PSIRP
Publish-Subscribe Internet Routing Paradigm
FP7-INFSO-IST-216173

DELIVERABLE D5.6

Raising Public Participation and Awareness Report

Title of Contract	Publish-Subscribe Internet Routing Paradigm
Acronym	PSIRP
Contract Number	FP7-INFSO-IST 216173
Start date of the project	1.1.2008
Duration	30 months, until 30.6.2010
Document Title:	Raising Public Participation and Awareness Report
Date of preparation	22.06.2010
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Target Dissemination Level:	Public
Status of the Document:	Final
Version	1.0
Document location	http://www.psirp.org/deliverables/
Project web site	http://www.psirp.org/

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1 Introduction

Disseminating PSIRP's fundamental project results within the scientific community has been one of the key activities of the project. Educating and raising awareness amongst commercial communities as well as the general public is crucial to spread our ideas and thinking and to gain a wider momentum amongst external communities. Creating an understanding of the project and its ongoing developments is the cornerstone by which continuous progress will be achieved. This document summarises some of the project's notable engagement activities towards these wider audiences.

2 International engagements and events

The following sections overview some of PSIRP's most notable international events.

2.1 2nd Japan EU Symposium on the "New Generation Network" and the "Future Internet"

The symposium was organized on 13th-14th of October, 2009, in Tokyo, Japan, in an effort to exchange views and opportunities for collaboration between the Japanese and European Future Internet efforts. This proved to be a relatively high-profile event, with around 200 participants from both Japan and Europe, including speakers such as Hideo Miyahara, President of the National Institute of Information and Communications Technology (NICT), Masataka Kawauchi, Director-General of International and Technology Policy Coordination of the Japanese Ministry of Internal Affairs and Communications, and Antti Peltomäki, the INFSO Deputy Director General of the European Commission. In addition, there was strong technology-oriented participation in the event, including the technical heads of initiatives such as the AKARI Future Internet architecture design project, and many others.

PSIRP was represented in the event by Janne Riihijärvi of RWTH, who gave an overview talk of the PSIRP activities titled "PSIRP: An Information-Centric Internetworking Architecture based on Publish/Subscribe". The talk was given in a session specifically focusing on Future Internet architectures and was attended by around 100 participants. The presentation consisted of an overview of the PSIRP information centric approach to internetworking, highlighting key differences in comparison to the more traditional endpoint centric approaches adopted in most other clean slate architecture projects, and also included a relatively detailed status update on the technical achievements of the project. Overall the talk was very well received and resulted in active discussions with many of the Japanese and European representatives. The PSIRP activities and conceptual approach were also mentioned several times in summary talks and were taken to represent a well-thought and highly promising approach to the Future Internet architecture design. Representatives from NICT and the AKARI project also specifically commented during the event that they will look closely into the principles of information-centrism and publish-subscribe technologies as alternatives to the traditional networking service model.

2.2 ICT Days' 2009, Sofia, 28-31.10.2009

A summary presentation of the PSIRP project was given and discussed during the seminar program of ICT Days' 2009 to an audience of approximately 30 people. Throughout the entire exhibition, project posters and printed publicity materials were distributed to the multiple participants at the BAS stand.

The ICT Days' 2009 event was held in parallel with a specialized ICT Expo exhibition designed to acquaint visitors with the latest innovations in all fields of information and communication technologies through a tailored seminar program. At least 100 businesses, companies, researchers, and customers participated in the expo, making the entire event an excellent dissemination and marketing venue for PSIRP.

The audience included 6 business representatives (20%), 15 ICT scientists and students (50%), and others (30%).

The following questions and comments were raised by the audience, delving into wider topics of the PSIRP project:

- Usage possibilities and access to Internet:
  - Why aren't the possibilities offered by the Internet being fully exploited right now? Give an example.
  - Recent statistics show that only 26% of the inhabitants of the planet use the Internet or even have basic Internet access, but 90% make use of mobile communication technologies. How will new technologies improve this figure in favor of PSIRP?
  - The audience was thoroughly intimidated upon hearing that 80% of all global e-mails are SPAM. How will PSIRP overcome such kinds of unsolicited traffic (e.g.phishing, SPAM, viruses etc.)?
- The PSIRP paradigm:
  - How to explain "information-centric"?
  - How to migrate from the Internet to PSIRP? Is new hardware needed?
  - Is there programming language support comparable to current support for the Internet in PSIRP?
  - Is it possible to eliminate firewalls? How would security be arranged?
- The business effects of PSIRP:
  - How will PSIRP affect mobile communications?
  - 15 years ago the Internet business was product oriented, rather than client centric. Today, however, businesses use a CRM approach. How will the CRM approach be implemented with the PSIRP concept?
  - What would attract new players, such as information brokers, bankers, and information processing providers, to adopt PSIRP? Aren't they satisfied with the Internet today? What will be different?

2.3 Event at Musala Soft Ltd., 9.06.2010

Musala Soft Ltd. is a leading Bulgarian software engineering services company, specialized in nearshoring, the delivery of complex and large-scale software projects, IT consulting, and Web-solutions implementation. Musala Soft and IPP-BAS collaborated to organize an event in the form of an open seminar about the PSIRP project. The event was open to all interested parties. Invitations were sent to all company personnel and an announcement was made to the Technical University Sofia Carrier Center mailing list. The audience mainly consisted of Musala employees (mostly software developers) and CST M.Sc. students from Technical University Sofia. The major PSIRP architecture standpoints and current project achievements were presented. The whole event was recorded on video for later viewing by Musala employees. Participants acquired knowledge pertaining to one of the major efforts in researching the future Internet and their questions afterwards led to a comprehensive and productive discussion. Topics of interest during the discussion were:

- How will transition from TCP/IP to the PSIRP model happen?

- Who would be the drivers?
- Will TCP/IP and PSIRP co-exist?
- How would PSIRP impact network security?
- How will advertising be organized? Will commercials be subscribeable?

The discussion at Musala showed that most of the audience found the topic of the seminar interesting and useful. All agreed that the event was well organized and the presentation was good. The project website was also presented in detail to the audience.

2.4 Industry engagement workshop, London, UK

An industry engagement workshop was organized on September 17th, 2009 in London, UK, with the objective of engaging in a dialogue with industrial stakeholders in order to influence the adoption of PSIRP ideas and to support the formulation of socio-economic impacts that could be realized through a PSIRP deployment.

The target audience of the event primarily included strategy-level industrial representatives from the service, content, manufacturer, and ISP sides.

Both vendors of the project had representation in the workshop. From the operator community, in addition to BT (a project partner), FT/Orange, Telecom Italia, Teliasonera, and Vodaphone were present. From the retail side Tesco was attending. The content side was represented by CTVC Ltd and through Carmen Mac Williams from Grassroots Arts Ltd.

The workshop outcome was used as input to deliverable D4.6, Final Evaluation Report on Deployment Incentives and Business Models.

2.5 Future Internet Assemblies

The PSIRP project has actively participated in the Future Internet Assembly (FIA). Two papers, "The Publish/Subscribe Internet Routing Paradigm (PSIRP): Designing the Future Internet Architecture" and "Publish/Subscribe for Internet: PSIRP Perspective" have been published in the FIA 2009 and 2010 books, respectively.

The PSIRP project was also presented in the 5th Future Internet Assembly in Valencia, Spain. The presentation covered the most notable aspects of the project, including the basics of information-centric publish-subscribe communications, clean-slate internetworking, comparisons between PSIRP's envisioned Internet and the current Internet, and PSIRP's architectural components and concepts. The presentation was well-received and generated a good amount of relevant discussion.

2.6 Other European projects

The **ICT SHOK** program represents a global research effort involving Europe, the United States, China, and others, to concentrate key research resources in order to develop future internetworking technologies and inspire new global business ecosystems based on advanced ICT foundations. The work of FP7 PSIRP has largely contributed to the success of ICT SHOK, mainly through its Information Networking division focusing on the storage, dissemination, and access of information.

The Athens University of Economics and Business (AUEB) maintains membership in the FP7 **"Euro-NF: Anticipating the Network of the Future – From Theory to Design"** network of excellence which aims to help integrate European research fragments. AUEB staff have presented PSIRP developments to their Euro-NF peers on several occasions, contributed to the Euro-NF vision document, and actively disseminated PSIRP material through several Euro-NF events and workshops. The extent of Euro-NF involvement represents a major route for ongoing marketing and research conditioning throughout the EU.

PSIRP staff has also contributed to the FP7 **EIFFEL** support action which has engaged in reciprocal ongoing development with PSIRP.

PSIRP has directly contributed requirements, results, and processes for the development of technical platform solutions in the **OneLab2** EU-funded research project. In addition, PSIRP and OneLab2 have compiled a joint technical report which outlines requirements and conceptual solutions for a framework to evaluate inter-domain networking solutions such as the PSIRP rendezvous solution. PSIRP has also held development sessions with OneLab2 in an effort to devise experiments centred on the Bloom filter forwarding mechanism of the PSIRP Blackhawk prototype.

3 Raising participation and awareness through academic partners

Future Internet research is a notably challenging field due to its inherent technical complexity and the extent to which it impacts the world. Clean-slate internetworking proposals such as PSIRP push the limits of creativity and technological advancement and these approaches are notoriously difficult to develop and understand because they typically require extensive experience and a robust academic background.

For this reason, we believe that PSIRP's academic members have a responsibility to explore the most effective means of fostering an understanding of PSIRP and involving external communities. Where research is complex and heavy academic backgrounds are requisite, strong academic involvement is typically needed to disseminate the corresponding results. Academic means of dissemination, chiefly to educate and create understanding, appear to be a promising route to exploit PSIRP innovations and raise public participation and awareness.

This section discusses notable dissemination and exploitation activities amongst PSIRP partners, designed to educate the general public and involve external communities in ongoing PSIRP development.

3.1 Public and collaborative development work

The **University of Essex** has recently made the PSIRP Blackhawk prototype available via its campus-wide wireless network. Over 2500 students have access to the test bed from within their dormitories and administrators hope to generate substantial testing in the future.

The **University of Campinas (UniCamp)** has been actively experimenting with the PSIRP prototype, documenting bugs in the code and actively disseminating PSIRP material via workshops and guest lectures in postgraduate courses. UniCamp has also implemented a Firefox plug-in for Blackhawk allowing users to directly handle SId/RId subscriptions from within a familiar browser environment. This is a major achievement as it represents a first step towards the creation of a user-friendly interface that will better enable the public to interact with and understand the PSIRP prototype.

PSIRP has also been collaborating with the **Communications Futures Program (CFP)** at the **Massachusetts Institute of Technology (MIT),** producing a joint paper discussing argumentation for a new internetworking architecture such as that provided by PSIRP, along with a whitepaper on identity in information-centric networking.

3.2 PSIRP integration within existing academic partners

AUEB-RC has considerably extended its undergraduate and graduate "Distributed Systems" course in order to address content-based routing and content-centric internetworking during the first year of the project. The publish/subscribe communication paradigm was introduced to the graduate course during the second year of the project. For the required programming project of the course, the students worked on content based routing, so as to have the background to work on more advanced topics in later courses. In the graduate course "Topics in Multimedia Systems," PSIRP was presented as a possible avenue for course projects. The goal is for some of these students to continue their work in PSIRP related topics in their MSc theses [D5.5].

IPP-BAS has devoted a seminar to PSIRP and created a dedicated Internet forum space for the project in the Bulgarian Research and Education network. A graduate student has been

recruited and components of the PSIRP architecture have been discussed in the “Global Networks” graduate course offered at the New Bulgarian University (NBU) at the end of the spring semesters each year. The course is part of the “Software technologies in the Internet” MSc specialty area.

RWTH Aachen University and its Department of Wireless Networks have been actively involved in PSIRP-related research, notably in the fields of network coding and publish-subscribe topology management. PSIRP results have been incorporated in information-centric networking and publish-subscribe communications portions of the course "Ad Hoc Networks and Mobile Computing" [D5.5] and a number of graduate and postgraduate students have been recruited into the project. RWTH is also a leading proponent of the merits of PSIRP’s publish-subscribe technologies in other computing domains such as cognitive wireless networking and wireless sensing. Recently, RWTH has also begun exploiting PSIRP results through several industry collaboration projects and usage studies.

3.3 Dedicated PSIRP courses

PSIRP’s academic partners have involved multiple graduate and postgraduate students in the project and integrated PSIRP material within existing academic course works at several universities. While the project has achieved excellent dissemination results through these pre-organized venues, dedicated academic courses allow project staff to further bring PSIRP to the forefront of attention, using project documentation as a principal learning tool and actively engaging a motivated audience through lectures and other ongoing events. In the following sections we present two such dedicated courses in detail and summarize other recent course-based dissemination efforts.

Following our earlier dissemination efforts within both research and industrial communities, we have instituted two successive special-topic courses within the Faculty of Information and Natural Sciences of the School of Science and Technology at Aalto University as part of a pilot-trial to gauge the effectiveness of academic courses for the dissemination and exploitation of PSIRP’s clean-slate internetworking architecture. The goal of these courses will be to promote

1) information dissemination (course code T-110.6120) and
2) application development (course code T-110.6100),

respectively, for the PSIRP project. These courses took place during the spring 2010 term (January – May) and were targeted towards advanced graduate and postgraduate students who possess a thorough background in ICT.

An external expert panel consisting primarily of doctoral-level researchers who possess extensive experience with PSIRP and related fields were convened to oversee the design, operation, and termination of these courses. Through the application of documented systematic forecasting and consensus techniques (e.g. the Delphi Method), the panel was responsible for the following key tasks:

1) Designing and validating the courses’ objectives, structures, contents, operating methods, and assessment measures.
2) Overseeing the instruction of the courses and monitoring their progress.
3) Documenting and analyzing the performance of the courses based on participant performance, participant feedback, and comments from overseeing staff.

4) Correlating the performance indicator of the courses' suitability to disseminate and exploit PSIRP results.

3.3.1 T-110.6120: Special course on pub-sub internetworking

The course T-110.6120 serves to address the need for effective dissemination of FP7 PSIRP material through an academic approach that embodies the structured learning environment and professor-student relationship of a university-level lecture course. In this, we hope to use academic courses to create an understanding of the project and its underpinnings.

Operational objectives

The need for PSIRP and the functionality it provides is deeply rooted in the idiosyncrasies of the current Internet. The Internet's developmental history, current problems, attempted solutions, operating conditions, usage demands etc. all serve as a basis that guides PSIRP's development. As such, it was agreed early in the planning stages of the course that we would need to give the participants a suitable amount of background in these areas in order to create the proper foundation to introduce the PSIRP project and facilitate its dissemination. Bearing this in mind, we formulated the following operational objectives along with their corresponding weightings in terms of emphasis within the course:

1) Provide a brief history of the Internet that highlights how the events surrounding its inception and the demands of users at the time contributed to its foundational endpoint-centric send-receive design. (5%)
2) Highlight milestone modifications during the past 40 years of Internet development and characterize their evolutionary nature in response to impending operational limitations. (5%)
3) Demonstrate that the core Internet architecture has essentially become ossified as a result of various technical and socio-economic conditions. (5%)
4) Identify notable problems plaguing the current Internet as a result of modern usage demands, introduce notable evolutionary and revolutionary solution proposals, and through this demonstrate the plausible need for a revolutionary clean-slate redesign. (5%)
5) Provide a comprehensive overview of the PSIRP project which includes the foundations of its information-centric pub-sub communication paradigm, design tenets, architectural components, prototype implementations, future outlooks etc., and conclude with practical demonstrations and a panel discussion. (80%)

These objectives were formulated based on the academic experience of project staff and the expert panel for the primary purpose of creating a beneficial learning environment and achieving PSIRP's long-term dissemination objectives.

Participant performance and feedback

The overall performance of the course participants was assessed by evaluating the quality of their contributions to lecture discussions, weekly assignment submissions, and final assignments, in this order of ascending weighted precedence.

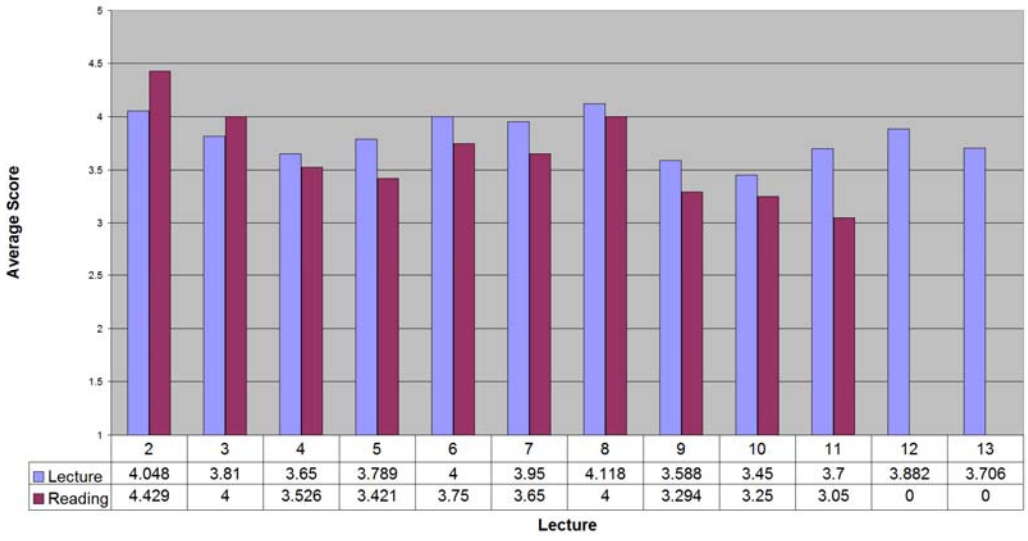
The weekly assignment submissions were very good overall. Students were generally quite adept at picking up the main points of each lecture and summarizing what they felt they had learned. We observed minor problems when students were asked to convey their opinions on the course material and whether there were any particular topics that they strongly agreed or disagreed with. Most students abstained or offered few insightful comments, indicating a lack of motivation to work beyond minimal assignment requirements. The students may not have taken the opportunity to think for themselves seriously. Individual analyses and commentary are of course highly encouraged and we are adamant about improving this aspect of the course in the future.

The participants also showed a good degree of resiliency and insightfulness in their final assignment submissions. They correctly identified the Internet's notable problems and evolutionary and revolutionary solutions, and exhibited an excellent understanding of the intricacies of endpoint-centric send-receive communications as well as PSIRP's information-centric pub-sub approach. We were also very pleased with the students' ability to explain the PSIRP architecture and its components. Participant submissions contained a good degree of depth and appropriate technical explanations covering the state-of-the-art and areas such as PSIRP identifiers, rendezvous and scoping, the Blackhawk prototype, zFilter forwarding etc.

We have concluded that the participants' performances reflect a good degree of learning that is comparable to that which is observed in traditional successful courses in ICT. We believe that the students profited from the course and gained a level of understanding that is equal to or above what is expected in order to gain ECTS credits.

Course participants were required to rate each lecture and its requisite reading material on a weekly basis using a Likert scale of 1 to 5. Students were explicitly informed that the nature of their responses would have absolutely no bearing on their successful completion of the course. The tools used to administer the surveys prevented participants from observing the responses of their peers, although participant responses were not anonymous when viewed by course staff.

The results of the participant feedback surveys are shown in Figure 1.



	2	3	4	5	6	7	8	9	10	11	12	13
Lecture	4.048	3.81	3.65	3.789	4	3.95	4.118	3.588	3.45	3.7	3.882	3.706
Reading	4.429	4	3.526	3.421	3.75	3.65	4	3.294	3.25	3.05	0	0

Figure 1 – Results of the T-110.6120 course survey

Based on these figures, the course staff and expert panel have concluded to a reasonable degree of certainty that participant sentiments towards the course are subjectively positive overall. Based on their experiences in academia, the course staff and expert panel have also expressed the view that these results are comparable or superior to those commonly observed from student bodies of traditional successful ICT courses. This reflects positively on the lecture materials, reading materials, lecturer performance, and the overall management of the course, and is especially encouraging in light of the fact that this was a pilot-trial.

3.3.2 T-110.6100: Special course in application development

T-110.6100 is an attempt at disseminating PSIRP material through active hands-on application development using PSIRP's Blackhawk prototype. The course is run as a code camp, emphasizing an intense learning environment and dedicated development over a period of 2 – 3 weeks. This type of course will allow us to determine the user-friendliness of the PSIRP paradigm and gauge its potential for success in the open development community. Another primary goal is to gain preliminary performance measures pertaining to the paradigm's ability to handle existing communication demands and developer methods.

As the course is still in progress, the following subsections only provide a preliminary overview of the course background and its most recent results.

Operational objectives

1) Provide one or more short introductory sessions outlining the nature of PSIRP's information-centric publish-subscribe networking approach and the functionality of the Blackhawk prototype and available APIs.
2) Assign to participants a series of development projects designed to give a comprehensive view of the capabilities of information-centric pub-sub internetworking.
3) Arrange a creative open environment which gives course participants the freedom to experiment with the Blackhawk prototype and employ the API to develop unique applications and services according to their own ideas.
4) Provide supportive assessment meetings in which participants freely demonstrate, analyze, and constructively evaluate their solutions and those of their peers.

Development work

The first development project (A1) consists of a web service "mash up" whereby students implement a simple client-server communication model over pub-sub using the Blackhawk prototype's Python API. A publisher periodically fetches a news feed from a selected web page and publishes the content for subscribers. New versions denote updated content. Two subscriber implementations are required. One subscriber is only capable of subscribing to the publication once the publication has been made (i.e. synchronous polling), and the other must be able to subscribe prior to the act of publication and receive the data immediately when the publication takes place (i.e. asynchronous interrupt). The mash up concept is illustrated in Figure 2.

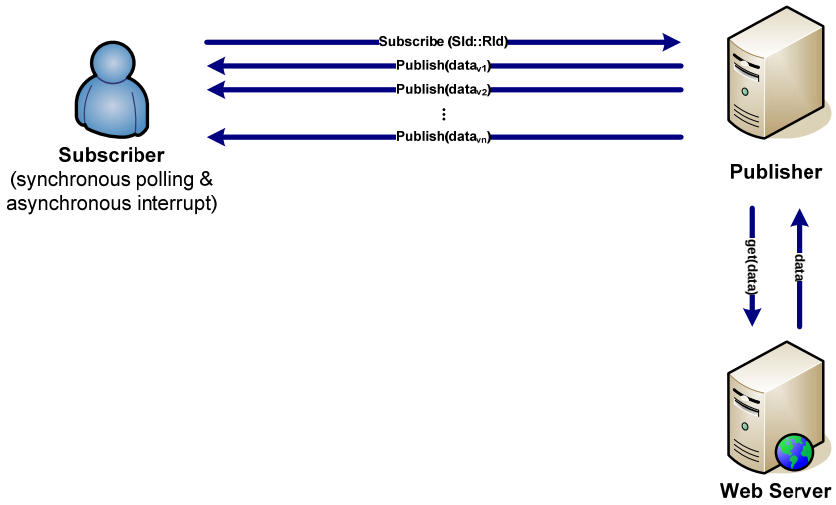


Figure 2 – A1 web service mash up

Preliminary results

As the code camp is still in progress, we have yet to obtain comprehensive results and feedback. This section includes an overview of the results of preliminary automated vulnerability analyses performed on the student code submissions for the first development assignment (A1).

The participants' A1 submissions were evaluated using the Rough Auditing Tool for Security (RATS) version 2.3. The standard vulnerability databases were used and the warning level for threat detection was set to 3 (the most strict, on a scale of 1 to 3). Function calls accepting external input were also included in the analysis. These options correspond to the following execution command:

```
C:\>rats <filename> -w 3 -i
```

Results follow:

Participant	Implementation	Vulnerabilities
1	Publisher	Possible input overflow (one occurrence)
	Subscriber	None found
2	Publisher	None found
	Subscriber	None found

Although automated tools can typically only provide a very rudimentary and limited code analysis, we are generally pleased with these preliminary results. The student implementations show virtually no vulnerabilities and the potential security problems that have been discovered are attributable to coding style, not the prototype or communication paradigm, and can thus be easily fixed.

Initial participant comments are also positive and students have been generally well-able to understanding information-centric pub-sub communications and adopt PSIRP principles in application development.

With these results, we have good reason to believe that Blackhawk and its APIs will show promise in the hands of developers and sustain PSIRP's dissemination and exploitation efforts. Efforts are underway to institute the PSIRP-specific offering of T-110.6100, in conjunction with T-110.6120, as a standardized course within Aalto University's Faculty of Information and Natural Sciences.

4 Project Web site

Most of PSIRP's project deliverables, technical reports, and publications, along with general information about the project, including the project presentation, are openly available in the publicly accessible project web site: http://www.psirp.org/. PSIRP makes use of its online resources, including this public homepage and semi-public wiki, to establish a partition that holds documents to be released to the greater community. This mechanism has proven to be a valuable tool throughout the duration of the project for the purpose of engaging external partners in meaningful discussions and providing records of our work and results.

The MMlab Web site in AUEB-RC includes a separate page for PSIRP and its results, see http://www.mm.aueb.gr/.

5 Open-source code releases

In accordance with project dissemination policies, the first code release of the PSIRP framework implementation was made under the GNU Public License version 2 (GPLv2) and Berkeley Systems Distribution (BSD) licenses. The Blackhawk publish/subscribe prototype for FreeBSD, developed within PSIRP WP3, was also released publicly in June 2009 and since then has had three version updates. Its source code is published under the GPLv2 and BSD open source licenses, so that users and developers of the code can choose which one of these licenses they want to apply (according to the plan in deliverable D3.1). In addition to the source code (written in C and Python), a virtual machine image for easy trials is available for download. In time, separately developed functional modules (e.g. rendezvous, topology, host-internal blackboard-based publication management and packet forwarding etc.) will be merged to provide a fully-functional architectural demonstrator.

External developer support is arranged through a PSIRP developer wiki and a mailing list for the wider community. The wiki is accessible at http://wiki.hiit.fi/display/psirpcode/Home, and initially it will contain instructions for usage and configuration of the prototype and for writing pub/sub applications for this platform. Additionally, the wiki can be a place to share other information and discuss development of the prototype, development of applications, as well as other issues. A wiki based support channel is easy to update quickly with new information, and also allows external contributions.

On the community's mailing list (psirp-code@hiit.fi), people from both inside and outside the PSIRP project can ask questions, provide assistance to each other, and discuss about development issues, among other things.

In addition to the Blackhawk publish/subscribe prototype the project offers:

- Efficient zFilter-based packet switch for NetFPGA hardware
- PLA implementation that provides network infrastructure protection by employing per-packet cryptographic signatures.

All the above mentioned code is available for downloading and public use in http://wiki.hiit.fi/display/psirpcode/Home .

6 List of publications

At the time of writing, the PSIRP project has 36 publications. Project publications have been presented in several key conferences including SIGCOMM 2009, ReArch '08, ReArch '09, IEEE INFOCOM 2010, and ISCC '10.

1) Särelä M., Rinta-aho T., Tarkoma S., “RTFM: Publish/Subscribe Internetworking Architecture,” ICT Mobile Summit 2008, Stockholm (Sweden), June 2008.

2) Nikander P., Marias G. F., “Towards Understanding Pure Publish/Subscribe Cryptographic Protocols,” Cambridge Security Protocols Workshop (SPW 2008), Cambridge (UK), April 2008.

3) Tarkoma S., Trossen D., Särelä M., “Black Boxed Rendezvous Based Networking,” 3rd ACM International Workshop on Mobility in the Evolving Internet Architecture (MobiArch08), co-located with the ACM SIGCOMM conference, Seattle (US), August 2008.

4) Xylomenos G., Katsaros K., Kemerlis V., “Peer Assisted Content Distribution over Router Assisted Overlay Multicast”, Euro-NF Future Internet Architecture Workshop, Paris, France, November 2008.

5) Rajahalme J., Särelä M., Nikander P., Tarkoma S., “Incentive-Compatible Caching and Peering in Data-Oriented Networks”, ReArch'08 - Re-Architecting the Internet, co-located with ACM CoNEXT 2008, Madrid, Spain, December 2008.

6) Esteve C., Verdi F., Magalhaes M., “Towards a new generation of information-oriented Internetworking architectures”, ReArch'08 - Re-Architecting the Internet, co-located with ACM CoNEXT 2008, Madrid, Spain, December 2008.

7) Katsaros K., Fotiou N., Polyzos G., Xylomenos G., “Overlay multicast assisted mobility for future publish subscribe networks,” ICT Mobile Summit 2009, Santander, Spain, June 2009.

8) Zahemszky A., Esteve C., Csaszar A., Nikander P., “Exploring the Pub/Sub Routing&Forwarding Space,” ICC Workshop on the Network of The Future, Dresden, Germany, June 2009.

9) Kjällman J., “Attachment to a Native Publish/Subscribe Network,” ICC Workshop on the Network of The Future, Dresden, Germany, June 2009.

10) Katsaros K., Fotiou N., Polyzos G. C., Xylomenos G., “Supporting Mobile Streaming Services in Future Publish/Subscribe Networks”, Wireless Telecommunications Symposium, Prague, Czech Republic, April 2009.

11) Fotiou N., Polyzos G., Trossen D., “Illustrating a Publish-Subscribe Internet Architecture”, Future Internet Architectures: New Trends in Service Architectures (2nd Euro-NF Workshop), Santander, Spain, June 2009.

12) Lagutin D., Tarkoma S., “Forwarding challenges and solutions for a publish/subscribe network”, ICT Mobile Summit 2009, Santander, Spain, June 2009.

13) Katsaros K., Bartsotas N., Xylomenos G., “Router assisted overlay multicast,” 5th Euro-NF Conference on Next Generation Internet (NGI 2009), Aveiro, Portugal, July 2009.

14) Jokela P., Zahemszky A., Esteve C., Arianfar S., Nikander P., “LIPSIN: Line speed Publish/Subscribe Inter-Networking”, SIGCOMM'09, Barcelona, Spain, August 2009.

15) Keinänen J., Jokela P., Slavov K., “NetFPGA Implementation of zFilter based Forwarding”, NetFPGA Developers’ Workshop, CA, USA, August 2009.

16) Katsaros K., V.P. Kemerlis, Stais C., Xylomenos G., “A BitTorrent Module for the OMNeT++ Simulator”. MASCOTS 2009, September 21-23, London.

17) Lagutin D., Tarkoma S., “Public Key Signatures and Lightweight Security Solutions in a Wireless Environment.” NEW2AN 2009, September 15-18.

18) Trossen D., “A Vision for an Information-centric Internet,” ITU World Forum Online Proceedings, October 8th, 2009.

19) Zahemszky A., Arianfar S..”Fast Reroute for Stateless Multicast.” The Workshop on Reliable Networks Design and Modelling, RNDM 2009, 14 October 2009.

20) Gajic B., Riihijärvi J., Mähönen P., “Performance Evaluation of Network Coding: Effects of Topology and Network Traffic for Linear and XOR Coding,” *Journal of Communications*, vol. 4, No. 11, pp. 885-893, November 2009.

21) Visala K., Lagutin D., Tarkoma S., “LANES: An Inter-Domain Data-Oriented Routing Architecture,” ReArch'09, December 1st, 2009.

22) Tarkoma, S., Ain, M., Visala, K., “The Publish/Subscribe Internet Routing Paradigm (PSIRP): Designing the Future Internet Architecture,” Towards the Future Internet - A European Research Perspective, 2009.

23) Lagutin D., Visala K., Tarkoma S., “Publish/Subscribe for Internet: PSIRP Perspective.” Towards the Future Internet - Emerging Trends from European Research, 2010.

24) Katsaros K., Xylomenos G., Polyzos G.C., “MultiCache: an incrementally deployable overlay architecture for information-centric networking,” IEEE INFOCOM WiP, San Diego, CA, USA, March 2010.

25) Katsaros K., Xylomenos G., Polyzos G.C., “A hybrid overlay multicast and caching scheme for information-centric networking,” 13th Global Internet Symposium, co-located with IEEE INFOCOM, San Diego, CA, USA, March 2010.

26) Zahemszky A., Jokela P., Särelä M., Ruponen S., Kempf J., Nikander P., “MPSS: Multiprotocol Stateless Switching,” 13th Global Internet Symposium, co-located with IEEE INFOCOM, San Diego, CA, USA, 2010.

27) Rajahalme J., “Incentive-informed Inter-domain Multicast,” 13th Global Internet Symposium, co-located with IEEE INFOCOM, San Diego, CA, USA, March 2010.

28) Gajic B., Riihijärvi J., Mähönen P., “Performance Evaluation of Network Coding in Middle-Sized Networks,” IEEE WCNC 2010, April 2010.

29) Zahemszky A., Gajic B., Esteve C., Reason C., Trossen D., Lagutin D., Tuononen J., Katsaros K., “Experimentally-driven research in Publish/Subscribe Information-centric Inter-Networking,” Tridentcom, May 2010.

30) Trossen D., Särelä M., Sollins K., “Arguments for a New Internetworking Architecture,” ACM SIGCOMM CCR, April 2010.

31) Lagutin D., Visala, K., Zahemszky A., Burbridge T., Marias, G. F., “Roles and Security in a Publish/Subscribe Network Architecture,” IEEE Symposium on Computers and Communications (ISCC'10), Riccione, Italy, June 2010.

32) Lagutin D., Tarkoma, S., “Cryptographic Signatures on the Network Layer – an Alternative to the ISP Data Retention,” IEEE Symposium on Computers and Communications (ISCC'10), Riccione, Italy, June 2010.

33) Fotiou N., Marias G.F., Polyzos G.C., “Fighting Spam in Publish/Subscribe Networks Using Information Ranking,” 6th Euro-NF Conference on Next Generation Internet (NGI 2010), Paris, France, June 2010 (best student paper award).

34) Katsaros K., Stais C., Xylomenos G., Polyzos G. C,. “On the incremental deployment of overlay information centric networks,” Future Network & Mobile Summit, Florence, Italy, June 2010.

35) Fotiou N., Marias G. F., Polyzos G. C., “Information Ranking in Content-Centric Networks,” Future Network & Mobile Summit, Florence, Italy, June 2010.

36) Xylomenos G., Cici B., “Socket Emulation over a Publish/Subscribe Network Architecture” Future Network & Mobile Summit, Florence, Italy, June 2010.

7 Selected list of presentations

While at the time of writing, the PSIRP project has had total 52 reported presentations in various events and forums (available on the PSIRP wiki), here we have selected a list of presentations that showcase our strong efforts during the project to boost awareness of PSIRP concepts and results mainly towards the developer community, academia, education/teaching, EU initiatives, national initiatives, international initiatives, international academia.

1) Trossen D., “PSIRP”, Future Internet Summer School, Aveiro (Portugal), 26.05.2010, ~50 persons in audience.
2) Kjällman J., “Blackhawk: A Publish/Subscribe System for FreeBSD”, FreeBSD Developer Summit 2010, Ottawa, Canada, 11.5.2010. Audience: ~100 persons.
3) Trossen D. “Panel on Future Internet Directions”, Panel at CoNEXT 2009 conference with Van Jacobson, Bruce Davie and others as panelist Audience: ~100 persons.
4) Fotiou N., “Towards an Information-Centric Network Architecture”, Presentation at Future Internet Cluster Workshop, Sophia Antipolis-France, 9 March 2010. Audience: ~20 persons.
5) Riihijärvi J., “PSIRP: An Information-Centric Internetworking Architecture based on Publish/Subscribe”, 2nd Japan EU Symposium on the "New Generation Network" and the "Future Internet", 13.10.2009 Audience: ~100 persons.
6) Jokela P., “LIPSIN: Line Speed Publish/Subscribe Inter-Networking”, SIGCOMM 2009, Barcelona, Spain, 18.-20.8.2009 Audience: ~300 persons.
7) Nikander P., “Pure Publish/Subscribe Inter-Networking”, Finnish ICT SHOK Future Internet Programme Phase 2 Kick-off, Tuusula, Finland, June 16 2009. Audience: ~100 researchers.
8) Trossen D., “Design for the Future Internet”, Computer Science 2008, Undergrad conference organized by UCL, 16.12.2008. ~35 persons in audience.
9) Nikander P., “Pure Publish/Subscribe Inter-networking”. MIT CFP Privacy & Security workshop, Cambridge, 21.10.2008. ~20 persons in audience

References

[D5.2] H. Flinck (ed.), PSIRP Deliverable 5.2: Dissemination and Exploitation Plan, 2008

[D5.3] H. Flinck (ed.), PSIRP Deliverable 5.3: Dissemination Report, 2008

[D5.4] H. Flinck (ed.), PSIRP Deliverable 5.4: Dissemination and Exploitation Report, 2009

[D5.5] H. Flinck (ed.), PSIRP Deliverable 5.5: Final Plan for Using and Disseminating Knowledge, 2010