

Actor	Type	Target	Public statement	
			connectivity services (especially in the access network part).	
		External	Participation to FP7 e-Cousin on the potential of ICN for Social networking [starting] SAIL OConS has triggered numerous question about the inter-domain orchestration, thus we intend to broaden the scope of the discussions, i.e., working on this together with other operators	
	Strategic guidelines	Internal	Continued research effort on for content distribution. [ongoing] SAIL OConS has increased the internal awareness about the concepts investigated (notably the network control functions and connectivity services)	
		External	Participation to the Emerging Network Consortium, comprising 8 industry players Orange is a partner of ICT Labs Projects on ICN experimentation. FT-Orange has joined the ONF in 2012 to address network programmability. Participation in ETSI-ISG on Network functions Virtualisation and following the ONF on SDN architectural framework (especially the inter-controller aspects)	
	Academy	Technical	Internal	
			External	
Strategic guidelines		Internal		
		External	Participation and to the ICN community, through IRTF ICNRG. Participation and workshops chairing/ panel participation.	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Moreover, FT Orange's strategy has been evolving recently to include content provision and delivery as a service, the NetInf paradigm may have a substantial impact on design and operations. Following such developments and taking in active part in future evolutions is thus important for Orange, both as a network operator and service provider.

Two examples of business opportunities enabled by NetInf:

- *Add Insertion: With transfer of named content with appropriate tags through metadata, it becomes natural and easy for ad insertion and similar types of applications. As interests (for content) flow from consumers all the way to the content producers, there are many opportunities along the path for content*

producers to insert relevant ads based on the interests. This translates to increased revenue opportunities.

- *TV Everywhere: In today's networks, users are limited by the service providers as to what content they may get. Time Warner recently has pushed the TV Everywhere initiative to allow paid content be accessible from multiple channels such as web portals in addition to cable TV. In order to achieve TV Everywhere, specific access management is necessary to allow users of other service providers to receive content unavailable elsewhere. Under a suitable NetInf approach, content can be authenticated, certified, and delivered to anyone interested regardless of his service provider. As a content-provider, Orange can benefit significantly through efficient caching of its content in the network. Judicious caching and pre-fetching policies can ensure a good quality of service for content by Orange.*

*Open Connectivity Services will be exploited by **France Telecom Orange** both from technical point of view (such as improvement in network operation , faster introduction of applications and services), as well as from a strategic point of view (such as guidelines for the future, early preparation for new business roles, etc.).*

Final Assessment of Alignment:

FT-Orange strategy has recently evolved, focusing now less on content production and distribution, so the exploitation plans have hence been revisited. SAIL and NetInf has triggered the opportunity of internal discussions with operational services on the potentiality and opportunities of ICN technology. FT-Orange considers that ICN is a key technology to add value to its networks, and to conduct case study analysis to prepare a potential deployment for specific services (e.g. IP-TV, social networks) or network segments (mobile Backhaul). In order to further support the deployment of ICN in a longer term, France Telecom – Orange has joined the Emerging Networks Consortium which is an industry forum aiming at promoting ICN through business cases. FT-Orange has now gained significant expertise on the ICN topic, and is recognized as one of the world-leading ISP on this technology, as exemplified by its presence on the steering committee of various events and conferences addressing ICN, and as guest editors of special issues of Journals.

Embracing the novel approach OConS has proposed for the network control functions and the connectivity services will take some time, so more actions are needed both within the standardization bodies and with open source projects related to these aspects (notably the control framework and the orchestration of connectivity services). FT-Orange intends to pursue these efforts especially at ETSI, IETF and ONF.

Telefónica I+D (TID)

Overall end-of-project exploitation statement

The results from the SAIL work on CloNe and OConS, both separately and in their interworking aspects, have provided Telefónica I+D with new insights and helped position the company as a reference for SDN based network and data centre solutions. The work in SAIL has produced an introductory course on SDN and OpenFlow for the company, which will be expanded in the near future to cover the needs of other companies of the Telefónica Group.

SAIL has been an important driver in SDN activities in the Telefónica group and an enabler for ONF participation as part of the standardisation strategy of Telefónica I+D.

CloNe activities have resulted in a clear view for a strategic plan in the evolution of data centre designs towards SDN based architectures that overcome scalability issues which have a great impact on the day to day operation of the Telefónica Group data centres.

Exploitation Table

The exploitation table is presented in Table 3.6. Some exploitation statements are presented.

Table 3.6. Telefónica I+D Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvements	Internal	Research in CloNe translates in an increased efficiency in the design, deployment and operation of data centres. SDN results from SAIL will allow increase dynamicity while reducing the costs of our network operation
		External	SAIL has positioned Telefónica I+D as the SDN experts in the group
	Strategic guidelines	Internal	
		External	SAIL has had a significant impact in the standardisation activities around SDN in Telefónica, I+D

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Telefónica I+D is the innovation company of the Telefónica Group. Founded in 1988, it contributes to the Group's competitiveness and modernity through technological innovation. To achieve this aim, the company applies new ideas, concepts and practices in addition to developing advanced products and services. It is the largest private R+D centre in Spain as regards activity and resources, and is the most active company in Europe in terms of European research projects in the ICT sector (Information and Communication Technology). Over the last few years, within the global market Telefónica I+D has grown to become a network of centres of technological excellence that stretches far beyond the Spanish borders, extending its R+D activities to offices situated in Barcelona, Granada, Huesca, Madrid, Valladolid, São Paulo (Brazil) and Mexico. At the same time, it is working for the companies in the Telefónica Group in the rest of Europe, America and Asia. In addition to the numerous technical awards it has won since its foundation, the company received the Príncipe Felipe Award for Business Excellence in 2002.

Main tasks attributed in the project: Telefónica I+D will contribute to the architectural and implementation tasks in WP-C and WP-D. WP-A: Interprovider Issues Theme Leader.

Previous experience relevant to those tasks:

Telefónica I+D participated and coordinates numerous projects in the 5th and 6th Framework Programme and was coordinating partner of ten of them. It is part of the POET of 7FP IP 4WARD. Telefónica I+D has expertise in general architecture, networking, and mobility.

Telefónica I+D contributes to OConS and CloNe and leads the Interprovider Theme. All current analysts coincide that virtualisation is one of the pillars of the Network in the near future. Telefónica I+D will use the results of the CloNe activity to help the Telefónica Group define new products and services as well as to correctly extrapolate vendor information as to what virtualisation models are going to prevail in the future.

The SAIL activities include monitoring, participating and potentially attending the VNRG meetings at IETFs.

Regarding OConS, Telefónica I+D is very interested in contributing to their definition and demonstration. One of the major trends announced by several vendors is the return to unicast communications, as users tend to consume personalised contents (what I want, when I want, where I want, and with the device I want) and Telefónica I+D wants to explore if OConS can help controlling and hopefully reverting this trend in order to optimise network resource usage.

Final Assessment of Alignment:

Telefónica I+D monitored the VNRG activities while the group was active as well as other SDN activities in the IRTF. In the scope of the IRTF, we used insight gained in the Interprovider Theme to contribute to the SDNi interface definition draft. This activity has surpassed expectations regarding the definition of OConS related network services. Additionally, the OConS data centre proof of concept has helped us demonstrate the potential of OConS concepts in an SDN environment. Additionally, SAIL has allowed us to kick-start the Telefónica Group participation in the ONF as well as in the ISG on Network function Virtualisation in the ETSI.

Regarding the impact on virtualisation models, Telefónica, I+D is helping define a new data centre model within the Telefónica Group. This has been possible thanks to the insight gained with our participation in the CloNe work-package.

Telecom Italia (TI)

The results from the SAIL work on NetInf have provided Telecom Italia with the ability to thoroughly evaluate the requirements that enable a successful delivery of an ICN solution, providing competitive advantage, in a large operator scenario. Telecom Italia will also take advantage of the know-how resulting from actively contributing to the NetInf research when evaluating possible future deployments of ICN solutions, as the SAIL results will provide the ability to eventually assess the maturity of the products and evaluate their applicability to TI context. Moreover, the results of the project, when combined with the emerging SDN approach, may also be exploited to create and manage new communication services, not just limited to pure content delivery.

Regarding mobility procedures, it is important for mobile operator to simplify the mobility management procedures and reduce the overhead signalling due to the mobility. At the time being, mobile users attached to the network share the same settings for mobility management procedures and the same static, preconfigured set of parameters, without taking into account their mobility patterns. The Mobility Parameters Optimization (MPO) mechanism studied in OConS implements a dynamic optimization of the mobility management procedures currently used in the Evolved Packet Core (EPC), as standardized by 3GPP, for 'low mobility' devices.

The work carried on in OConS can facilitate the introduction in Telecom Italia network of optimizations for the management of the devices with low mobility. Telecom Italia will take advantage of the OConS work in the network evolution. Moreover, Telecom Italia will evaluate the opportunity to propose some of the parts of the MPO algorithm into 3GPP SA2 WG.

Exploitation Table

The exploitation table is presented in Table 3.7. Some exploitation statements are presented.

Table 3.7. Telecom Italia Exploitation Table.

Actor	Type	Target	Public statement	
Industry	Technical improvements	Internal	<p>Use NetInf background and know-how to evaluate how ICN technologies can be applied in a large operator's network to reduce CAPEX/OPEX.</p> <p>Use NetInf background and resulting know-how to assess the economic viability and possible advantages of ICN solutions vs. traditional CDN technologies.</p> <p>Use NetInf background to assess when products are mature enough to possibly use ICN as CDN evolution/ replacement.</p> <p>Use NetInf resulting know-how to assess whether ICN solutions offered by the industry will satisfy the operators' requirements.</p> <p>Use OConS know-how to evaluate how the Mobility Management in the Telecom Italia mobile network can be optimized in order to reduce the per-user costs.</p>	
		External		
	Strategic guidelines	Internal	Use NetInf background to evaluate how an ICN solution when available can be leveraged to create new communications services.	
		External		
	Academic	Technical	Internal	
			External	
Strategic		Internal		
		External	Leverage on ICN results in SAIL NetInf to combine it with SDN approach.	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Telecom Italia, being a network operator and a service provider, is particularly interested in bringing innovation into the network, to increase the value of its services and reduce the overall network infrastructure and operational costs. The research addressed by SAIL will when successful have a significant impact on the above goals. The Network of Information research and experimentation, in particular, will allow TI to explore the ways this new paradigm can be practically exploited to evolve the network and provide new information-centric services to the users. Moreover, results achieved in SAIL will be exploited by TI in the standardization process, leveraging the industrial strength of the consortium.

SAIL's mobile network architecture innovations, like Dynamic Mobility Management, will enable operators to preserve their investments, helping them to distribute traffic coming from mobile applications on network nodes in a smarter and more efficient way than today. This is particularly important also in face of the foreseen dramatic growth of mobile data and of new devices, like machine-type devices, which bring very low

ARPU to operators, if not correctly optimised in the network. Moreover, results achieved in SAIL will be exploited by Telecom Italia in the standardisation process, leveraging in particular the industrial strength of the consortium.

On the socio-economic side, Telecom Italia will take advantage from investigating new business models enabled by SAIL innovations and from studying innovative business synergies and agreements between Operators and other players that will give the Operator also the opportunity to contribute to the overall societal welfare. SAIL will also give Telecom Italia the knowledge of regulatory issues possibly impacted by new technologies and of mutual impacts between security and privacy issues.

Final Assessment of Alignment:

On the Network of Information side, Telecom Italia's current exploitation plans continue to be aligned with the initial goals.

For the mobile network architecture innovations, Telecom Italia's current plans continue to be aligned with the initial goal, trying to optimize the mobility management procedure in order to manage the mobile traffic in a smarter and more efficient way than today.

As to the standardization process, we still plan to exploit the SAIL results as there will be an opportunity, in particular ICN is currently in a research phase (e.g. ICNRG) and still needs to move in a standards phase.

On the socio-economic side, while TI had to withdraw from the activity in WPA because of an internal reorganization and a change in the mission of the group that was contributing, the outcome of WPA will be exploited when applicable to the TI context.

Portugal Telecom Inovação (PTIN)

Overall end-of-project exploitation statement

The operational and business management in the telecommunications industry has been evolving since the 80's/90's in line with the evolution of telecommunication networks, i.e., in line with the way services are provided by network operators. Business and Operational Support Systems (B/OSSs) were first built over each network domain (PSTN, PLMN, etc.), and later in the end of the 90's beginning of the 2000's operators started to feel the need to offer more complex services which required the combination of different services provided by different technologies. From this moment on the B/OSSs stacks have evolved into a converged stack. This evolution has been constant since new challenges arise every day, and Cloud Computing is one the main challenges that operators face today.

Today Wide Area Network (WAN) connectivity services within the cloud computing domain are considered a mean for users to reach cloud services and not as an inherent resource of the cloud. In other words, network services need to be provided as elastic and scalable resources that can be interconnected with the remaining cloud resources and provided in an on-demand and self-managed manner. However, the need to have a network able to fit the cloud model is becoming increasingly clear. This is not only an opportunity for telecommunication operators to become active players in the cloud business, but also a challenge as current business and operational systems need to evolve according to this scenario. Further, it is necessary to integrate the offer of cloud and WAN resources/services. PTIN, as a worldwide reference in the B/OSSs market, needs to be prepared for this evolution.

The Portugal Telecom (PT) Group with the SmartCloudPT [39] initiative provides a variety of cloud services and is building what is considered to be the sixth biggest data centre in the

world. This fact accelerates even more the need for the referred evolution within the PT Group.

SAIL project has provided PTIN the knowledge and skills on the cloud networking topic, namely on how to in a near future successfully integrate cloud infrastructure services - Infrastructure as a Service (IaaS) - and WAN services. This means that a strong knowledge acquisition on cloud infrastructure management systems has been obtained within the project, which combined with the companies inherent knowledge of the WAN services and systems allowed to identify the different challenges behind an integration scenario. Moreover, ways of overcoming each challenge have been defined and successfully validated. More specifically, network services interfaces and control interfaces have been defined that allow PT to expose network services in a cloud fashion way and mechanisms have been developed that allow the provisioning of these services in an on-demand manner.

In this context the output of the SAIL project is being already used to leverage internal activities to provide the required functionalities to PTIN B/OSSs.

Exploitation Table

No public statements in the table.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

PTIN is the R&D arm of the Portugal Telecom group; transferring knowledge to other PT companies is one of the key objectives of PTIN's activity. SAIL project results, particularly those coming from the Cloud Networking Work Package, will be internally disseminated and SAIL prototypes will be demonstrated to PT business and operational departments. In particular, Cloud Networking technologies developed in SAIL are expected to open up new capabilities and extend PT's virtual private networking service portfolio, by exploring the combination of network virtualisation and cloud computing.

Final Assessment of Alignment:

In line with the initial exploitation statements, in the last year PTIN has been internally disseminating the output of the Cloud Networking Work Package (which includes the demonstration of the CloNe prototype) near PT business and operational departments.

A Workshop dedicated to the theme as already taken place which counted with over 40 participants from both business and operational departments which had a very good feedback from the participants.

Also, on-going meetings with these departments have taken place to assess the feasibility of extending the PT's virtual private networking service portfolio.

Swedish Institute of Computer Science (SICS)

Overall end-of-project exploitation statement

SICS has developed and evaluated approaches for fault management in overlay networks and business goal translation in network management. We have developed autonomous detection and localisation of faults and anomalies, as well as a method for spatio-temporal event correlation across multiple virtual layers – both methods have been implemented and evaluated through simulations. Furthermore, we have developed automated translation of high-level business goals into enforceable operational policies for virtualised network resources. The work in network management has mainly been disseminated through

publication of scientific results in relevant conferences, and partially been included in prototyping activities.

These results form the basis for further research which in turn also will be exploited through dissemination and technology transfer. With the present results, we have formed the foundation for the new management paradigm of Probabilistic Network Management, whose development and standardization we aim at leading and contributing to.

Exploitation Table

The exploitation table is presented in Table 3.8. Some exploitation statements are presented.

Table 3.8. Swedish Institute of Computer Science Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical	Internal	
		External	Transfer of technologic advances to industrial partners
	Strategic guidelines	Internal	Attract highly qualified personnel and leading business partners
		External	Lead, develop, and define the research area of Probabilistic Network Management

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

SICS mission includes “actively promoting industrial use of new research ideas and results in industry and society at large”. Besides regular scientific publication of our research results, we attach importance to adapting and making use of the results in the particular environment and scenarios of our industrial and other collaboration partners.

In SAIL the above is done with two means. The first is to contribute to the prototype development in collaboration with the partners. The second is to contribute to the early standardisation, in particular for NetInf technology. Additionally, SICS has a well-developed collaboration pattern with small and mid-sized enterprises in Sweden, carrying our joint projects, and acting as an external R&D resource. SICS has also a proven record of disseminating and promoting industrial deployment of its research findings, including establishing of spin-off companies, as well as licensing of its software and patents.

SICS will develop and evaluate approaches for fault management in overlay networks and business goal translation in network management. One will investigate autonomous detection and localisation of faults and anomalies spanning across multiple virtual layers. Furthermore, one will investigate automated translation of high-level business goals into enforceable operational policies for virtualised network resources. The work in network management will be exploited partly by incorporating results into architecture and prototyping, and partly by dissemination of scientific results in relevant conferences.

Final Assessment of Alignment:

SICS has carried out its main mission in SAIL by development and dissemination of original research and by transferring the new research to industrial partners. The work carried out has

spawned both new research areas and new industrial partnerships, which are essential components in SICS's exploitation strategy.

IST – Technical University of Lisbon (IST)

Overall end-of-project exploitation statement

IST, with its good record of participating in projects within European frameworks, has obtained significant gains not only in terms of visibility but also concerning the improvement of processes and procedures related with both teaching and research activities; this is a clear result of the continuous exploitation that has been performed from the participation in these projects, and which was enhanced from the participation in SAIL. Much of the experience and results obtained in SAIL, as in other projects, will continue to be put into teaching, not only in graduate courses, but also, and more important, into the students' theses. The specific research topics addressed in SAIL, namely in WP-C (OConS) are very up to date, and enabled the reinforcement of research activities in the area of networks. This participation contributed to increase IST's scientific reputation and competitiveness at the national and international levels, attracting students and enabling better links with industry. The strategy of IST is twofold: participation enables both the staff and the students to improve their knowledge on the specific area of Mobile and Wireless Communications, whilst the training acquired by students is an effective way to process transfer technology to industry. This strategy was successful, as in fact knowledge was increased in the areas addressed within OConS (the technical ones in WP-C, and the business ones in WP-A), and some students finalised their theses during SAIL's timeline, and went to work in industry in somehow related topics. Furthermore, it developed the student's knowledge in a very competitive area, which in turn lead to enhanced career opportunities for them. Not of least importance, the staff of IST working in the project got improved experience of working in teams, at the international level, as well as being exposed to project management techniques, which is also of value not only for the staff itself, but also valuable knowledge to be passed onto to students in an Engineering school.

Exploitation Table

The exploitation table is presented in Table 3.9. Some exploitation statements are presented.

Table 3.9. IST – Technical University of Lisbon Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvement	Internal	Areas addressed within OConS (the technical ones in WP-C, and the business ones in WP-A).
		External	Some students finalised their theses during SAIL's timeline, and went to work in industry in topics somehow related to OConS.
	Strategic guidelines	Internal	The participation in SAIL contributed to increase IST's scientific reputation and competitiveness at the national and international levels, attracting students, due to increased links with industry.
		External	Research will continue in the topics addressed in SAIL, and the experience gained in SAIL enable the participation in other FP7 projects, and helped as well to sustain the line of

Actor	Type	Target	Public statement
			research developed within the SAIL.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

IST has a good record of participating in projects within European frameworks for many years, with significant gains not only in terms of visibility but also concerning the improvement of processes and procedures related with both teaching and research activities; this is a clear result of the continuous exploitation that has been performed from the participation in these projects. Much of the experience and results obtained in projects is being put into teaching, not only in graduate courses, but also, and more important, into the students' theses. This participation contributes to increase IST's scientific reputation and competitiveness at the national and international levels, attracting students and enabling better links with industry. IST will take advantage of its participation in eMobility to ensuring a proper exploitation. The strategy of IST is twofold: participation enables both the staff and the students to improve their knowledge on the specific area of Mobile and Wireless Communications, whilst the training acquired by students is an effective way to process transfer technology to industry. Furthermore, it develops the student's knowledge in a very competitive area, which in turn leads to enhanced career opportunities for them. Not of least importance, the staff of IST working in the project will get improved experience of working in teams, at the international level, as well as being exposed to project management techniques, which is also of value not only for the staff itself, but also valuable knowledge to be passed onto to students in an Engineering school.

Final Assessment of Alignment:

The final balance of IST's participation in SAIL is excellent. The initial exploitation targets were achieved, and the team of IST that has participated in the project has further consolidated its activities in the area of networks.

University of Paderborn (UPB)

Overall end-of-project exploitation statement

UPB continues to research how applications can be deployed in geographically distributed multiple cloud sites. This research is assisted by students and their theses work. Technical innovations in this research field are practically verified by prototypes.

We intend to distribute these prototypes under open source licences, akin to the OpenNetInf prototype.

In addition, as an academic partner, we pursue publication of our results in conferences, journals, and PhD theses.

Exploitation Table

The exploitation table is presented in Table 3.10. Some exploitation statements are presented.

Table 3.10. University of Paderborn Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improve	Internal	Technical innovations in UPB's research field are practically verified by a CloNe and a NetInf prototype. Students are deeply involved.
		External	
	Strategic guidelines	Internal	UPB continues its research on next generation of application deployment.
		External	Technical innovations in UPB's research field are practically verified by a CloNe and a NetInf prototype. Students are deeply involved.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

UPB is planning to exploit the SAIL results in several ways.

First, we plan to generate patents based on the developed results. We will also use the state-of-the-art experience and know how to teach the next generation of engineers and computer scientists.

Furthermore, we will use the acquired know how and experience to improve UPB's competitive position in the landscape of academia to improve the attractiveness for students and highly skilled staff members.

Final Assessment of Alignment:

The project work strengthened not only the cloud computing expertise of UPB (its Paderborn Center for Parallel Computing and its computer network research group) with cloud computing and information-centric networking.

Aalto University (AALTO)

Overall end-of-project exploitation statement

AALTO (Aalto University) has contributed to the socio-economic task within WP-A by analysing and evaluating the business aspects of the technical architectures designed in other WPs, focusing largely to WP-B (NetInf) technologies. Besides the project deliverables, AALTO has published the results as academic conference and journal papers. These papers are exploited as part of doctoral dissertations that are to be completed in the near future. The educational exploitation has focused on AALTO's international master's programme on Communications Ecosystem and national master's programme on Network Economics. Additionally, AALTO has coordinated between SAIL and the Finnish national programmes on Future Internet (Tivit/FI). The public results of Tivit/FI have been exploited in SAIL and vice versa. Furthermore, AALTO has discussed actively with SESERV coordination action. These discussions have led to dissemination actions such as workshop participations and a collaboration paper. In the future, AALTO plans to continue exploiting the results in teaching and in the Finnish national programme on Internet of Things (Tivit/IoT).

Exploitation Table

The exploitation table is presented in Table 3.11. Some exploitation statements are presented.

Table 3.11. Aalto University Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvements	Internal	Use results as part of Master's thesis and doctoral dissertations (on-going) Include results in lectures (on-going) Improve the expertise of the research team and develop the value network configuration methodology further (on-going)
		External	Communication of the results in academic conferences and journals advances the knowledge of wider scientific community (on-going)
	Strategic guidelines	Internal	Create new and maintain existing collaboration partnerships with the academic and industrial partners (on-going)
		External	Exploit results in the Finnish national research programmes Tivit/FI + Tivit/loT (on-going) Steer the work of AALTO in Tivit/loT (ongoing) and in SIGMONA (planned) research projects Improve the understanding of local regulator (FICORA) concerning the evolution of Internet content delivery (on-going)

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

AALTO (Aalto University) will contribute to the socio-economic task within WP-A by analysing and evaluating the business aspects of the technical architectures designed in other WPs. AALTO will exploit the results of this work for the purposes of teaching and further research in other projects. Especially AALTO plans to coordinate between SAIL and the Finnish national programme on Future Internet (Tivit/FI). The public results of Tivit/FI will be exploited in SAIL and vice versa. The educational exploitation will focus on AALTO's international master's programme on Communications Ecosystem and national master's programme on Network Economics.

Final Assessment of Alignment:

The current exploitation status and plans are well aligned with the initial statement. All the mentioned exploitation actions have been taken and some additional plans have been added in the course of the project, including for example exploitation in the research projects that have been started recently or are being started in the near future.

KTH – Royal Institute of Technology (KTH)

Overall end-of-project exploitation statement

With regards to dissemination, the results of our work done in the context of SAIL have been published in various high-quality journals and conferences. The research has also flowed to advanced masters-level courses at KTH. In addition, a number of master's thesis projects with topics that are related to the research we conducted in SAIL were done by students. We are planning on contributing some of our work to the OpenStack open source cloud platform. Finally, the work we conducted in SAIL has influenced the direction of our future research.

Exploitation Table

The exploitation table is presented in Table 3.12. Some exploitation statements are presented.

Table 3.12. KTH – Royal Institute of Technology Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvement	Internal	Concepts further developed in SAIL have been included in masters-level course http://www.s3.kth.se/lcn/courses/EP2400/
		External	
	Strategic	Internal	
		External	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

The Royal Institute of Technology (Kungliga Tekniska Högskolan), KTH, is a public university conducting high quality education and research of a broad spectrum – from natural science to all branches of technology, including architecture, industrial economics, urban planning, work science and environmental technology. KTH is an international institution with established research and educational exchanges all over the world, especially in Europe, the USA, Australia and South-East Asia. It is KTH's ambition to play an even stronger role in the EU research programmes than today. The TSLab department conducts leading edge research in the area of developing communication systems from a user perspective, and in the area of future network infrastructures. The network management group at KTH is led by Prof. Rolf Stadler. It currently comprises two faculty and eight staff members. Its research focuses on decentralised real-time monitoring, scalable management systems, and self-organising service architectures. The work is supported by several Swedish Agencies (VINNOVA, SSF, STINT) and Cisco Systems.

Main tasks attributed in the project:

KTH holds the following responsibilities:

WP-D: Contributor to Task D.1 (Architecture), D.2 (Prototyping, Standardisation, and Testing), and D.3 (Management aspects of cloud computing). KTH will study network architectures for cloud computing, and carry out experimental activities and trials.

Previous experience relevant to those tasks:

KTH has cumulated experience in research on network architectures and protocol design. Currently KTH is conducting experimentation on network virtualisation in the FP7/FEDERICA project; on future peer-to-peer architectures in the on-going FP7/P2P-

Next project; on network support for high definition video communication in CELTIC-EUREKA/HDVIPER. Our contributions to Ambient Networks and 4WARD, where we developed the concept of In- Network Management will help us to attack the problem of decentralized resource allocation and management in the context of cloud networking.

KTH will contribute mainly to WP-D. One anticipates that results will be achieved in the area of cloud networking and management, as well as in prototyping of WP-D concepts. KTH will team up with SAIL industrial partners and study possibilities for exploiting WP-D results.

Final Assessment of Alignment:

KTH has achieved important results in the area of cloud networking and management that were reported in several publications. In addition, prototypes of achieved results had been included in the integrated WPD demo that was shown at FuNeMS. We are currently working with Ericsson research on problems relating to cloud resource management.

Fraunhofer AISEC (Fraunhofer)

Overall end-of-project exploitation statement

The Fraunhofer Research Institution AISEC is specialized in the manifold facets of IT-security, addressing the security in and protection of network, cloud computing and embedded systems. The contribution in SAIL and the resulting project outcome enables Fraunhofer ASIEC to strengthen its competences to acquire new projects and to enhance the knowledge base used for lectures and seminars that are typically held at the Technische Universität München. Security related questions specifically on future internet scenarios and technologies, especially addressing new networking technologies and cloud networking solutions.

Exploitation Table

The exploitation table is presented in Table 3.13. Some exploitation statements are presented.

Table 3.13. Fraunhofer AISEC Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical	Internal	
		External	
	Strategic guidelines	Internal	OConS Architectural Framework as new, distributed approach to control for network virtualization and Software-defined Networking
		External	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

FhG AISEC (formerly SIT): all Institutes of the Fraunhofer-Gesellschaft promote and undertake applied research in an international context, of direct utility to private and public enterprise and of wide benefit to society as a whole. So does the Fraunhofer

Institute for Secure Information Technology SIT involved in SAIL. The knowledge and experiences gained will raise proficiency of the networking aspects of cloud computing, which are viable for follow-up research, improving the cooperation competences or allowing to enhance experimental testing environment deployed at SIT (now AISEC). This confirms the role of SIT in the value chain that is intermediate between those of the industrial and academic partners as being experienced in providing research services to a range of customers, including private companies, institutions and the public sector.

The Fraunhofer Institute for Secure Information Technology (Fraunhofer) is a specialist in IT- security. Institutes of the Fraunhofer-Gesellschaft promote and undertake applied research in an international context, of direct utility to private and public enterprise and of wide benefit to society as a whole. Fraunhofer is experienced with all technologies and topics that are relevant for IT-security and security by IT. The contribution in SAIL enables Fraunhofer SIT to strengthen its competences in security related questions in future internet scenarios.

Final Assessment of Alignment:

FHG AISEC: Most relevant are security related questions specifically on future internet scenarios and technologies, especially addressing new networking technologies and cloud networking solutions. These are firstly, the OConS Architectural Framework as a new, distributed approach to the control for network virtualization and Software-defined Networking is relevant. Secondly, results in the area of cloud networking are important to us. This relates to authentication and authorization procedures for accessing distributed data centers. It also relates to TPM based auditing functions assessing the geolocation of cloud computing facilities.

University of Bremen (UHB)

Overall end-of-project exploitation statement

UHB will continue to research on future internet architecture with focus on flexible, adaptive and open connectivity services and information centric networks (ICN).

There is one ongoing PhD thesis on combining OconS multipath mechanism with ICN, which will be continued after the end of SAIL. This work is supported by student thesis and projects. The work in OConS will be continued in Postdoc and student projects.

The basis laid in the SAIL project, both regarding OConS and ICN will be taken as basis for future funded research projects. The well-established cooperation to SAIL partners, such as UC or NICTA is intended to be continued independent of European funding.

Results obtained within OConS have already been published in two PhD theses, a third one is under preparation. All existing and future results are being published, as standard approach of an academic partner.

Further insights from the project will be used for teaching activities, in Master level lectures as well as in seminar and student projects.

Exploitation Table

The exploitation table is presented in Table 3.14. Some exploitation statements are presented.

Table 3.14. University of Bremen Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvements	Internal	Concepts and ideas of Future Internet Architectures are taken presented in advanced lectures. Problems identified in OConS and NetInf are discussed and further addressed in seminars, student projects and final theses.
		External	Findings from SAIL OConS can be used in technology transfer projects and consultancy to/with local SMEs. Engineers trained in SAIL at the doctoral and master level are now available for new jobs and challenges in the job market. They will continue to use the ideas developed in SAIL in new contexts.
	Strategic guidelines	Internal	UHB can offer exciting topics in the area of Future Internet to attract excellent students.
		External	UHB continues to research on future internet architectures deployment. With expertise from SAIL new projects can more easily be proposed. Challenges identified in OConS are intended to be followed up in future projects.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Open Connectivity Services will play an important role in defining the Future Internet. Within WP-C, University of Bremen (UHB) is focusing on the development of appropriate connectivity APIs, novel routing concepts, wireless resource management and technical migration strategies, in addition to the prototype development for comprehensive evaluations and demonstration. The identified solutions during this work will be disseminated by means of scientific publications. The obtained knowledge will be used in future research projects and academic work.

The University of Bremen will use the results obtained in SAIL for education of Bachelor, Master and PhD students and will further explore and utilise results in future research projects. Particular focus will be put on joint projects with industry, transferring expertise, novel ideas and concepts obtained in SAIL for key applications areas. In teaching, exciting and interesting areas for Bachelor, Master and PhD theses will be selected in SAIL topics and concepts, experiences from SAIL will be used to make the courses more lively and interesting.

Final Assessment of Alignment:

The work in SAIL has an impact on the research and educational work of UHB: SAIL topics are being used for student projects and within seminars. Two PhD theses have been finalized in the SAIL context; two more are to be finalized in the next 1.5 years. Scientific publications have been published in journals and on conferences. New research proposals in the area of NetInf and OConS are under discussion. New partnerships with NICTA and UC have been set-up, future exchange of students and researchers have been agreed beyond SAIL funding.

Hewlett-Packard (HPLB)

Overall end-of-project exploitation statement

Cloud is central to the needs of HP’s Enterprise customers in the future and Cloud is identified as one of HP’s main priorities for growth in the future. The SAIL project’s Cloud Networking (CloNe) research is in line with the HP’s “Converged Cloud” strategy and explores technical and architectural options for integrating data centres and networks to provide more flexible options for service deployments and opportunities for in-network services. HP’s Converged Cloud is a common architectural foundation across traditional IT and private, managed and public clouds, [40]. The CloNe work explores further technical integration of the network and the cloud. CloNe architecture informs strategic options for future Converged Cloud Infrastructure deployments for HP’s Enterprise customers.

Exploitation Table

The exploitation table is presented in Table 3.15. Some exploitation statements are presented.

Table 3.15. Hewlett-Packard Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvement	Internal	
		External	SAIL’s CloNe architecture approach provides flexibility to integrate networks and data centre infrastructures to provide a wide range of cloud solutions to our customers.
	Strategic guidelines	Internal	
		External	Flexibility is central to the range of cloud options that HP provides through its “Converged Cloud” offerings. SAIL’s CloNe architectures allow HP to explore new “federated” models that encompass network and cloud service providers.
Academic	Technical	Internal	
		External	
	Strategic guidelines	Internal	
		External	SAIL’s CloNe research informs the future research activities of HP Labs Cloud and Security lab in Bristol. The Lab works closely with HP’s business divisions to transfer cloud technology and ideas developed in the lab, including CloNe into HP’ products and services

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

HP contributes to WP-D, Cloud Networking. HP manufactures computing, storage, and network systems. One views the trend to virtualisation as essential to provide the operational flexibility and automated management that our customers require as they provide ever more sophisticated services to their customers. Integrating the wide area network management with data centre management is one of the key pieces of the virtualised infrastructure offering which can be deployed at large scale in data centres or distributed within the wide area network itself. HP will use the results of CloNe

activity to further help us explore tighter integration of wide area network and data centre virtualisation in our products and services, and to explore new models for offering distributed virtualised infrastructure services to our customers.

Final Assessment of Alignment:

Cloud remains as important to HP now as it did when the Cloud Networking element of SAIL was first conceived. HP’s Converged Cloud Strategy emphasises flexibility and choice and the ideas that SAIL CloNe promotes for federating data centre infrastructure and wide area networks provide more flexibility for customers and providers alike.

Tecnia (TECNALIA)

Overall end-of-project exploitation statement

The work developed within SAIL allowed Tecnia’s involved researchers to specialise their expertise not only in monitoring of human activity and DTN routing as planned, but also in the design of self-managed processes and deployments where monitoring and smart learning have a deep impact on network and application performance. In the field of wellbeing and ageing, Tecnia has coordinated the preparation of two new project proposals submitted to national funding programmes, and has been able to make a stronger market positioning in the field of people’s behaviour monitoring and detection of social patterns.

The expertise acquired during the work within SAIL has resulted in valuable benefit for the staff involved in the project, so as to steer future research career of novel researchers and create new opportunities within our business unit.

Moreover, Tecnia has been able to gain contact with relevant standardisation groups and actors in the field of DTN (contact with DTNRG), and has published the implementation of its routing protocol for DTN based on human routines (HURRY protocol) as an open source project release, thanks to the work developed within OConS.

Exploitation Table

The exploitation table is presented in Table 3.16. Some exploitation statements are presented.

Table 3.16. Tecnia Exploitation Table.

Actor	Type	Target	Public statement
Industry	Technical improvement	Internal	Tecnia has strengthened its market position in the wellbeing and ageing area, fostering collaborations with new customers for the development of ad-hoc products
		External	
	Strategic	Internal	
		External	
Academic	Technical	Internal	The specialisation of Tecnia’s research team is very valuable for the development of own assets
		External	
	Strategic	Internal	Tecnia will continue its key research activity within the Telecom Unit, taking advantage of the outcome from SAIL and the OConS implementation developed within the project

Actor	Type	Target	Public statement
		External	

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Tecnalía works with clients related to the wellbeing and ageing area, offering solutions to improve daily life for elderly and handicapped people. Monitoring the environment where these people live requires transparency and simplicity, not easy to accomplish. They require small devices (non-intrusive) able to detect normal and emergency situations and react accordingly.

The know-how obtained in SAIL will be used to go for real implementations of network coding techniques that improve current physical layer transmission techniques. Moreover the development of self-management techniques in DTN networks will be incorporated to current and new personal communication devices for a more efficient routing and caching when the devices are mobile and highly constrained in terms of resources (memory, battery, CPU, ...). Current products lack of awareness both of the context and the users. The techniques developed in SAIL will allow these products to gain monitoring capabilities, learn people habits and react to new situations in an optimal way. SAIL techniques will materialise in a Smart Wireless product-line based on the monitoring of human activity over time. This line of products will be based on an exhaustive and continuous collection of relevant data (location, social affinities) that let the system characterise people's behaviour and infer future needs based on history and current state. Such information is very relevant to automatically personalize the environment according to the user preferences (very useful with elderly and handicapped people).

Final Assessment of Alignment:

The alignment of Tecnalía's initial plan with the current status of exploitation activities is pretty much satisfactory. The know-how acquired by the research team has permitted both the development of internal assets to reinforce our position and gaining beneficial relation with regional industrial partners. Main areas of expertise developed are focused on Delay Tolerant Networking protocol design and implementation, and Network Coding algorithms applied to environments where human behaviour has an influence on the encoding decision.

Institut Télécom

Overall end-of-project exploitation statement

The results of the CloNe networking technologies and OconS are currently enabling Institut Mines–Télécom to pursue developments of SDN technologies, networks and networking management and networking operating systems. This is occurring in house, at national level and in other EU projects (e.g. ITEA2 Easi-Clouds) and new European collaborative projects subject of a call 11 proposal.

In parallel, Institut Mines Télécom is using CloNe solutions to interconnect its own platform with other Cloud Computing and Network platforms and BigData initiatives.

Exploitation Table

The exploitation table is presented in Table 3.17. Some exploitation statements are presented.

Table 3.17. Institut Télécom Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical	Internal	
		External	
	Strategic guidelines	Internal	CloNe technologies and results put forward when interviewing prospective graduate students and future research assistants and recruits.
		External	Carrying our results in Research Technology institute launched by French government called IRT SystemX. Institut Mines-Télécom leading a program on network architectures and cloud computing benefits from experience gained in SAIL, especially OConS and CloNe. The projects will use SDN and ADN technologies or approaches. See for example: http://www.irt-systemx.fr/ (only in French was launched on February 21 st , 2013.).

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Institut Télécom plans to use its experimental platform (256 core cluster - connected via 10 and 40 Gbps Infiniband networks - with embedded virtualisation technology) that emulates a complete private cloud to test and validate some of the SAIL concepts and results including interfaces in our experimental platform. Institut Télécom will produce concrete components for building, controlling and managing cloud networking and will contribute to candidate concepts and SAIL technology transfer. Moreover, Institut Télécom intends to exploit and disseminate the knowledge gained in SAIL by the integration of project results within academic publications and within further research projects. Institut Télécom will provide knowledge transfer among educational staff and students and will participate to seminars and workshops. Institut Telecom is also active in the relevant IETF working Groups. IT will take benefit of its in depth understanding of the SAIL topic to disseminate this understanding inside the IT SME club for potential re-appropriation by the SMEs of the new technologies developed in the project.

Institut Télécom aims at ensuring knowledge transfer towards students, both from engineering and MSc programs. IT will take benefit of its in-depth understanding of the topics developed in SAIL to disseminate this understanding inside the IT SME club, for potential re-appropriation by the SMEs of the new technologies developed in the project. Institut Télécom participates in SAIL WP-D and will be particularly contributing in the WP-D cloud networking architecture, prototyping and security for the cloud. One intends to present SAIL results in the Future Internet Assembly and other European Commission events, such as think tanks and FIRE. Contribution to cloud working groups (e.g., OCCI) and possibly to other related standardisation bodies is also among our goals. In addition, one will seek interaction with other European projects and open source fora in clouds.

Final Assessment of Alignment:

The current and planned exploitation are completely in line with the initial plans. In fact have gone beyond the expected plans since Institut Télécom platform is connected now also to Ericsson's, HP's and PTIN's. In addition some of the SAIL partners have access to our platform on a need and request basis.

Technion – Israel Institute of Technology (IIT)

Overall end-of-project exploitation statement

The Technion SAIL team was involved in both WPC and WPD research. We were able to conduct, present and publish high-quality and innovative research that is directly advancing the SoTA in these areas. Some of our research was published in international venues, which increases the visibility and the impact of the SAIL project on a global basis.

The Technion team published articles in the following venues: Infocom 2011 (April 2011, Shanghai, China, 3 papers), Hot-ICE 2011 (March 2011, Boston, USA), CNSM 2012 (October 2012, Las Vegas, USA), ICCCN 2012 (August 2012, Munich, Germany). In the context of SAIL collaboration, we took part of one WPC paper (IEEE WCNC, April 2013, Shanghai, China) and an article in the data communication magazine (July 2011 edition). All of our research was published with appropriate acknowledgement to the SAIL project.

Our SAIL-related research involved PhD student and faculty staff, and was presented in the Technion to interested students and faculty members. Some of our SAIL research was also presented in The Technion 2012 TCE conference <http://tce.technion.ac.il/>. It also helped us in taking further research steps in the context of Israeli-funded consortiums (Cornet, Rescue).

Exploitation Table

The exploitation table is presented in Table 3.18. Some exploitation statements are presented.

Table 3.18. Technion – Israel Institute of Technology Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical	Internal	
		External	
	Strategic guidelines	Internal	Our CloNe and OConS-related research also involved PhD students.
		External	Our CloNe and OConS-related research provided us with future research topics, also in Israeli-funded consortiums (Cornet, Rescue).

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

The Technion is a university, and as such, most of its research is disseminated in first class conferences and magazines, The Technion exploits the results of its research in standard bodies we are active (primarily the broadband forum), and other EU, US and Israeli-funded consortiums. Additionally, the research results can be used for

advanced courses in the Technion and other educational events, such as the 4WARD FISS, Future Internet Summer School.

Final Assessment of Alignment:

Clearly, on the dissemination front, the Technion was very successful, with 7 publications in high reputation conferences, including international exposure that spans outside of Europe (data communication magazine, INFOCOM conference, China, US).

Despite our intention, and due to reasons that are unrelated to the SAIL project, the Technion team was not involved at all in the Broadband forum, and thus, did not conduct any activity that was related to SAIL within this standard body.

Our SAIL-related research involved PhD student and faculty staff, and was presented in the Technion within educational sessions and Technion-organized TCE conference, [41]. It also helped us in taking further research steps in the context of Israeli-funded consortiums (Cornet, Rescue).

DOCOMO Communications Laboratories Europe (DOCOMO)

Overall end-of-project exploitation statement

SAIL generated valuable results and insights around the topic of information-centric networks and the transfer of related technologies and knowledge to respective departments in NTT DOCOMO is envisaged. Moreover, it is planned to consult our mother company NTT DOCOMO on strategic decisions concerning the potential deployment of information- or service-centric networks. If in the future information centric-networks should be considered as a competitive and mature technology for the NTT DOCOMO network and actual plans are being initiated to actually deploy an information- or service-centric network technology DOCOMO Euro-Labs will give strategic guidelines and accompany NTT DOCOMO using the knowledge gained from the SAIL project.

In the near future DOCOMO Euro-Labs does not see immediately a need to further conduct research on information- or service centric networks technologies beyond the duration of the SAIL project. The main activity of DOCOMO Euro-Labs during the project was on in-network service. This research activity will be frozen after the SAIL project ended and results have been consolidated and transferred to NTT DOCOMO.

Exploitation Table

No public statements in the exploitation table.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

DOCOMO Euro-Labs is looking for innovative solutions contributing to the improvement of NTT DOCOMO's network and service operation. In particular, the research aspects addressed in SAIL's Network of Information should lead to an advanced approach for information handling in mobile operators' networks. Results are expected to advance security and privacy technologies for information objects in the Network of Information, mobility management for operators based on the movement of information objects within the network and across network domains through in-network caching and programmable node architectures leading to a potential redesign of roaming.

DOCOMO's focus in the project is placed on realising the vision illustrated by the following scenario:

Imagine a video is distributed from a central server to a number of mobile users. However, the video is enriched with some information that is generated locally, close to the users receiving the video. Examples of such local information might be weather info, traffic jam alerts or even locally generated video, such as web cam from a surrounding area.

A straightforward solution to realise such a service is to send the local information to the central server, process it there, i.e., create a set of video streams customised for specific users or areas and then send those back to their corresponding users.

A better way to provide the described service is as follows: consider the available locations in the network providing processing units capable of integrating the locally generated information with the centrally originated video and place the respective service components at those locations which are beneficial for execution with respect to some performance metrics.

Both flexible placement of service components at instantiation time and dynamic re-arrangement of service components onto fitting resources at runtime should be possible to achieve best possible service quality under varying service conditions. This requires functionality in the network which derives appropriate processing resources and coordinates instantiation or migration at runtime based on information like which resources are available at which locations, service requirements and current network status.

DOCOMO' plan during the project is to develop a set of technologies to make this vision true. Doing that is expected to bring benefits to both users and network operators, and as such should be highly appreciated by all involved parties. DOCOMO plans to deploy such a solution in its network as soon as possible.

Final Assessment of Alignment:

Research on security and privacy as planned in the Description of Work was not performed within the SAIL project.

In the near future DOCOMO Euro-Labs does no longer see an immediate need to further conduct research on information- or service centric networks technologies beyond the duration of the SAIL project.

INRIA

Overall end-of-project exploitation statement

Inria gained considerable expertise in the area of dynamic resource provisioning in the context of volatile workload applications or services. In this direction we designed and implemented (parallel programming in distributed environments) a relevant theoretical model along with an efficient calibration procedure to fit the model on real data. This work opened up promising perspectives in the exploitation of *uncertainty* for new tendencies in *probabilistic management* aimed at making the most of Software Design Network assets. We published one journal article and have a few conference presentations and demonstrations on our work. Inria will actively continue its research on this matter. In particular, the Inria members currently involved in the SAIL project have coordinated the proposition of an European research project submitted to the call *Objective ICT-2013-10.1 EU-Japan research and development cooperation Global scale experiments over federated testbeds: Control, tools and applications*. Moreover, as Inria RESO is also part of the Computer Science Department of the ENS Lyon, we envision to introduce in the Master teaching program, new research classes related to dynamic resource management in cloud networking.

Exploitation Table

The exploitation table is presented in Table 3.19. Some exploitation statements are presented.

Table 3.19. INRIA Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvement	Internal	We increased our expertise on resource management policies within Cloud Networking.
		External	Fruitful and “win-win” collaboration with industrial partners. Sensibilization to the current and topical needs of future infrastructures development.
	Strategic guidelines	Internal	Our CloNe related research involved PhD students and strengthened Inria visibility with respect to cloud networking.
		External	Our CloNe related research provided us with future research topics, originating new national and European consortiums (Dialog, Disco, Inria Alcatel-Lucent joint lab...) that also involve other SAIL partners.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan:

INRIA, the national institute for research in computer science and control, is dedicated to fundamental and applied research in information and communication science and technology. The INRIA RESO team (stopped in December 2012) used to study and to develop new solutions in terms of protocols, services and software for next-generation Internet networks and infrastructure. RESO designed Grid network services and network middleware to simplify the programming and to optimise the execution of the communication parts while fully exploiting the capacities of the evolving network infrastructure. INRIA RESO also developed software for virtualised infrastructure management, bandwidth scheduling, dynamic network and IT resource provisioning. Those scientific outcomes have been entirely transferred to the Inria spin-off Lyatiss launched in 2010 by P. Vicat-Blanc, former head of RESO.

INRIA RESO was essentially involved in WP-D of SAIL project. RESO committed to grant access to the Grid5000/Aladdin national testbed to the SAIL consortium. Originally, we also intended to participate to the following tasks: Task D.1 on architecture design, Task D.2 on prototyping and experimentations, Task D.3 on resource allocation optimisation, Task D.4 on distributed security.

Final Assessment of Alignment:

In early spring 2010, a significant proportion of Inria RESO members who were involved in the SAIL project decided to leave our group to create the Lyatiss start-up. This major transformation drained RESO from its main know-how on virtualization techniques, while Lyatiss entered the SAIL consortium as a full partner on its own. This split naturally led us to redefine the two parties’ objectives in terms of scientific contributions, to cope with the respective expertise of the two subgroups, and in accordance with the new budget redistribution (initial envelope of Inria was shared with Lyatiss). As a result, Inria mainly focused its activity on two directions:

- The elaboration of a Virtual Infrastructure Description Language (VXDL), until the end of 2011 with the defence of a PhD student. Afterwards, our implication on this topic ceased and the responsibility of VXDL was completely transferred to Lyatiss.
- On dynamic resource allocation, concentrating on the video-on-demand use case. In this area, resource management approaches based on theoretical properties of relevant workload models were devised and tested. In the course and in full conformity with our initial commitments, we also set up an experimental platform embedded in the Grid5000 testbed to test and validate our probabilistic resource management policies.

Our SAIL-related research involved 2 PhD students, 2 engineers and faculty staff.

Trinity College Dublin (TCD)

Overall end-of-project exploitation statement

As an academic partner, we exploit SAIL via teaching, publication and additional research. SAIL results have been published in various journals and conferences and we have graduated and on-going research students working on ICN and NetInf. Some aspects of ICN are also being taught at masters-level. TCD have and will continue to contribute to the open source work on NetInf. As with ICN, our work on DTN also continues, in addition to all the above, including our being maintainers for the main DTN reference implementation, DTN2. SAIL also supported TCD in enabling Stephen Farrell to carry out the role of IETF security area director.

Exploitation Table

The exploitation table is presented in Table 3.20. Some exploitation statements are presented.

Table 3.20. Trinity College Dublin Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvement	Internal	We have graduated and on-going research students and include DTN and ICN within some taught masters-level modules.
		External	
	Strategic validation	Internal	
		External	DTN and ICN are on-going research activities for TCD.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

TCD will use SAIL to generate additional course materials for our taught MSc and structured PhD programmes which already include some delay-tolerant networking (DTN) lectures. One will also graduate two PhDs partly funded by SAIL. As a leader in DTN, TCD will continue to collaborate with Irish, European and worldwide partners on various DTN projects and activities. SAIL and NetInf will extend our set of potential partners for such research projects. TCD will take part in any IRTF research and IETF standardisation activities around DTN or NetInf.

Final Assessment of Alignment:

Our current plans are very much like our initial assessment. The only significant divergence is due to the increased IETF participation due to the security area director role.

National ICT Australia (NICTA)

Overall end-of-project exploitation statement

The main way in which NICTA has exploited the project results is via scientific publications in high quality venues and education, including student projects and direction of research work for PhD students. A number of fruitful collaborations we have established with other SAIL partners are expected to continue beyond the duration of the project.

Exploitation Table

The exploitation table is presented in Table 3.21. Some exploitation statements are presented.

Table 3.21. National ICT Australia Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical improvement	Internal	Some of the research work was included in university advanced coursework in networking.
		External	Two student projects (1 MSc equivalent, 1 BEng equivalent) were completed on SAIL topics, as well as part of one PhD.
	Strategic guideline	Internal	Attract qualified and motivated students (see projects above).
		External	A number of high quality publications and active collaboration with other SAIL partners which will outlive the project.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

For NICTA, the primary means of exploiting the project results is via scientific publications and demonstrations of the experimental platform showcasing the NICTA and collaborating partners results at high level conferences. Along with NICTA staff, PhD students will be participating in SAIL and both contributing their research results and using the scenarios for development of research solutions. There is also a potential to contribute to the IETF DCCP Working Group within the "new CCIDs" part of the WG charter.

Final Assessment of Alignment:

Up to November 2012, 7 publications (conferences, technical reports, PhD thesis) based on our technical contribution to SAIL WPC were completed and accepted.

- Olivier Mehani. "Contributions to Mechanisms for Adaptive Use of Mobile Network Resources". PhD thesis.
- Olivier Mehani et al. "User- and Application-Centric Multihomed Flow Management". LCN 2011.

Collaboration aiming for additional publications is currently under way.

- Luis Diez et al. "Design and Implementation of the Open Connectivity Services Framework". MONAMI 2012
- Xi Li et al. "Evaluating User-centric Multihomed Flow Management for Mobile Devices in Simulated Heterogeneous Networks". MONAMI 2012
- Golam Sarwar et al. "Performance Evaluation of Multipath Transport Protocol in Asymmetric Heterogeneous Network Environment". ISCIT 2012.

We developed an experimental testbed which can be used as a demonstration platform.

- François Hoguet. Network Mobility for Multi-homed Android Mobile Devices. Tech. rep. 6239. Nicta, Sept. 2012.
- Yang Wang. Mobile Multi-protocol HTTP Proxy. Tech. rep. 6329. Nicta.

University of Cantabria (UC)

Overall end-of-project exploitation statement

The work which has been carried out in the framework of the SAIL project has allowed UC to strengthen some research lines, as well as opening new ones, which will continue after the SAIL project finishes.

UC had some open activities in the framework of access selection within heterogeneous access environments. The SAIL project, in general, and the OConS, in particular, provides a framework for this research line. A PhD is being finalized in this topic and the idea would be to broaden it after the SAIL project, by integrating the SDN philosophy.

In addition, some line lines of research have stemmed during the project lifetime, such as the work which has been conducted on Network Coding. A PhD has started on this topic during the SAIL project, and it is expected to finish in two years.

The different scientific activities which have been conducted during the SAIL project lifetime have provided a framework in which around six MSc students have carried out their thesis.

Finally, the acquired know-how and the developed simulators/tools will be exploited in the future, so as to promote new collaboration opportunities.

Exploitation Table

The exploitation table is presented in Table 3.22. Some exploitation statements are presented.

Table 3.22. University of Cantabria Exploitation Table.

Actor	Type	Target	Public statement
Academic	Technical	Internal	New PhD and MSc topics, aligned with the scientific topics which have been addressed in OconS.
		External	
	Strategic guidelines	Internal	With the proposed PhD and MSc topics, attract students, both internal and external.
		External	Using the acquired knowhow during the SAIL project so as to foster new research initiatives in related topics to the ones which have been tackled in the OConS work package.

Overall assessment from the Initial exploitation plan

Description of Work and Initial Exploitation plan (from initial planning):

Considering the profile of UC (devoted to higher education and advanced research), the plan is to disseminate and exploit the results achieved during the SAIL project by means of different mechanisms. UC participates in the organising committee of various conferences (e.g. ICST MONAMI) and one is also targeting such conferences. UC also plans to cooperate with the particular dissemination activities promoted by the SAIL project, such as workshop organisation (collocated, e.g., with other conferences). On the other hand, the acquired know-how will be the basis for future cooperation and research initiatives, especially regarding Next Generation Networks and the corresponding challenges which are envisaged at the access part, from the architecture designed in the OCONS WP. Last, but not least, UC will also benefit from the framework brought about by the project so as to improve and extend its syllabus portfolio, both by advanced lectures in Master programmes and as a guideline for Master thesis and PhD topics. UC would be also interested in other teaching activities, like the organisation of Summer Schools.

In particular, UC plans to exploit the simulator framework as well as the testbed (prototyping activities) which will be developed in the framework of the SAIL project to carry out more analysis afterwards. Their use will continue to grow even after the SAIL project finishes. It will be exploited both for education activities and for future research initiatives. Regarding this latter point, the know-how acquired during the project life time will be used to foster the relationship with the European industry. Hence, UC aims at exploiting the possibilities brought about by the gaps in terms of technologies, products and services, which should be covered by means of the SAIL results.

Final Assessment of Alignment:

The initial objectives have been met. Regarding the internal exploitation activities, two PhD theses and around six MSc thesis are being/have been conducted in the framework provided by the research tasks tackled by UC during the SAIL project. Besides, UC organized the SAIL Summer School, in June 2012.

From a dissemination point of view, UC has contributed to a relatively large number of papers presented in various conferences, and has organized the OConS Workshop during the MONAMI'12 conference. UC has also disseminated the demonstration activities carried out, with a public demo in such conference.

The acquired knowhow will be exploited so as to foster new research initiatives, in particular aiming to integrate the OConS approach (more focused on the access part) with the Software Defined Networking philosophy.

LYATISS

Overall end-of-project exploitation statement

Lyatiss was involved in the design, implementation and demo of the prototype of flash network slices, with a particular focus on the FNS monitoring and elasticity control.

A video use case scenario has been proposed and implemented, then demoed at the FuNeMs workshop (D.2). The implementation of this use case helped Lyatiss in the definition of demonstration of its technology transferred from INRIA, and led to new developments to Lyatiss software product, CloudWeaver™, enabling it to support multi-network providers and Layer 2 and Layer 3 FNS links. This prototype also validated the integrability of Lyatiss

technology through the integration with OpenNebula and OpenStack via the development of an OCCI agent.

Lyatiss' work on business goal specification and translation within the SAIL project (D.3) directly impacted VXDL (Virtual Infrastructure Description Language), a language invented by INRIA and Lyatiss that allows the description of a Virtual Infrastructure or a "compute-and-communicate" resources graph, by implying some VXDL extensions on elasticity constraints.

New security challenges were also identified (D.4) and led to the definition of possible security extensions for the VXDL language.

The Lyatiss participation in SAIL also contributed to the visibility of the company. Lyatiss visibility has been increased through the publication of international scientific publications, the participation to technical panels and public demonstrations.

4 Conclusion

As stated by the European Commission, good dissemination and exploitation of results should be a strategic objective [42]. SAIL is a major project within the Network of the Future Objective of EU FP7, and so special attention has been given to dissemination and exploitation of results. This report gives a detailed description of the project dissemination and exploitation activities.

Concerning dissemination activities, all the major activities of the project were presented in detail. These included the Public Website, the Leaflet, the Newsletter, the Press Releases issued by the project, and the appearances of SAIL in the press. More technically oriented results included the Papers in Conferences and Journals, the workshops organized by SAIL, the Demonstration Events, and the SAIL Training School. Interaction with other Projects and Fora has also been an important activity. Finally Web2.0 and Open Source Activities have also been presented.

Exploitation activities are also addressed in detail, with a common framework being used by all project participants. Hence, for each partner, overall end-of-project exploitation statements are presented, together with an overall alignment with the Initial exploitation plan. Together with this, an exploitation table is presented, being structured along several dimensions, i.e.: the actor (i.e., industrial and academic), the type (technical improvements or strategic guidelines), and the audience (internally to the consortium and or externally to a wider community).

5 References

- [1] http://cordis.europa.eu/fp7/ict/future-networks/home_en.html, Feb. 2013
- [2] *Description of Work*, SAIL Project, EC FP7 Call 5 Project N° 257448, Aug. 2010.
- [3] J. Carapinha (ed.), D-A.4: Final Migration Description, SAIL Project, Feb.. 2013.
- [4] Telecommunications Software and Systems Group, <http://www.tssg.org>, Feb. 2013.
- [5] Passive Project, <http://ict-passive.eu>, Feb. 2013.
- [6] Julich Supercomputing centre, http://www.fz-juelich.de/portal/EN/Home/home_node.html, Feb. 2013.
- [7] European Middleware Initiative, <http://www.eu-emi.eu>, Feb. 2013.
- [8] University of Amsterdam, <http://english.uva.nl/start.cfm>, Feb. 2013.
- [9] Geysers Project, <http://www.geysers.eu>, Feb. 2013.
- [10] Euro-NF Project, http://euronf.enst.fr/en_accueil.html, Feb. 2013.
- [11] Seserv Project, <http://www.seserv.org>, Feb. 2013.
- [12] Springer, <http://www.springer.com>, Feb. 2013.
- [13] Dagstuhl Seminar on Information-Centric Networking, <http://www.dagstuhl.de/en/program/calendar/semhp/?semnr=10492>, Dec. 2010.
- [14] Dagstuhl Seminar on Information-Centric Networking -- Ready for the Real World?, <http://www.dagstuhl.de/en/program/calendar/semhp/?semnr=12361>, Sep. 2012.
- [15] Named Data Networking Project, <http://www.named-data.net>, Feb. 2013.
- [16] Pursuit Project, <http://www.fp7-pursuit.eu/PursuitWeb>, Feb. 2013.
- [17] ACM SIGCOMM Workshop on Information-Centric Networking (ICN-2011), <http://www.neclab.eu/icn-2011>, Aug. 2011.
- [18] ACM SIGCOMM Conference 2011, <http://conferences.sigcomm.org/sigcomm/2011>, Aug. 2011.
- [19] ACM SIGCOMM Workshop on Information-Centric Networking (ICN -2012), <http://www.neclab.eu/icn-2012>, Aug. 2012.
- [20] ACM SIGCOMM Conference 2012, <http://conferences.sigcomm.org/sigcomm/2012>, Aug. 2012.
- [21] ACM SIGCOMM Workshop on Information-Centric Networking (ICN -2013), <http://conferences.sigcomm.org/sigcomm/2013/icn.php>, Feb. 2013.
- [22] Efraim Project, <http://www.efraim-online.com>, Feb. 2013.
- [23] Internet Measurement Conference – IMC 2012, <http://www-net.cs.umass.edu/imc2012>, Feb. 2013.
- [24] Netinf sourceforge page, <http://sourceforge.net/projects/netinf>, Feb. 2013.
- [25] GIN – The Global Information Network, <http://gin.ngnet.it>, Feb. 2013.
- [26] Future Network and Mobile Summit 2012 – FuNeMS 2012, <http://www.futurenetworksummit.eu/2012>, July 2012.

- [27] Future Media Distribution Using Information Centric Networks, <http://www.sail-project.eu/future-media-distribution-information-centric-networks>, Feb. 2013.
- [28] SAIL Summer School, <http://www.sail-project.eu/summerschool>, June 2012.
- [29] SAIL Project YouTube Video Channel, <http://www.youtube.com/user/SAILprojectEU/videos>, Feb. 2013.
- [30] Tremblay, B., Schoo, P. (eds.), *D-A.2 - Draft Architecture Guidelines and Principles*, SAIL Project, July 2011.
- [31] Libnetvirt library, <https://github.com/danieltt/libnetvirt>, Feb. 2013.
- [32] pyOCNI, <http://occi-wg.org/2012/02/20/occi-pyocni>, Feb. 2013.
- [33] DTN2, <http://sourceforge.net/projects/dtn>, Feb. 2013.
- [34] HURRYwalla, <http://sourceforge.net/projects/bytewalla3>, Feb. 2103.
- [35] Correia, L.M. (ed.), *D-A.5: Exploitation and Dissemination Plan*, SAIL Project, Jan. 2011.
- [36] <http://www.ietf.org/proceedings/82/sdn.html>, Feb. 2013.
- [37] <http://tools.ietf.org/html/draft-farrkingel-pce-abno-architecture-00>, Feb. 2013.
- [38] <http://www.ngmn.org/workprogramme/centralisedran.html>, Feb. 2013.
- [39] SmartCloudPT, www.smartcloudpt.pt, Feb. 2013.
- [40] <http://h10124.www1.hp.com/campaigns/enterprise/converged-cloud/us/en/overview.html>, Feb. 2013.
- [41] TCE Conference, <http://tce.technion.ac.il>, Feb. 2013.
- [42] J. Enfedaque, "Communicating EU Research in FP7: The Formula", European Commission, Brussels, Belgium, 2010.

Annex A – Issued Newsletters

Here one presents the first two pages of every newsletter issued during the project. All issues of the newsletter can be found in <http://www.sail-project.eu/category/newsletters>.



SAIL Project Newsletter

Scalable and Adaptive Internet Solutions

Issue No. 1
December 2010

Editor: Luis M. Correia

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

Welcome to the [SAIL project](#) and our very first Newsletter. It is our belief that this quarterly update from our project is going to be something that you look forward to, that stands out in the massive flood of information that cross your way during a typical quarter of a year of work.

The SAIL project is a research project within the European Commission ICT Work Program, targeting The Network of the Future. With a birds-eye view, projects within this call are aiming at "Overcoming structural limitations of the current Internet architecture arising from an increasingly larger set of applications, of devices and edge networks to be supported".

Now, this got me thinking – who are we to define the networks of our grandchildren?

Can we, even if we are working in the forefront of the evolution, really foresee what the Internet will look like – and how it will be used – 20 years from now? Remember that the first web-browser is less than 20 years old. Since then, we have seen many, all that time unforeseen, usages of the web emerge. The Internet, the web and the cloud will redefine themselves numerous times in the coming two decades.

So I doubt that we can predict all the usage patterns of the future. Nevertheless, I am certain that SAIL will contribute to this future, whatever it may bring. For a starter, we are now doing the work on "Scenarios", describing how our foreseen technical architectures can fit into the industry architectures of tomorrow, and giving you a teaser of what to look forward to in coming Newsletters. Having that said, find a quiet place,

lean back and read more about the progress of our project and our journey to come!

Under the Spotlight in this issue is Network of Information, and our work to develop a network architecture and protocols for global scale Information-Centric-Networking – an approach that has recently received considerable attention in the research community and in the industry.

Enjoy your reading!

Thomas Edwall, Project Manager.

2. Under the Spotlight: Focus on WP-B

WP-B (Network of Information – NetInf) work is motivated by recent observations and predictions for exploding capacity needs for mobile video communications, the proliferation of CDN technology for large-scale content distribution, and the growing acceptance for ICN concepts in mainstream applications, such as P2P-based distribution/streaming. WP-B is investigating how ICN concepts, such as name-based routing, receiver-oriented transport, and ubiquitous caching can be employed as cornerstones for a future network architecture.

SAIL is currently analysing technology and business aspects for applying ICN to different scenarios: the *Next-Generation Mobile Communication Network* scenario is an important scenario with respect to addressing current and future bandwidth demands for content/service distribution in mobile communication networks. The analysis shows that NetInf-based approach can provide significant simplifications and efficiency improvements by integrating support for in-network storage and processing capabilities into network nodes – for content distribution, but also for providing new services.

The *NetInf-TV* scenario explicitly addresses content-distribution-related requirements for a NetInf infrastructure. Here, we analyse how NetInf can provide CDN-like functionality – without the limitations of current CDN

SAIL Newsletter

Issue No. 1, Dec. 2010

technology. We also analyse how NetInf can enable services in an ISP multiplay environment.

The *Developing Regions* scenario is focusing on robustness and resilience aspects of the NetInf technology. Here, we analyse how NetInf can help to reduce the digital divide by enabling low-cost, yet robust and reliable communication services that could be offered by a community ISP. The general proposition is that NetInf can provide a better, more robust and efficient, solution to the communication needs of communities in developing regions than the existing Internet protocols. The information-centric approach and the inherent caching features as well as its improved resilience to disruptions make NetInf a good option here.

This analysis is aligned with the overall work in SAIL on socio-economic aspects, and serves for identifying important requirements for the ICN architecture.



Figure 1: Information-centric networking node architecture.

The ICN architecture work in SAIL is leveraging results from previous projects, such as [WARD](#) and [FIND](#) and will be based on a set of architecture invariants that enable global interoperability, while providing sufficient room for domain-specific adaptations and experiments.

An important aspect of the ICN work within SAIL is migration from and interworking with existing networks and applications. WP-B is therefore actively contributing to standardisation of related and potential base technologies for ICN, such as the [IETF](#) work on access to in-network storage (DECADE) and P2P streaming (P2PSP). SAIL has established links to the ICN research community, and SAIL members are co-organising a Dagstuhl seminar on ICN together with members of the [NSF-NDN project](#).

3. Inside SAIL: News from WPs and Themes

WP-A Impact and Collaboration Enabling (ICE)

WP-A is called Impact & Collaboration Enabling, a name that reflects well its main missions. Starting with the collaboration part, WP-A is providing the technical coordination between the technical work packages (WP-B, WP-C and WP-D) through the Technical Manager and POET team. It also provides a set of tools and fora that is aimed at stimulating the cross communication between WPs.

WP-A has a task devoted to Migration and Standardisation, which helps the technical WPs to find the appropriate channels for the technical results to find its way into the appropriate standardisation fora. It will also support the overall migration planning for how to get from today's Internet to a future communication network built from SAIL technology.

The Dissemination task of WPA facilitates publication of results and creates concrete opportunities for spreading SAIL technical ideas through arranging workshops and an in-depth summer school. Details of these events will be available in future newsletters, as well as from the SAIL web site.

Finally, the Socio-Economic task is currently doing a business analysis of the scenarios being developed within SAIL. It also provided two well received contributions to the Socio-Economics of the Network of the Future workshop at the [IEEE Conference meeting in Istanbul](#), on Oct. 18-20, 2010.

WP-B Network of Information (NetInf)

Under the spotlight in this issue.

WP-C Open Connectivity Service (OCoNS)

WP-C focused so far on the description of scenarios and use-cases to be developed and covered by Open Connectivity Services. Several use-cases are considered, including wireless challenged networks, optimised services with heterogeneous content, and cloud and operator services.

To see what are main the drivers for adopting OCoNS, we are currently analysing these use-cases from a business viewpoint and from each stakeholder's perspective.

Finally, we have also initiated discussions on the architectural framework and on the required mechanisms to be implemented as Connectivity Services.

Figure A.1. Newsletter No. 1 – December 2010.

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

The first half-year period of SAIL has passed and already we are showing results of our architectural work. Our first public deliverables are due and available at the web-site for download and we are preparing for our first periodical review with the Commission. Research work wise we are now at the stage of the detailed architecture work and iteration of the first prototyping approaches. It means there is an intense activity on-going across all Work Packages.

In a project of the size of SAIL, how do you connect the deep scientific research work produced within each Work Package, to something that is understandable and concrete to an outside follower of the project? How do you secure that you maintain alignment in-between the work-packages so that the initial objectives with the project is kept intact? And from another angle, how do you maintain an innovative and free-thinking work environment where prosperous ideas are allowed to grow - even though they might not be fully in-line with what you originally have foreseen? How do you balance between control and free-thinking? Well, good questions all of them and no given answer.

In this 2nd Newsletter we go under the spotlight and shed light on how we intend to address these aspects in a way we believe will be a successful one, namely by looking more into detail on our recent project wide "scenarios" and "use cases" and the related deliverable that summarised this work. In SAIL we put a lot of emphasis in securing that in whatever work we do, and whatever result we

disclose, refer to it in a context that shall be easy to relate to for a broader audience. That it makes sense to everyday people with an interest in our industry? Sometimes the scenarios are deliberately stretched and perhaps too visionary - yet, they refer to situations we envision our technologies will be used in - by people in the generation of our grand-children. It is our strong intent not to see the scenario work as a "tick-in-the-box-document" that is put aside once approved, but instead repeatedly use it as guidance and sanity check for the research work to come. Let us know once you see that we deviate from this approach!

Thomas Edwall
(Project Manager)

2. Under the Spotlight: Focus on WP-A

The main focus for WP-A during the initial phase of the project has been Deliverable D.2.1/D.A.1 "Description of project wide scenarios and use cases". The deliverable describes overall scenarios that tie together the work in the different WPs. These scenarios have been refined into specific use cases, highlighting important functions, technologies, and capabilities enabled by SAIL technology and network architecture. The deliverable includes an extensive business analysis of the scenarios and use cases. The project-wide scenario has three iterations, each adding additional aspects and functionality, which have been defined to guide the main direction of the research in the project.

Alice is in the base scenario streaming video from her mobile handset to a personal content repository. Initially, just a few friends are interested in watching, but it turns out that the content is exceptionally popular, and a consumer crowd is forming. In the next two scenario iterations, a multi-operator network, and multiple people providing content from the same event are added, respectively.

While the scenario starts out with a simple case of small-scale distribution of user-generated

content, the iterations add complexity and scale that is very difficult to handle with today's technology. The scenario thus provides ample challenges for the research in SAIL.

Deliverable D.2.1/D.A.1 "Description of project wide scenarios and use cases" is already available at the [project website](#).

Another main responsibility for WP-A is to enable and coordinate SAIL dissemination activities. In order to reach as wide an audience as possible, SAIL is trying out a wide range of dissemination methods and channels. Besides the more traditional means of dissemination, the project is also engaged in new social networks approaches, like a [blog](#) and a [LinkedIn](#) group. The SAIL project also has a [SlideShare](#) account and is engaged in [YouTube](#), which is being used for videos and presentation slides. Other channels, such as [Twitter](#) are also explored. The blog, for example, has received some positive reactions.



SAIL workshops will constitute one of the primary channels for SAIL to interact with the surrounding research community. The first workshop, planned for October/November 2011, will focus on the topics of Information Centric networking, Open Connectivity and Cloud Networking in a way that can bring input to the architectural and technical development work in the SAIL project. The focus of the second workshop, planned for fall 2012, will be on disseminating SAIL results.

As the legal and regulatory landscape will delimit which technologies will be possible to deploy in the future internet, SAIL is considering arranging a set of national regulatory workshops during 2011 to understand the critical issues. If the workshop results indicate that it would be meaningful to address these issues on a European level, we will consider a European regulatory workshop in 2012.

These workshops will be open, and announced in due time at the project website.

Figure A.2. Newsletter No. 2 – March 2011.

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

With 30% of the project months passed, we have a bright outlook for our remaining voyage. There is an intense work on-going in all Work Packages (WPs) and Themes, and we have a tightly united team with a willingness to cooperate at everyone's best. "Everyone" in SAIL terms now mean 25 partners, as we are welcoming Lyttis as new partner in the consortium!

The second General Meeting of SAIL was held in Santander, Spain, 21-23 February, where the beautiful Palacio de la Magdalena was overtaken by SAILers for three days. The organiser of this successful meeting was [University of Cantabria](#). During these days, the ground for the upcoming intense work on the architectural deliverables from the respective WP was laid. The work with these deliverables is now in its most intense phase, and each WP has had or is in the preparation phase for dedicated face-to-face meetings.

Prototyping and the other Themes of the project will be the unifying glue that brings the technical aspects of NetInf, Clote and OCoNS together, and leverage the added value that comes with an integrated Project. During the Santander meeting, this became evident at the extremely well populated Prototyping Theme meeting.

Our first review meeting was held March 17th in good and constructive spirit, resulting in a lot of good discussions, valid comments and some remarks. The received feedback is taken in, and is now implemented into our project work plan. We are now approaching summer and a much longer vacation period for most of us. "Summer" for most of us usually consists

references to "clear skies" in one way or another. Call it a paradox if you like, that in this issue of our newsletter we will challenge that conception by taking a jump up into the clouds while exploring the exciting area of Cloud Networking! You will learn why distributed Clouds, residing at arm's lengths from us, will be a key ingredient of the future Internet.

So, let the sun wait for a while and enjoy the Clouds!

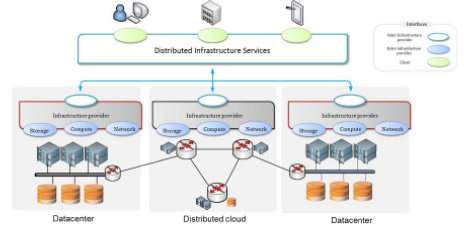
Thomas Edwall
(Project Manager)

2. Under the Spotlight: Focus on WP-D - Cloud Networking

Cloud computing is today changing the way applications and software can be deployed and managed. The concept of on-demand and pay-per-use software services is highly attractive to large and small enterprises that wish to reduce IT costs. Through cloud computing, one is able to outsource the management of entire systems, letting companies focus on their core businesses.

The work in the Cloud Networking WP is centred on two premises. The first one is that in the near future we will have a distributed cloud, that is a cloud deployed in the network and at network edges. This cloud will be closer to the end-user, minimising latency and maximising end-user experience. Not less importantly, that cloud will avoid congested network links, since the application will be placed closer to the user.

The second premise is that applications that are currently deployed in data centres will need flexible, secure and high speed connections in "customer - data centre" and "data centre - data centre" links. The provisioning of those connections should be performed in a time scale that is compatible with the allocation of computing resources in a data centre. We call this flexible network service a *flex network slice*. We envision a pay-per-use model for this network service as well, which will enable small



and medium enterprises to get access to those in an affordable way.

In that scenario, applications can be deployed in the network, in data centres, or in both at the same time. In order to allow that, the Cloud Networking architecture is designing a Distributed Infrastructure Service plane that will decompose and distribute applications across different administrative domains, e.g. data centres, and operators networks (figure above).

Recently, we presented our work in the [Future Internet Assembly in Budapest](#) at a session named "The network lost in the cloud". The one topic that seemed to be a consensus amongst all presenters was the need for a cloud end-to-end contract (in the form of an SLA) that includes networking. For example, the [project GEMINI](#) uses optical networks to provide cloud connectivity. SAIL Cloud Networking is investigating the use of MPLS/BGP, OpenFlow and Virtual Networks to provide inter-cloud connectivity.

One of the interesting questions in that session was about the need for visibility into the networks. The [project RESERVOIR](#) has implemented a federation of clouds and without knowing what is happening in the networks, a little could be done when transfer of large datasets or VMs has to be performed. In SAIL, we foresee the network operator as being part of this eco-system, offering a network service. Thus, cloud providers do not need to have visibility into the network, rather, they will see a service that is offered by the network provider.

Yet another interesting aspect is the business implications of how we implement the Distributed Infrastructure Service. One possibility is the use of a centralised scheme where all underlying resources. This

scheme could make optimal decisions, but is unlikely to happen in practice, since providers are not willing to expose such type of information. The second possibility is through the use of distributed schemes, where each provider is treated as a black box with internal decision making. In that case, we can have one instance negotiating with all providers for a request (hierarchical model), or we can have fully distributed negotiation between providers for a given request (peer model). Both cases are part of Clote's architecture.

3. Inside SAIL: News from WPs and Themes

WP-A

Impact and Collaboration Enabling (ICE)

WP-A has now started the activities for the definition of a strategy for migration. SAIL's contributions to ETSI's [Future Network Technologies](#) (http://www.etsi.org/WebSite/NewsandEvents/FNT/FutureNetworkTech/090406_0000) are being coordinated by WP-A.

A paper presenting the main challenges within the project was accepted to a special call of IEEE Communications Magazine, to be issued July 2011. The project will participate with a booth at [FutureNet2011](#). A presentation has been agreed to be given in the [RESERVOIR](#) workshop in June in Oxford ([Building the Future Internet - The Social Nature of Technical Choices](#)).

Work on Deliverable D.A.7 has continued, and the 1st full draft version will be ready by mid-May.

If you haven't already, please visit [Sailors Inn](#), the blog of SAIL. Since the last newsletter, there has been blog posts around the [2nd SAIL general](#)

Figure A.3. Newsletter No. 3 – June 2011.



SAIL Project Newsletter
Scalable and Adaptive Internet Solutions

Issue No. 4
September 2011

Editor: Luis M. Correia

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

For most people, summer means vacation, but this summer in SAIL, we did more than enjoying the sun and the beach. Five important documents have been delivered to the EU commission, and it is now your turn to enjoy the harvest as we made those documents available on our web site.

During the project's first phase, we put a large effort on defining the architecture to support the concepts that we introduced in the use cases and scenario Deliverable (D.A.1) earlier this year.

The "Draft Architecture Guidelines and Principles" (D.A.2) Deliverable presents, as its name says, 4 principles and guidelines applicable to the architecture work being done in SAIL. This includes contributions from the Themes defining objectives, frameworks, and early results. The document also includes a simplified view of SAIL's overall architecture, identifying the main interfaces between WPs.

The architecture for the Information Centric Networking (ICN) approach has been described in "The Network of Information Architecture and Applications" (D.B.1). The document presents different design options for the core building blocks of an ICN: naming, name resolution, forwarding and routing, and mobility and security. The document studies how the architecture applies to the selected applications and use cases, and also describes recent work in NetInf migration and standardisation.

In "Architectural Concepts of Connectivity Services" (D.C.1), OCoNS proposes a new set of networking architecture principles, defining the functional entities and interfaces of the architectural framework that suits these new

requirements. It then describes the proposed connectivity services and their management mechanisms. Finally, these elements are mapped to the connectivity use cases and scenarios.

ClOe integrates networks and data centres, considers the networking resources into the existing data centre infrastructure, and allows the application to use computing and storage resource distributed in the network for a better end-user experience, and all this in multi-administrative domain scenarios. "Cloud Network Architecture Description" (D.D.1) describes the architecture to support these features from intra- and inter-domain perspectives.

When introducing new technologies as we do in SAIL, it is not enough to identify the technical issues, but we also need to evaluate the impacts on the business and the society. "New Business Models and Business Dynamics of the Future Networks" (D.A.7) studies the intangible, business and regulatory aspects of selected use cases.

As the project now will shift focus towards prototyping of the concepts outlined in these documents, we conclude our in-depth tutorials of our WPs by putting extra spotlight focus on the Open Connectivity Services work!

Enjoy the reading.

Thomas Edwall (Project Manager)
Benoit Tremblay (Technical Manager)

2. Under the Spotlight: Focus on WP-C - Open Connectivity Services

During the last months, the focus in OCoNS was put on our first deliverable, "Architectural Concepts of Connectivity Services". We have started thus with a comprehensive analysis, which discusses and challenges the current networking guidelines and principles, and, whenever necessary, we have proposed changes and adaptations. Knowing that current networking abstractions are not appropriate to deal with the increasingly complex landscape, we

<http://www.sail-project.eu>

1/6

SAIL Newsletter

Issue No. 4, Oct. 2011

have clearly identified and proposed the following abstractions and functional entities common to all mechanisms: IE - Information management (e.g., networking context/view), DE - Decision (e.g., path computation), EE - Execution (e.g. forwarding), Orchestration (i.e., toolbox and blueprint to deal with a given service request), and PathConnection-emulation (e.g., similar to bearers in 3GPP, VLAN/tags in PBB-TE, or paths/labels in MPLS/LDP/RSVP-TE).

We reckon that our approach enables a smooth possible grouping (i.e., layering) of these abstractions/entities into major communication functions, and, moreover, we facilitate the support of several instantiation models (e.g. centralised path computation, several degree of hierarchisation for resource management, fully decentralised forwarding and mobility execution). Likewise, we will define, and intend to standardise, open/extendible interfaces to operate on these abstractions/entities, e.g., on DE-EE we can use an OpenFlow-like enriched with OCoNS services and policies, on EE-DE we can use appropriate triggers depending on a given connectivity service sought, on DE-DE we need inter-domain exchanges, and through the external API we manipulate the connectivity path through the Orchestration toolbox.

In D.C.1, we have also detailed several advanced connectivity services, such as: Multi-Path mechanisms that allow the same flow to use multiple simultaneous paths in a fair and efficient way, mechanisms to support Multi-homed nodes for effective handover and for delivering a given flow to multiple points, and protocol mechanisms for dynamically selecting different

transport protocols and configuring the parameters for a given flow, mechanisms that assist ICN to benefit from the established multiple paths at the transport and network layers, integration of network-coding and cross-layer techniques to improve the performance of Multi-PP mechanisms, and end-to-end network control for supporting the WAN interconnectivity. Likewise, D.C.1 specifies a set of mechanisms to manage and control these connectivity services in an efficient and scalable way, thus, it specifically tackles: dynamic and distributed mobility management, security aspects in relation with mobility, and resource management mechanisms (e.g., cognitive radio through spectrum sensing, radio resource allocation, wireless mesh and DTN management, policy routing, and overlaying for data-centre interconnection).

By providing a set of abstractions and interfaces that can be grouped into networking functions and services in a flexible and adaptable way, we can definitely say that the OCoNS framework decreases the networking landscape complexity, allowing for easier evolutions; accordingly, the functions can be reused at several layers, instantiated on various models, being orchestrated on-demand through open APIs. Finally, we aim at a recursive/reflexive use of a given OCoNS mechanism (where it can call itself with the same or with a different input/policy), so instead of throwing-in more protocols and mechanisms, we can reuse and instantiate the existing ones within appropriate "networking-processing" nodes or slices (in Colloquial vocabulary).

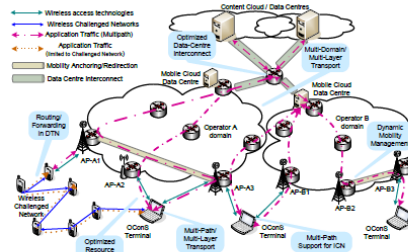


Figure 1. OCoNS Scenario.

<http://www.sail-project.eu>

2/6

Figure A.4. Newsletter No. 4 – September 2011.



SAIL Project Newsletter
Scalable and Adaptive Internet Solutions

Issue No. 5
January 2012

Editor: Luis M. Correia

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

Advancing into 2012, it is time to summarise the latest leg of the SAIL voyage. The SAIL schooner is out on open waters again after some well-deserved rest at the dock after a successful 2011, ready to set loose again for the final phases of our project. That all crew members have made an excellent job in 2011 is evident when looking at all the produced deliverables, submitted publications and gained publicity from SAIL - you deserve a big and honest Thank You!

In a large collaboration project like SAIL, the journey cannot always be smooth. From time to time, you will be forced to adjust the course and take corrective actions, in order not to end up on shore. But isn't that usually the case if you want to challenge and make a difference? It is part of the adventure, and in order to stay in the lead, you will have to - at all times - be receptive to input from your surrounding and re-assess your mission based on what the situation looks like for the moment. Yet stay calm enough to not lose sight of the horizon and the overall goals voyage.

In projects, as well as in sailing, you sometimes have to adjust your ambition level to the externalities. On a boat you do it by taking in on the sails, limiting the area of sailcloth facing the wind. In a project, you do it by adjusting your ambition level so that you keep a manageable scope, avoiding drowning under the work burden.

We have shown that we have what is required to balance on the crest between our partners' interest and the best for SAIL. I feel confident that we together will succeed, and that we will come out of the current troubled waters stronger than ever!

Having in mind the recent 4th General Meeting at IST, in Lisbon, Portugal, on Jan. 23rd 2011, and looking into the immediate future, the project is now in the phase of detailing the architecture in the respective Work Packages (WPs). A lot of focus during the meeting was spent on harmonising the view of how Cloud Networking (ClOe) and Network of Information (NetInf) will utilize selected mechanisms from the Open Connectivity Service suite (OCoNS) for providing their services. Main highlights though were the first internal demo event, where the concrete prototyping work being done within SAIL was shown-off to all project members. In this issue of our newsletter, you will get a glimpse of it as well. Curious about more? Remember to always check out the [SAIL's blog](http://www.sail-project.eu) for latest updates from the project!

Enjoy the reading.

Thomas Edwall (Project Manager)
Benoit Tremblay (Technical Manager)

2. Under the Spotlight: Focus on the Prototyping Theme

One of the highlights of the meeting week in Lisbon was the internal demo event and workshop. The time had come when prototypes that are being worked on across the project were showcased to everyone within the project. No less than 12 demo stations, 4 from each technical WP, were set up around the topics of NetInf, OCoNS, and ClOe. It was great to see many of the concepts, which previously have been explained in presentations and deliverables, in a more tangible way. This made it easier to grasp technical aspects and details, and to understand the concepts turned into code. An inspiring start of the project's last year.

Tuesday was the main demo day, with a plenary session where all demo teams gave a quick overview of what they were about to demonstrate. The session was introduced by Michael Soellner, Theme Leader for prototyping. Next, it was time for the demos. Everyone within the project walked around and explored all the

SAIL Newsletter

Issue No. 5, Jan. 2012

demo stations. As expected, all demos worked, but as we all know - anything can happen during a demo. The opportunity to discuss details and ways to further explore the concepts and to cooperate was well used until Wednesday noon.

Furthermore, we took the opportunity to capture all demos on video. We will now take some time and edit the raw material into separate movies. Keep your eyes on the [SAIL's blog](http://www.sail-project.eu) and on the main [SAIL web site](http://www.sail-project.eu), where the video clips will be presented.

During the meeting, the Prototyping Theme started to discuss first conclusions from the internal workshop, and the next steps in preparing the future public demonstration events. The description of the planned demonstration scenarios and the cooperation will be published in a deliverable in Apr. 2012.

3. Inside SAIL: News from WPs and Themes

WP-A

Impact and Collaboration Enabling (ACE)

In June, starting on the 23rd, SAIL will arrange a Summer School, in Santander, Spain, where students from across Europe are invited. More information will follow, so stay tuned.

In the socio-economics area, the work continues to identify and understand the new and existing business models, and how they may affect SAIL technologies. As part of this work, the WP has compiled a document with business requirements, including business, social and regulatory aspects. This document will, as a next step, be reviewed by all technical WPs.

Google launched its social network Google+ a few months ago, and SAIL was fast to establish a presence there. If you are using Google+, take the opportunity to add SAIL to your circles <https://plus.google.com/u/0/h/1156411302142693755214/>.

WP-B

Network of Information (NetInf)

WP-B is developing an Information-Centric Networking (ICN) architecture, with a focus on support for heterogeneous technological and administrative domains. This work is now concentrating on prototyping, where we are developing different components for NetInf networks and starting to put them together in application scenarios. For that we are producing specifications for different components of the system, which we are continuously sharing with the community. For example, we have designed the NetInf name format in a way that it can be useful for different applications and systems that have to provide name-content integrity. We

have submitted the corresponding specifications to the IETF to ensure broader review and to offer them as enablers for in-network storage applications in F2P and CDN deployments. The specifications are available as [draft-ietf-ccnr-ndecade-01](http://www.sail-project.eu) and [draft-balamkabe-ndecade-01](http://www.sail-project.eu).

We are also applying this process to other components, such as the NetInf protocol and its specific mappings to underlying networks. The prototyping work is progressing fast: there are several different NetInf implementations under development, such as the [OpenNetInf](http://www.sail-project.eu) Open Source implementation from Padua University, a NetInf implementation for next-generation routers from NEC, a NetInf-based localised CDN system from NSI, and a NetInf implementation for challenged networks based on the Delay-Tolerant Networking architecture from Trinity College Dublin. Some of these implementations have been showcased at the SAIL internal demo event.

WP-C

Open Connectivity Service (OCoNS)

WP-C goal is to provide Open Connectivity Services using novel and enhanced networking mechanisms that are beneficial to end-users and their applications (e.g., Higher QoS/QoE and with the most adapted connectivity), as well as to network operators (e.g., more efficient usage of the network resources).

The Future Internet will come with many challenges to cope with, and the deficiencies to overcome are countless; thus, appropriate Connectivity Services need to be deployed and instantiated using an overall framework, flexible and open enough to accommodate existing and upcoming mechanisms and networking technologies. Accordingly, we have further advanced with the specification of the OCoNS architectural framework, where our effort was put on the design of the orchestration functionalities: in fact, to serve a given application/request, this orchestration is needed in order to dynamically configure and instantiate a set of OCoNS mechanisms, functional entities and their associated protocols.

In parallel, prototyping activities were carried on to show OCoNS benefits and to demonstrate enhanced connectivity services, such as OCoNS multi-path support for NetInf, OCoNS multi-PP access with dynamic distributed mobility management, and OCoNS for autonomous Data-Centre interconnection.

WP-D

Cloud Networking (ClOe)

As per WP-D objectives, we are well on track to build an architecture for Cloud Networking that includes management and security aspects. Normally, cloud computing infrastructure-as-a-

<http://www.sail-project.eu>

1/4

<http://www.sail-project.eu>

2/4

Figure A.5. Newsletter No. 5 – January 2012.



SAIL Project Newsletter

Scalable and Adaptive Internet Solutions

Issue No. 6
April 2012

Editor: Luis M. Correia

Inside this Issue

1. Editorial
2. Under The Spotlight
3. Inside SAIL
4. Looking Outside
5. What's Next

1. Editorial

This year, spring and blooming nature in countries of the northern hemisphere is synchronised with spring and budding of results in the SAIL project. With less than the time it takes to make a baby left to the project, we are entering an intense phase of project result dissemination where everything that has been cooking inside the project is about to be brought into the light. NetInf (WP-8) are now proud parents of a the new born *mlib*, a package consisting of different implementations of name-content binding validation algorithms for the NI URI format that SAIL members published earlier. *mlib* also contains additional protocol and NetInf router/client implementations and can be found at <http://sourceforge.net/projects/netinf/>.

As in families, the birth of a child is though just the beginning of a life-time adventure. It is the responsibility of the parents to cater for that the coming generation get a good start in life and are fostered to continue developing what their ancestors invented. In SAIL, we take that responsibility seriously and as a sign of that our Summer School for students, post-docs and researchers will be the place for us to explain, in depth, our view of their Future Internet. Take the chance to read more about the Summer School in this newsletter, and why not book the week of 25th June for attending in person in beautiful Santander, Spain?

An aspect of growing older is that with age comes wisdom, at least if you manage to keep your senses open and receptive to what is happening around you. If you do not do that, your wisdom would likely be perceived as stubbornness. For

our project, we intend to interact with other close relatives at similar stage of life through a series of workshops. At FuNeMS, in Berlin in July, for instance, there will be a Cloud Networking workshop co-organised by SAIL and three other FP7 projects. About a month later in Helsinki, there will be a second ACM SIGCOMM workshop on Information-Centric Networking, co-organised by us and renowned expert from the international network research community.

As you can see, even if that getting out of the winter, SAIL has not hibernated. All of this you can read more about further down...

Thomas Edvall (Project Manager)
Benoit Tremblay (Technical Manager)

2. Under the Spotlight: Focus on SAIL Summer School

[SAIL Summer School Future Internet explained - Index](#)

The SAIL project has been already running for more than one year and a half. During this time, we have been able to acquire a wide knowledge on the Future Internet and some of its most important barebones. Although a large number of dissemination activities have been carried out, most of them consisting on the presentation of project results in different conferences, journals, etc., the SAIL Summer School now gives the opportunity to students and researchers to get a unique insight about the latest research aspects and trends of this fascinating subject.

Between June 25th and 28th, some of the people working in the SAIL project will offer in Santander (Spain) a complete view of some of the key concepts of the Future Internet. In particular, they will cover topics such as Cloud Networking, Network Virtualisation, Network of Information and Open Connectivity Services. The detailed programme is shown in Fig. 1. All the lectures will be carried out by top researchers in these areas.

SAIL Newsletter

Issue No. 6, Apr. 2012

25 Monday	26 Tuesday	27 Wednesday	28 Thursday
A SAILer view on the Future Internet R. Tremblay (Eindhoven)	Open Connectivity Services A. Trossen-Gal (U. Hamburg) R. Agreus (U. Cantabria)	Information-Centric Networking and NetInf H. Gal (U. Potsdam)	Performance Analysis of Network Caches L. Hiltunen (Espoo)
Coffee Break	Coffee Break	Coffee Break	Coffee Break
Network Virtualisation F. Spada (ETH)	Open Connectivity Services K. Uchi (Dresden)	GIK: A Hybrid Approach to ICM M. Chaharsooghi (Eindhoven)	Network Economics Methods in Information URI Address L. Hiltunen (Espoo)
Lunch Break	Lunch Break	Lunch Break	Lunch Break
Network Virtualisation F. Spada (ETH)	Protocols: Routing for DTN based on location and mobility S. Fries (Trento)	Protocols for Distributed Management R. Soder (ETH)	Internet of the Things & Smart Cities L. Nurita (U. Cantabria)
Coffee Break	Coffee Break	Coffee Break	Coffee Break
Hands-on session: Cloud computing with OpenStack H. Puhakainen & F. Fernandez (Eindhoven)	PhD Work-in-Progress Session	Protocols for Distributed Management R. Soder (ETH)	

Fig. 1. Summer School Program.

The venue of the Summer School, Santander, is a northern Spanish city which, besides providing an outstanding backdrop for the event, is becoming one of the most advanced and broad Internet of the Things (IoT) living laboratory. In this sense, the already interesting program will be complemented by two keynotes, which are somehow related to the Smart City paradigm that Santander is fostering. Mikael Eriksson (Ericsson Consumer Lab, Sweden) will talk about the upcoming Networked Society challenges and possibilities, while Prof. Luis Muñoz (Technical Manager of SmartSantander - VII Framework flagship project on experimental IoT platforms) will close the Summer School, by giving a talk on the role that smart cities and IoT may have on the Future Internet.

In addition to all the lectures, including a hands-on session, with exercises and challenges to be handled by the attendees, the Summer School will also incorporate within its program a Work-in-Progress session, in which Ph.D. students will have the opportunity to discuss with colleagues, on an open and flexible environment, their research on any topic related to the Future Internet. An award will be given to the best contribution, considering both its technical merit and the presentation.

From here, we encourage everybody to take the opportunity to get the latest insights about the Future Internet, while enjoying an appealing social program within a fantastic landscape. We are looking forward to seeing you all in Santander. The registration is open until May 31st, 2012.

For all the detailed information about the SAIL Summer School, visit www.sail-project.eu/summerschool.

3. Inside SAIL: News from WPs and Themes

WP-A [Impact and Collaboration Enabling \(ICE\)](#)

The work is proceeding around socio-economics, as well as standardisation and migration, aspects. These are crucial in order to create and anchor the impact of SAIL results in a wider scope. Together, these areas will support the efforts to get SAIL solutions implemented across the "live" Internet.

We also decided extend the SAIL presence to Facebook, in addition to our presence on [LinkedIn](#), [Twitter](#), [Youtube](#), [Slideshare](#) and [Google+](#). Why? Well, Facebook is after all a social network used by many people across the world, and you might not be an exception. By [linking SAIL on Facebook](#) you will get updates from us right into your Facebook feed, so you don't need to look for it elsewhere.

WP-B [Network of Information \(NetInf\)](#)

WP-B is developing the Network of Information, an Information-Centric Networking (ICN) architecture with a focus on support for heterogeneous technological and administrative domains. SAIL partners and collaborators have recently updated the specification of the NI scheme for "Naming Things with Hashes" in two Internet Drafts: [draft-farrel-decade-ni](#) and [draft-hallambaker-decade-ni-params](#). The specifications have been extended to include support for different representation formats of NI names, including a binary format (intended for constrained environments and packet-level communications) and a human-readable format.

Figure A.6. Newsletter No. 6 – April 2012.

Annex B – Complete List of Published Papers

The complete list of accepted papers in conferences is presented in Table B.1. In Table B.2 a list of publications in magazines and books is presented and in Table B.3 the list of publications in Technical Reports and other events is presented.

Table B.1. List of papers accepted in conferences.

Name of Paper	Authors	Conference/Venue
Open Connectivity Services for the Future Internet	Lucio S. Ferreira, Ramon Agüero, Luisa Caeiro, Avi Miron, Michael Soellner, Peter Schoo, Lucian Suciu, Andreas Timm-Giel, Asanga Udugama	WCNC 2013, Shanghai, China, Apr. 2013
ISP Business Models in Caching	Jorn Kunsemoller, Nan Zhang, Joao Soares	Second International Workshop on Data Management in the Cloud, Brisbane, Australia, Apr. 2013
Genetic Algorithm based Feature Selection Algorithm for Effective Intrusion Detection in Cloud Networks	Anand Kannan and Gerald Q. Maguire, Jr, Ayush Sharma and Peter Schoo	KDCloud12 IEEE workshop, Brussels, Belgium, Dec. 2012
Scalable Network-Aware Data Centre Federation	Suksant Sae Lor, Luis M. Vaquero, Dev Audsin, Paul Murray, Hareesh Puthalath, Bob Melander, Azimeh Sefidcon, Joao Soares, Marcio Melo, Jorge Carapinha, Houssemed Medhioub, Djamal Zeghlache	IEEE ICON 2012, Singapore, Dec 2012
Demonstrating a Versatile Model for VoD Buzz Workload in a Large Scale Distributed Network	Jean-Baptiste Delavoix, Shubhabrata Roy, Thomas Begin and Paulo Goncalves	IEEE CloudNet 2012, Paris, France, Nov. 2012
Negotiating On-demand connectivity between clouds and wide area networks	Hareesh Puthalath, Joao Soares, Bob Melander, Azimeh Sefidcon, Jorge Carapinha, Marcio Melo	IEEE CloudNet 2012, Paris, France, Nov. 2012
Using libNetVirt to control the virtual network	Daniel Turull, Markus Hidell, Peter Sjödin	IEEE CloudNet 2012, Paris, France, Nov. 2012
Optimized Flow Management using Linear Programming in Integrated Heterogeneous Networks	Umar Toseef, Yasir Zaki, Andreas Timm-Giel and Carmelita Görg	ICSNC 2012 - International Conference on Systems and Networks

Name of Paper	Authors	Conference/Venue
		Communications, Lisbon, Portugal, Nov. 2012
QoS Aware Multi-homing in Integrated 3GPP and non-3GPP Future Networks	Umar Toseef, Yasir Zaki, Liang Zhao, Andreas Timm-Giel and Carmelita Görg	ICSNC 2012 - International Conference on Systems and Networks Communications, Lisbon, Portugal, Nov. 2012
From Clouds to Mist: Bringing Clouds Closer to the End User	Holger Karl, Matthias Keller	2nd Sino-German Workshop on Cloud-based High Performance Computing, Potsdam, Germany, Oct 2012
Distributed Oblivious Load Balancing Using Prioritized Job Replication	Amir Nahir, Ariel Orda, Danny Raz	8th International Conference on Network and Service Management (CNSM 2012), Las Vegas, USA, Oct. 2012
Dynamic Resource Allocation with Management Objectives - Implementation for an OpenStack Cloud	Fetahi Wuhib, Rolf Stadler and Hans Lindgren	8th International Conference on Network and Service Management (CNSM 2012), Las Vegas, USA, Oct. 2012
Performance Evaluation of a Distributed and Probabilistic Network Monitoring Approach	R. Steinert and D. Gillblad	8th International Conference on Network and Service Management (CNSM 2012), Las Vegas, USA, Oct. 2012
OpenNetInf - Prototyping an Information-centric Network Architecture	Christian Dannewitz, Matthias Herlich, Holger Karl	WASA-NGI-V workshop (as part of LCN) WASA-NGI-V, Clearwater, FL, USA, Oct. 2012
Efficient and Fair Radio Resources Allocation for Spontaneous Multi-Radio Wireless Mesh Networks	L.S. Ferreira and L.M. Correia	ISSSE 2012: International Symposium on Signals, Systems and Electronics, Potsdam, Germany, Oct. 2012
Cloud Networking: a View from the WAN	Jorge Carapinha	Carrier Ethernet World Congress, Barcelona, Spain, Sep. 2012
OConS Service for Management of Connectivity in Spontaneous	L.S. Ferreira and L.M. Correia	MONAMI 2012 OConS Workshop, Hamburg,

Name of Paper	Authors	Conference/Venue
Community-Based Wireless Mesh Networks		Germany, Sep. 2012
OConS Supported On Demand Radio Resource Allocation for Virtual Connectivity	L. Caeiro, F.D. Cardoso and L.M. Correia	MONAMI 2012 OConS Workshop, Hamburg, Germany, Sep. 2012
Design and Implementation of the Open Connectivity Services Framework	Luis Diez, Olivier Mehani, Lucian Suci, and Ramon Agüero	MONAMI 2012, Hamburg, Germany, Sep. 2012
Uplink QoS Aware Multi-homing in Integrated 3GPP and non-3GPP Future Networks	Umar Toseef, Yasir Zaki, Andreas Timm-Giel, and Carmelita Görg	MONAMI 2012, Hamburg, Germany, Sep. 2012
On the Equilibrium of Pricing Assignment for Heterogeneous Wireless Access Networks	Carmen Lopez, Johnny Choque, Ramon Agüero, Joan Serrat, and Luis Munoz	MONAMI 2012, Hamburg, Germany, Sep. 2012
On the Addition of a Network Coding Layer within an Open Connectivity Services Framework	David Gomez, Sofiane Hassayoun, Arnaldo Herrero, Ramon Agüero, David Ros, and Marta Garcia-Arranz	MONAMI 2012, Hamburg, Germany, Sep. 2012
A price based load balancing scheme for wireless access networks	Johnny Choque, Ramon Agüero, Luis Munoz	MONAMI 2012, Hamburg, Germany, Sep. 2012
Evaluating User-centric Multihomed Flow Management for Mobile Devices in Simulated Heterogeneous Networks	Xi Li, Olivier Mehani, Ramon Agüero, Roksana Boreli, Yasir Zaki, and Umar Toseef	MONAMI 2012, Hamburg, Germany, Sep. 2012
A Re-Optimization Approach for Virtual Network Embedding	Marcio Melo, Jorge Carapinha, Susana Sargento, Ulrich Killat, and Andreas Timm-Giel	MONAMI 2012, Hamburg, Germany, Sep. 2012
Which are the Services of an Information-Centric Network, and Who Provides them?	Anders Eriksson, Börje Ohlman, Karl-Ake Persson	The Fourth International Conference on Advances in P2P Systems (AP2PS 2012), Barcelona, Spain, Sep. 2012
Impact of Network Coding on TCP Performance in Wireless Mesh Networks	David Gomez, Sofiane Hassayoun, Arnaldo Herrero, Ramon Agüero and David Ros	23rd IEEE International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC), Sydney, Australia, Sep. 2012
On the Equilibrium of Resource Allocation for Heterogeneous Wireless Access Networks	Carmen Lopez, Ramon Agüero, Johnny Choque and Luis Munoz	23rd IEEE International Symposium on Personal, Indoor and Mobile Radio Communications

Name of Paper	Authors	Conference/Venue
		(PIMRC), Sydney, Australia, Sep. 2012
On the Effects of Caching in Access Aggregation Networks	John Ardelius, Björn Grönvall, Ake Arvidsson, Lars Westberg	SIGCOMM ICN'2012, Helsinki, Finland , Aug 2012
MADServer: A Server Architecture for Mobile Advanced Delivery	Agoston Petz, Anders Lindgren, Pan Hui, and Christine Julien	ACM CHANTS 2012, Istanbul, Turkey, Aug. 2012
V2C: A secure vehicle to cloud framework for virtualized and on-demand service provisioning	Sathyanarayanan Rangarajan, Monica Verma, Anand Kannan, Ayush Sharma, Ingmar Schon	International Conference on Advances in Computing, Communications and Informatics (ICACCI 2012), Chennai, India, Aug. 2012
N-ary tree based key distribution in a Network as a Service provisioning model	Anand Kannan and Gerald Q. Maguire, Jr, Ayush Sharma, Volker Fusenig, and Peter Schoo	International Conference on Advances in Computing, Communications and Informatics (ICACCI 2012), Chennai, India, Aug. , 2012
Handovers with Forward Admission Control for Adaptive TCP Streaming in LTE-Advanced with Small Cells	Reuven Cohen and Anna Levin	ICCCN 2012, Munich, Germany, July/Aug. 2012
Resource allocation in the network operator's cloud: A virtualization approach	Joao Soares, Romeu Monteiro, Marcio Melo, Susana Sargento, Jorge Carapinha	2012 IEEE Symposium Computers and Communications (ISCC), Cappadocia, Turkey, July 2012
Future Scenarios of Commercial Internet Content Delivery	Nan Zhang, Heikki Haemmaeinen, Tapio Leva	23rd European Regional ITS Conference, Vienna, Austria, July 2012
The Network Operator's Cloud - A Virtualization Approach	Joao Soares, Romeu Monteiro, Jorge Carapinha, Marcio Melo, Susana Sargento	MoCS 2012, Cappadocia, Turkey, July 2012
On Converged Multidomain Management of Connectivity in Heterogeneous Networks	Fariborz Derakhshan, Heidrun Grob-Lipski, Horst Roessler, Peter Schefczik, Michael Söllner	Future Network & Mobile Summit 2012 Conference, Berlin, Germany, July 2012
"Intelligent Cloud Network Orchestration"	Pascale Vicat-Blanc	Future Networks and Mobile Summit - "Cloud Networking" Panel, Berlin, Germany, July 2012
Cloud Networking: An Infrastructure	Paul Murray, Azimeh	Future Networks and

Name of Paper	Authors	Conference/Venue
Service Architecture for the Wide Area	Sefidcon, Rebecca Steinert, Volker Fusenig, Jorge Carapinha	Mobile Summit - "Cloud Networking" Panel, Berlin, Germany, July 2012
libNetVirt: the network virtualization library	Daniel Turull, Markus Hidell, Peter Sjödin	Workshop on Clouds, Networks and Data Centers - IEEE ICC 2012, Ottawa, Canada, June 2012
Evaluating OpenFlow in libNetVirt	Daniel Turull, Markus Hidell, Peter Sjödin	8th Swedish National Computer Networking Workshop (SNCNW 2012), Stockholm, Sweden, June 2012
Efficient cache management for content distribution in Information Centric Networks	Ian Marsh, Anders Gunnar	8th Swedish National Computer Networking Workshop (SNCNW 2012), Stockholm, Sweden, June 2012
Performance Evaluation of the Random Replacement Policy for Networks of Caches	Massimo Gallo, Bruno Kauffmann, Luca Muscariello, Alain Simonian, Christian Tanguy	ACM Sigmetrics, London, United Kingdom, June 2012
Integrating heterogeneous virtualized data centers through the WAN - A practical perspective	Victor Souza	VTDC'12, Delft, Netherlands, June 2012
Bridging the security drawbacks of virtualized network resource provisioning model	Ayush Sharma, Volker Fusenig and Ingmar Schoen, and Anand Kannan	1st European Workshop on Dependable Cloud Computing (EWDC 2012), Sibiu, Romania, May 2012
Cloud Networking: Network aspects of the cloud (Abstract)	Benoit Tremblay, Thomas Edwall	Keynote speech at FIA Aalborg, Denmark, May 2012
Adaptive Allocation of Virtual Radio Resources over Heterogeneous Wireless Networks	Caeiro, L., Cardoso, F. and Correia, L.M.	EW'2012 - 18th European Wireless Conference, Poznan, Poland, Apr. 2012
Network as a service' for operators in the cloud	Jorge Carapinha	Telecom Cloud Services Summit, Berlin, Germany, Apr. 2012
Cloud meets WAN: In-Network Support for Distributed Services	Paul Murray, Azimeh Sifidcon, Bob Melander, Hareesh Puthalath	"Cloud Computing in the Telecom Environment" workshop at the World Telecommunications Congress 2012,

Name of Paper	Authors	Conference/Venue
		Miyazaki, Japan, Mar. 2012
Modeling Cloud Computing and Cloud Networking with VXDL"	Guilherme Koslovski, Sebastien Soudan, Pascale Vicat-Blan	World Telecommunications Congress - Cloud Computing in the Telecom Environment, Bridging the Gap, Miyazaki, Japan, Mar. 2012
Security Architecture for Cloud Networking	Volker Fusenig, Ayush Sharma	International Conference on Computing, Networking and Communications - ICNC 2012, Maui, Hawaii, Jan./Feb. 2012
A distributed spatio-temporal event correlation protocol for multi-layer virtual networks	R. Steinert, S. Gestrelus, and D. Gillblad.	IEEE GLOBECOM 2011, Houston, Texas, USA, Dec. 2011
Building Virtual Private Clouds with CloudNet	J. Soares, J. Carapinha, M. Melo, R. Monteiro, Susana Sargento	ADVCOMP 2011, Lisbon, Portugal, Nov. 2011
Open Connectivity Services for Future Networks	Liang Zhao, Asanga Udugama, Yasir Zaki, Umar Toseef, Carmelita Görg, Andreas Timm-Giel	The 8th International Conference & Expo on Emerging Technologies for a Smarter World - CEWIT2011, New York, USA, Nov. 2011,
Dynamic Window Coupling for Multipath Congestion Control	Sofiane Hassayoun, David Ros and Janardhan Iyengar	IEEE ICNP 2011, Vancouver, Canada, Oct. 2011
Radio Resource Management for Optimising Wireless Mesh Networks Deployments	Lucio Studer Ferreira and Luis M. Correia	The 14th International Symposium on Wireless Personal Multimedia Communications - WPMC 2011, Brest, France, Oct. 2011
Network and Host Based Distributed Mobility	Pierrick Louin, Philippe Bertin	The 14th International Symposium on Wireless Personal Multimedia Communications - WPMC 2011, Brest, France, Oct. 2011
User- and Application-Centric Multihomed Flow Management	Olivier Mehani, Roksana Boreli, Michael Maher, Thierry Ernst	IEEE 36th Conference on Local Computer Networks (LCN), Bonn, Germany, Oct. 2011
Subversion Over OpenNetInf and	B. Ahlgren, B. Ohlman, E.	IEEE 36th Conference

Name of Paper	Authors	Conference/Venue
CCNx	Axelsson, L. Brown	on Local Computer Networks (LCN), Bonn, Germany, Oct. 2011
Gossip-based Resource Allocation for Green Computing in Large Clouds	R. Yanggratoke, F. Wuhib, R. Stadler	7th International Conference on Network and Service Management (CNSM 2011), Paris, France, Oct 2011
Modeling data transfer in content-centric networking	Giovanna Carofiglio, Massimo Galloy, Luca Muscariello and Diego Perino	23rd International Teletraffic Congress (ITC 23), San Francisco, USA, Sep. 2011
OConS: Towards Open Connectivity Services in the Future Internet	Ramón Agüero, Luisa Caeiro, Luís M. Correia, Lúcio Ferreira, Marta García-Arranz, Lucian Suciú, Andreas Timm-Giel	MONAMI 2011 (Special Session on Future Research Directions), Aveiro, Portugal, Sep. 2011
OConS: Towards Open Connectivity Services in the Future Internet	Aguero, R., Caeiro, L., Correia, L.M., Ferreira, L.S., Garcia-Arranz, M., Suciú, L. and Timm-Giel, A.	MONAMI 2011, Aveiro, Portugal, Sep. 2011
Simulation framework for the evaluation of access selection algorithms over heterogeneous wireless networks	Johnny Choque, Ramon Agüero and Luis Munoz	MONAMI 2011, Aveiro, Portugal, Sep. 2011
Energy-Efficient Radio Resource Management in Self-Organised Multi-Radio Wireless Mesh Networks	Lucio Studer Ferreira, Luis M. Correia	IEEE PIMRC 2011, Toronto, Canada, Sep. 2011
Modeling Virtual Networks and Clouds	Pascale Vicat-Blanc	ETSI Future Network Technologies Workshop, Sophia Antipolis, France, Sep. 2011
Information-Centric Networking in the Future Internet	Jean-François PELTIER	ETSI Future Network Technologies Workshop, Sophia Antipolis, France, Sep. 2011
Modeling Virtual Networks and Clouds	Sebastien Soudan	OGF 33, Lyon, France, Sep. 2011
DTN Trials and Router Updates	Aidan Lynch, Stephen Farrell, Alex McMahon, Stefan Weber, Kerry Hartnett	The Extreme Conference on Communication - Extremecom 2011, Manaus, Brazil, Sep. 2011

Name of Paper	Authors	Conference/Venue
Translation of Probabilistic QoS in Hierarchic and Decentralized Settings	B. Bjurling, R. Steinert and D. Gillblad.	13th Asia-Pacific Network Operations and Management Symposium, Taipei, Taiwan, Sep. 2011
MDHT: A Hierarchical Name Resolution Service for Information-centric Networks	Matteo D'Ambrosio, Christian Dannewitz, Holger Karl and Vinicio Vercellone	SIGCOMM ICN workshop, Toronto, Canada, Aug. 2011
Secure naming structure and p2p application interaction	C. Dannewitz, T. Rautio, O. Strandberg, B. Ohlman	IETF Trust's Legal (IETF-80), Prague, Czech Republic, Mar./Apr. 2011
Towards an Information-Centric Internet with more Things	D. Kutscher and S. Farrell	Interconnecting Smart Objects with the Internet Workshop 2011, Prague, Czech Republic, Mar. 2011
Bandwidth and storage sharing performance in information centric networking	Giovanna Carofiglio Bell Labs, Massimo Gallo, Luca Muscariello	The Tenth International Conference on Networks (ICN 2011), St. Maarten, The Netherlands Antilles, Jan. 2011
Dagstuhl seminar on information-centric networking	Dirk Kutscher, Bengt Ahlgren, Holger Karl, Borje Ohlman, Sara Oueslati, Ignacio Solis	Dagstuhl seminar series, Dagstuhl, Germany, December 2010
Information-Centric Networking – A position paper	D. Kutscher, H. Flinck, H. Karl	FGFI 2010 : 6th GI/ITG KuVS Workshop on Future Internet, Hannover, Germany, Nov. 2010
Gossip-based Resource Management for Cloud Environments	F. Wuhib, R. Stadler, M. Spreitzer	6th International Conference on Network and Service Management (CNSM 2010), Niagara Falls, Canada, Oct. 2010
Challenges for Cloud Networking Security	Peter Schoo, Volker Fusenig, Victor Souza, Marcio Melo, Paul Murray, Herve Debar, Houssemedhiou and Djamel Zeglache	MONAMI 2010, Santander, Spain, Sep. 2010
A Prototype for In-Network Management in NaaS-enabled Networks	Dominique Dudkowski, Bioniko Tauhid, Giorgio Nunzi, Marcus Brunner,	The 12th IEEE/IFIP International Symposium on Integrated Network Management (IM

		2011), Dublin, Ireland,
A Survey of Information-Centric Networking (Draft)	B. Ahlgren, C. Dannewitz, C. Imbrenda, D. Kutscher, B. Ohlman	Dagstuhl Seminar on Information-Centric Networking, Dagstuhl, Germany,
Building enterprise-class clouds	Jorge Carapinha	Telecom Cloud Services Summit, Berlin, Germany
Cost Effective Resource Allocation of Overlay Routing Relay Nodes	Rami Cohen and Danny Raz (Technion),	INFOCOM 2011, Shanghai, China,
Cost-aware live migration of services in the cloud (Presentation)	David Breitgand, Gilad Kutiel and Danny Raz	Hot-ICE '11, Boston, USA,
Data Plane Optimization in Open Virtual Routers	Rathore, M. Hidell, P. Sjödin	IFIP Networking 2011, Valencia, Spain
Distributed Monitoring and Resource Management for Large Cloud Environments	Fetahi Wuhib, Rolf Stadler,	The 12th IEEE/IFIP International Symposium on Integrated Network Management (IM 2011), Dublin, Ireland,
Efficient allocation of CQI Channels in Broadband wireless Networks	RamiReuven Cohen and Danny RazGuy Grebla (Technion),	INFOCOM 2011, Shanghai, China,
Efficient content distribution in a hybrid opportunistic network	A. Lindgren	IEEE CCNC, Las Vegas, USA,
Experiments with subversion over OpenNetInf and CCNx	Bengt Ahlgren, Börje Ohlman, Erik Axelsson, Lars Brown	SNCNW 2011, Linköping, Sweden
Locating Virtual Infrastructures: Users and InP Perspectives	Guilherme Koslovski, Sebastien Soudan, Paulo Gonçalves, Pascale Vicat-Blanc,	The 12th IEEE/IFIP International Symposium on Integrated Network Management (IM 2011) - Special Track on Management of Cloud Services and Infrastructures (IM 2011 - STMCSI), Dublin, Ireland,
Long-term Adaptation and Distributed Detection of Local Network Changes	R. Steinert, D. Gillblad	IEEE GLOBECOM 2010, Miami, USA
Reliability Support in Virtual Infrastructures (Abstract)	G. Koslovski, W.L. Yeow, C. Westphal, T.T. Huu, J. Montagnat, P. Vicat-Blanc	2nd IEEE International Conference on Cloud Computing Technology and Science (CloudCom), Indianapolis, Indiana USA,
SAIL Cloud Networking	Dominique Dudkowski	ASMONIA Workshop, Heidelberg, Germany,

SAIL: An Overview (video presentation)	Luis M. Correia	SESERV Workshop, St Annes College, University of Oxford, U.K.
Socio Economic aspects in SAIL (Presentation)	P.A. Aranda Gutiérrez	3rd EURONF IA.7.5 Workshop on Socio-Economic Issues of the Networks of the Future, Ghent, Belgium,
The Future of Internet	Börje Ohlman	SHOK conference, Finland.
Towards an Information-Centric Internet with more Things (Slides)	Dirk Kutscher, Steven Farrell	Interconnecting Smart Objects with the Internet Workshop, Prague, Czech Republic
Using hardware classification to improve PC-based OpenFlow switching	V. Tanyinyong, M. Hidell, P. Sjödin	IEEE Workshop on High Performance Switching and Routing (IEEE HPSR 2011), Cartagena, Spain
Adaptive Allocation of Virtual Radio Resources over Heterogeneous Wireless Networks	Luísa Caeiro, Filipe D.Cardoso and Luís M. Correia	Proc. of 18th European Wireless Conference (EW2012), Poznan, Poland
Bandwidth and storage sharing performance in information centric networking	Giovanna Carofiglio, Massimo Gallo, Luca Muscariello	ACM SIGCOMM 2011 Workshop on ICN
ICP: Design and Evaluation of an Interest Control Protocol for Content-Centric Networking	G. Carofiglio, M. Gallo, L. Muscariello.	IEEE INFOCOM NOMEN 2012, Orlando, Florida, USA
Modeling data transfer in content-centric networking	Giovanna Carofiglio, Massimo Gallo, Luca Muscariello	ITC23; San Francisco, USA
On Converged Multidomain Management of Connectivity in Heterogeneous Networks	Fariborz Derakhshan, Heidrun Grob-Lipski, Horst Rößler, Peter Schefczik, Michael Söllner	Future Network & Mobile Summit 2012 Berlin, Germany
Open Connectivity Services for Future Networks	Andreas Timm-Giel, Liang Zhao, Asanga Udugama, Yasir Zaki, Umar Toseef, Carmelita Görg	CEWIT 2011, New York, USA
Opportunities in NGN Network Virtualization	Jorge Carapinha	Fokus Fuseco Forum, Berlin, Germany
Report on DTN Applications During Arctic Summer 2010 Trial	Stephen Farrell, Alex McMahon, Stefan Weber, Kerry Hartnett, Aidan Lynch, Eoin Meehan	International Workshop on Opportunistic and Delay/Disruption-Tolerant Networking (CNSM 2011), Brest, France
Subversion Over OpenNetInf and	Bengt Ahlgren, Börje	WASA-NGI-IV

CCNx	Ohlman, Erik Axelsson, Lars Brown	Workshop ,Bonn, Germany
------	--------------------------------------	----------------------------

Table B.2. List of publications in magazines and books.

Name of Publication	Authors	Magazine/Book
An OpenFlow Network Design Cycle	Pedro A. Aranda Gutierrez, Diego Lopez	Book chapter ; boot title to be determined, expected publication March 2013
Information-Centric Networking	Kostas Pentikousis, Prosper Chemouil, Kathleen Nichols, George Pavlou	Guest Editorial of FT Topic on ICN, IEEE Communications Magazine, Vol. 50 n°12, December 2012
In-NetDC: the Cloud in Core Networks	Suksant Sae Lor, Luis M. Vaquero, Paul Murray	IEEE Communications Letters, 16(10): 1703 – 1706, Oct. 2012
Dynamic Resource Management in Clouds: A Probabilistic Approach	Paulo Gonçalves, Shubhabrata Roy, Thomas Begin and Patrick Loiseau	IEICE Transactions on Communications, Special Issue on Networking Technologies for Cloud Services. E95-B(08), August 2012.
A Survey of Information-Centric Networking	Bengt Ahlgren, Christian Dannewitz, Claudio Imbrenda, Dirk Kutscher, Börje Ohlman	IEEE Communications Magazine, 50(7): 26 – 36, July 2012
Information-Centric Networking	Kostas Pentikousis, Prosper Chemouil, Kathleen Nichols, George Pavlou, Dan Massey	Guest Editorial of FT Topic on ICN, IEEE Communications Magazine, Vol. 50 n°7, July 2012
A Gossip Protocol for Dynamic Resource Management in Large Cloud Environments	Fetahi Wuhib and Rolf Stadler, Mike Spreitzer	IEEE Transactions on Network and Service Management, 9(2): 213 – 225, June 2012
Asymptotic Analysis of Flooding in CSMA-based Large Scale Ad-Hoc Wireless Networks	Hamed Shah-Mansouri, Babak Hossein Khalaj, Seyed Pooya Shariatpanahi, Javier Del Ser and Susana Perez-Sanchez	EURASIP Journal on Wireless Communications and Networking, 2012:312
Acquisition of human traces with Bluetooth technology: Challenges and proposals	Jose Maria Cabero, Virginia Molina, Inigo Urteaga, Fidel Liberal and Jose Luis Martin	Ad Hoc Networks Special Issue, Elsevier journal, June 2012
A Tussle Analysis for Information-centric Networking architectures	Alexandros Kostopoulos, Ioanna Papafili, Costas	FIA Book 2012, April 2012

Name of Publication	Authors	Magazine/Book
	Kalogiros, Tapio Leva, Nan Zhang, Dirk Trossen	
Optimum selection of access networks within heterogeneous wireless environments based on linear programming techniques	Johnny Choque, Ramon Aguero and Luis Munoz	Journal Mobile Networks and Applications, 16(4): 412 – 423, Aug. 2011
Toward decentralized probabilistic management	A.G. Prieto, D. Gillblad, R. Steinert, and A. Miron.	Communications Magazine, 49(7):80 – 86, July 2011.
Content, Connectivity, and Cloud: Ingredients for the Network of the Future	Bengt Ahlgren, Pedro A. Aranda, Prosper Chemouil, Luis M. Correia, Holger Karl, Sara Oueslati, Michael Söllner, Annikki Welin	IEEE Communications Magazine, 49(7): 62 – 70, July 2011
Cloud Networking: Implications of Agile Virtualisation on Provider Relationships	Pedro A. Aranda Gutierrez and Jorge Carapinha	Electronic Communications of the EASST
Information-Centric Networking (Guest editorial)	K. Pentikousis, P. Chemouil, K. Nichols, G. Pavlou, D. Massey	IEEE Communications Magazine - July 2012 (IEEE Com. Mag., Vol. 50 n°7, 2012), Special issue on ICN
Information-centric networking: a natural design for social network applications	Mathieu, B., Truong, P., Wei You, Peltier, J.-F.	IEEE Communications Magazine - July 2012 (IEEE Com. Mag., Vol. 50 n°7, 2012), Special issue on ICN

Table B.3. List of publications in Technical Reports and other events.

Title of Publication	Authors	Venue
The Global Information Network Architecture	Matteo D'Ambrosio, Paolo Fasano, Mario Ullio, Vinicio Vercellone	Telecom Italia Technical Report, 2012
Versatile Model for VoD Buzz Workload: Demonstration in Grid 5000 test bed	Jean-Baptiste Delavoix, Shubhabrata Roy, Thomas Begin and Paulo Goncalves	Grid5000 Winter School, Nantes, France, Dec. 2012
Mobile Multi-protocol HTTP Proxy	Yang Wang	NICTA research publications, 2012
Network mobility for multi-homed Android mobile devices	François Hoguet	NICTA research publications, 2012