



SEVENTH FRAMEWORK PROGRAMME
THEME ICT-1-1.1
SEVENTH FRAMEWORK PROGRAMME
THEME ICT-1-1.1
“Network of the future”

Project acronym: EFIPSANS

Project full title: **E**xposing the **F**eatures in **I**P version **S**ix protocols that can be exploited/extended for the purposes of designing/building **A**utonomic **N**etworks and **S**ervices

Proposal/Contract no.: INFISO-ICT-215549

D6.4 - Dissemination and Use Plan (DUP)

Project Document Number: EFIPSANS/CO¹/WP6/D6.4/v1.0 (official version)

Project Document Date: 30/06/2009

Work Package Contributing to the Project Document: WP6

Deliverable Type and Security: R/CO

Editor: Thorsten Ries (University of Luxembourg)

Abstract: As an update of D6.1, this Deliverable continues to describe the activities undertaken by the EFIPSANS project for the dissemination and awareness creation during the first 18 months. The dissemination was based on the EFIPSANS first results, dissemination provided to different target audiences, co-operation achieved with the IPv6 Forum and European IPv6 Task Force, the related IST projects, national and international initiatives.

The focus was on combining innovation with political leadership and extending “Ease of use to everyone”.

The dissemination activities follow the plans outlined in the deliverable D6.1

Keywords: EFIPSANS, Dissemination, D6.4

¹ Security Class: PU – Public; PP – Restricted to other programme participants (including the Commission); RE – Restricted to a group defined by the consortium (including the Commission), CO – Confidential, only for members of the consortium (including the Commission)

| | |
|----------------------------------|---|
| Project Number | INFSO-ICT-215549 |
| Project Name | Exposing the Features in IP version Six protocols that can be exploited/extended for the purposes of designing/building Autonomic Networks and Services |
| Document Number | INFSO-ICT-215549/EFIPSANS/CO/WP6/D6.4/v1.0 |
| Document Title | Dissemination and Use Plan (DUP) (regularly updated) |
| Work Package | WP6 |
| Editor | Thorsten Ries (University of Luxembourg) |
| Authors | Lesley Hanna (TSSG) Cynthia Wagner (University of Luxembourg) Thorsten Ries (University of Luxembourg) |
| Reviewers | Symeon Papavassiliou (ICCS) Aurel Machalek (University of Luxembourg) Giannis Katsaros (VELTI) |
| Contractual delivery date | 30/06/2009 |
| Delivery Date | 30/06/2009 |
| Version | 1.0 |

Executive Summary

In the scope of the EFIPSANS project, new cutting edge networking concepts and technological results are under design that will have an impact on the future of the Internet related issues, which are some of the major criteria in achieving robust, scalable, resilient, self-healing, self-configuring, self-recovering Internet dimensions through new autonomic features in the context of Future Internet and the new Internet economy. It is therefore important to publish and disseminate the results from the project through the appropriate channels and in a timely fashion, as well as to create and promote knowledge that could be exploited or used in further research and/or commercial applications.

This report summarises multiple dissemination activities undertaken in the EFIPSANS project during the past 18 months of the project.

The traditional channel of on-line dissemination such as presentations in international conferences, publications in scientific journals is used. In addition, the EFIPSANS website intends to show public results, training material, etc. to the public. Demonstrations in live and video presentation mode already have and will attract large number of audience.

The European IPv6 Task Force, the IPv6 Forum as well as the Public Safety & Communication Europe Forum have been used as strong dissemination and stakeholders' platforms.

Liaison with a number of IST projects, national and European agencies, as well as project's participation in standards activities through ETSI ISG and IETF participation Forum will actively raise its visibility to high levels.

Finally, all EFIPSANS project partners have developed clear ideas about how to use the know-how obtained from the EFIPSANS project in short term network deployment and operation. Therefore, knowledge having a potential for industrial or commercial application in research activities or for developing, creating or marketing a product or process, or for creating or providing a service is highlighted.

Table of Contents

| | |
|---|----|
| List of Tables | 5 |
| 1 Introduction | 6 |
| 2 Dissemination strategy | 7 |
| 2.1 EFIPSANS logo | 7 |
| 2.2 Internet presentation | 7 |
| 2.3 Internal Seminars | 9 |
| 2.4 Conferences, Workshops and Seminars | 9 |
| 2.4.1 List of scientific (peer reviewed) publications: M1 – M18 | 10 |
| 2.4.2 Future publications, submitted or under review | 14 |
| 2.4.3 Demonstration of SHIM6 at IETF/ICT Lyon | 17 |
| 2.4.4 Contributions to White Papers | 17 |
| 2.5 Dissemination of Knowledge | 17 |
| 2.5.1 Co-operation with other projects/Liaisons | 19 |
| 3 Standardisation | 20 |
| 4 Exploitation | 21 |
| 5 Further Plans | 29 |
| 5.1 Publications | 29 |
| 5.2 Dissemination | 29 |
| 5.3 Standardisation | 30 |
| 5.3.1 IETF RFC Draft proposal | 30 |
| 6 Conclusion | 32 |

List of Tables

| | |
|---|----|
| Table 1: List of scientific (peer reviewed) publications: M1 – M18..... | 13 |
| Table 2: List of future publications, submitted or under review..... | 16 |
| Table 3: Conferences: Participation and (Co) organization..... | 19 |
| Table 4: Exploitation plans..... | 25 |
| Table 5: Milestones Work Item 1..... | 27 |
| Table 6: Milestones Work Item 2..... | 28 |

1 Introduction

The EFIPSANS project aims at exposing the features in IP version six protocols that can be exploited or extended for the purposes of designing or building autonomic networks and services. What this means is, a study of the emerging research areas that target desirable user behaviours, terminal behaviours, service mobility, e-mobility, context-aware communications, self-ware, autonomic communication/computing/networking will be carried out, and out of these areas desirable autonomic (self-*) behaviours in diverse environments e.g. end systems, access networks, wireless versus fixed network environments will be captured and specified. Appropriate IPv6 protocol or architectural extensions that enable the implementation of the captured desirable autonomic behaviours will be sought and specified. A selected set of the specified autonomic behaviours will be implemented and demonstrated. Also, technical reports on the concrete IPv6 feature combination scenarios including any new extensions used to implement the selected set of autonomic behaviours will be presented. The vision is that the specified autonomic behaviour specifications, the identified exploitable IPv6 features and new protocol and architectural extensions will one day be standardized in the long run (after the first 3 years of EFIPSANS) i.e. maturing from being drafts to standards.

Current networking models imply a great complexity in network operation. Often, this complexity is so high that most networking engineers prefer to stay away from touching running systems and have tremendous anxiety in fixing failing systems. The famous saying, “Never touch a running system” has become a technology rule. It’s also used to block changes in systems and possibly put barriers to adding new technology paradigm such as IPv6. In order to be deployed widely new features must be simple to use. In the IPv4 Internet, the huge existing infrastructure makes it hard to introduce new easy-to-use features. The deployment of IPv6 is the opportunity to build in network features in a more complete way with enhanced ease of use and easier co-existence between safety and service accessibility. So, the EFIPSANS project addressed exactly this issue in introducing a new dimension of autonomicity to allow the introduction of IPv6 in networks in need of large-scale upgrading and become a viable solution to the extension of IPv6 in the next generation networks and the Future Internet at large.

The project has disseminated its first results and plans to various stakeholders with a clear message combining innovation and the needed political goodwill and leadership to ascertain the path to proper deployment in real world. The initiative of using Luxembourg as a showcase supported by the Luxembourg government office responsible for the entire government networks will be a cornerstone in this plan.

While developing the technical solution, EFIPSANS adhered to the objectives of **i-2010** initiative (A European Information Society for growth and employment²), addressing the information infrastructure that requires flexibility, trustworthiness, competence, efficiency and consistency in the operation of information infrastructure.

The EFIPSANS project took multiple initiatives to raise public participation and awareness through different links: European IPv6 Day, IPv6 Forum, EU IPv6 Task Force, Future Internet concertation meetings, OECD and links to national agencies, participation in national and international conferences and events, standards groups, etc., which are highlighted in the next sections. Furthermore, initial exploitable results have already been identified and an overview of how the created and obtained knowledge could be exploited or used in further research and/or commercial applications is highlighted.

This deliverable is an update to deliverable D6.1 – Dissemination and Use Plan (DuP).

² http://ec.europa.eu/information_society/eeurope/i2010/index_en.htm

2 Dissemination strategy

2.1 EFIPSANS logo

In order to be recognizable and identifiable, and showing the importance of IPv6 in the project, an EFIPSANS logo was developed, which is shown in Figure 1.



Figure 1: The EFIPSANS logo

2.2 Internet presentation

The EFIPSANS website got a major design update in February 2009 and can be found at www.efipsans.org (see Figure 2). Visitors searching for, “IPv6 autonomic networking” via Google, also find the site on the first page and information several times more. The site so far contains:

- 1 An overview of the project
- 2 News page
- 3 Information on the consortium members
- 4 An indication of the structure of the project
- 5 Links to other relevant projects and initiatives
- 6 Downloadable documents about the project
- 7 A list of EFIPSANS publications
- 8 An events list
- 9 The EFIPSANS survey

The site also has the opportunity for users with a user name and password to log in and get access to other, potentially confidential information and reports. This is not a facility used for the execution of the project. However, it is primarily aimed at providing information to reviewers and other authorized users in an easily accessible way. Although the website acts as a resource for partners wishing to carry out dissemination activities, day to day communication and deliverable management is carried out via the project wiki, an internal communication tool quite separate to the public website.



Figure 2: Screenshot of the EFIPSANS website

The website will be **updated at least once per month** to ensure that returning visitors have new features to see and to keep the content current. Particular emphasis will be given to:

1. Publicising the public versions of deliverables and making them available
2. Highlighting results from the project, such as example demonstrations and the socio-economic research. As an example, the presentations from Beijing (see also Table 3) are available as individual files and will be made available for download as an information resource
3. Promoting links with other projects and initiatives, especially the ETSI ISG.

2.3 Internal Seminars

Internal education is a mandatory process towards educating the “public” and raising the awareness of new technologies. Therefore, EFIPSANS plans regular internal workshops and tutorials for its partners.

- **Modelling workshop – 27. - 30. April 2009, Berlin**

Topic: Development of Advanced Systems Engineering Methodologies for the engineering of GANA’s Context-aware autonomic Decision-Making-Elements (DMEs/DEs) – potentially with cognitive properties, their Control-Loops, etc, including the application of methods like the OMG’s MDA approaches and Formal Description Techniques (FDTs) towards Simulations and Validations of complex autonomic behaviours, as well as Code-Generation from formal models of Context-aware DMEs/DEs for diverse networking environments, and design principles for the “evolvability” of GANA components (e.g. the DM

- **IPv6 Tutorial – 25 June 2009, Budapest**

Topic: The tutorial aimed to provide an overview of IPv6 topics like:

- IPv6 network management (tools, flows, etc.)
- IPv6 QoS (Classes of services, flow label usage, etc.)
- Security (IPv6 Threat analysis and security issues, firewalling with IPv6, etc.)
- IPv6 and IPv4
- IPv6 and 3G networks (address allocation using GPRS, IP Multimedia Subsystem (IMS), etc.)

2.4 Conferences, Workshops and Seminars

Events like Conferences, Seminars, or Workshops are considered to be a key dissemination activity. By publications or presentations of the EFIPSANS results, the project can be promoted to the relevant technical community and to the public in general. Chapter 3 lists accepted and held publications as well as the submitted papers and those under review respectively.

Partners have already made many publications in journals and conferences, during this first reporting period. More publications are scheduled for the next reporting period.

All papers accepted after peer-review up to 30 June 2009 are listed in Table 1. Where dates of publication have been made available, 21 publications are available to date (see next page).

2.4.1 List of scientific (peer reviewed) publications: M1 – M18

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|----|--|--------------------|---|-----------|-----------|----------------------|------|---------|----------------------|-------------|
| 1 | QoS Provisioning in Wireless Data Networks under Non-Continuously Backlogged Users | T. Kastrinogiannis | Proc. 6th Int. Symposium on Modelling and Optimization in Mobile, Ad-Hoc and Wireless Networks and Workshops (RAWNET 2008) | Apr. 08 | | Berlin | 2008 | 71-76 | | No |
| 2 | On the Problem of Joint Power and Rate Control in CDMA Ad Hoc Networks | T. Kastrinogiannis | Proc of 3rd International Symposium on Wireless Pervasive Computing (ISWPC) | May 08 | | | 2008 | 78-82 | | |
| 3 | Monitoring Issues for Autonomic Networks: The EFIPSANS Vision | A. Liakopoulos | 1st European Workshop on Mechanism for Future Internet | July 08 | | Salzburg (Austria) | 2008 | | | |
| 4 | Utility-based Uplink Power Control in CDMA Wireless Networks with Real-Time Services | T. Kastrinogiannis | Ad-hoc, Mobile and Wireless Networks (LNCS), Vol.5198 | Sept. 08 | Springer | | 2008 | 307-320 | | |
| 5 | Document Based Network and System Management | E. Hoefig | Proc. 2 nd ACM International Conference on Autonomic Computing and Communication Systems (Autonomics 2008) | Sept. 08 | | Turin (Italy) | 2008 | | | |
| 6 | Utility Based Short-Term throughput driven scheduling approach for efficient resource allocation | T. Kastrinogiannis | Wireless Personal Communications Journal, special issue on "Resource and Mobility Management and Cross-Layer Design for the Support of Multimedia Services in Heterogeneous Emerging Wireless Networks" | Nov. 08 | Springer | | 2008 | | | |

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|----|--|---------------------|---|----------------------------|-----------|----------------------|------|---------|----------------------|-------------|
| 7 | Requirements for a Generic Autonomic Network Architecture (GANA), suitable for Standardizable Autonomic Behavior Specifications of Decision-Making-Elements (DMEs) for Diverse Networking Environments | R. Chaparadza | International Engineering Consortium (IEC), Annual Review of Communications Volume 61 | Dec 08 | | | 2008 | | | |
| 8 | Game theoretic distributed uplink power control for CDMA networks with real-time services | T. Kastrinogiannis | Computer Communications | vol 32 iss 2 Feb. 09 | Elsevier | | 2009 | 376-386 | | No |
| 9 | An Opportunistic Combined Power and Rate Allocation Approach in CDMA Ad Hoc Networks | T. Kastrinogiannis | Proc. of IEEE Sarnoff Symposium on Advances in Wired and Wireless Communications | Apr. 08 | | | 2008 | 1-5 | | |
| 10 | Address Auto-configuration Methods in IPv6 Networks | F. Nemeth | HSN Workshop | May 09 | | | 2009 | | | |
| 11 | Efficient QoS-Driven Resource Allocation in Integrated CDMA/WLAN Networks - An Autonomic Architecture | G. Aristomenopoulos | CST Mobilight 2009 | May 09 | | Athens (Greece) | 2009 | | | |

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|----|---|---------------------|--|-----------|-----------|----------------------|------|-------|----------------------|-------------|
| 12 | Creating a viable Evolution Path towards Self-Managing Future Internet via a Standardizable Reference Model for Autonomic Network Engineering | R. Chaparadza | FIA 2009 (Published in Future Internet Book, Nov 2009) Feedback from ICT Mobile Summit & SOCRATES workshop (see ³) | May 09 | | Prague | 2009 | | | |
| 13 | A Utility-based Power Allocation Non-cooperative Game for the Uplink in Multi-Service CDMA Wireless Networks | E.E. Tsiropoulou | IWCMC | June 09 | | Leipzig (Germany) | 2009 | | | |
| 14 | A Unified Approach for Efficient Network Selection in Multi-Service Integrated CDMA/WLAN Systems | G. Aristomenopoulos | IWCMC | June 09 | | Leipzig (Germany) | 2009 | | | |
| 15 | Realization of QoS Provisioning in Autonomic CDMA Networks under Common Utility-Based Framework | E.E. Tsiropoulou | WoWMoM | June 09 | | Kos (Greece) | 2009 | | | |
| 16 | Demystifying Self-awareness of Autonomic Systems | M. Smirnov | ICT '09 Mobile summit | June 09 | | Santander (Spain) | 2009 | | | |

³ EFIPSANS had been invited to present the broader picture on Self-Management/Self-Organization, not just in the RAN but also the edge and core network environments for mobile and fixed nets. A number of participants were interested to know that we are addressing some Self-features even on the level of Routing, Forwarding, Discovery, etc, through the instantiation of GANA, beyond what they know from SON. Motorola USA has a research group that has recently started working on a similar approach to GANA, establishing some similar abstractions and interworking hierarchical control loops. The research director of the group followed through the GANA presentation and thinks we could have some co-operation. The issue of Stability in control loops was discussed briefly and some approaches were discussed but the conclusion is that there has to be some further research and continuous discussions to share knowledge on the subject. Projects like Self-NET (FIRE) are very much interested in having a joint workshop with EFIPSANS, since we have somewhat common approaches and/or issues to look into. They think a Workshop in November should be jointly organized. SOCRATES-E3-EFIPSANS-Workshop Slides: <http://www.fp7-socrates.eu/?q=node/31>

| | | | | | | | | | | |
|----|--|------------------|--|-----------|--|----------------------|------|--|--|--|
| 17 | An approach to Measurement Based Quality of Service Control for Communications Networks | A. Davy | IM 2009 Dissertation Digest | June 09 | | Long Island (NY-USA) | 2009 | | | |
| 18 | Defensive Configuration with Game Theory | S. Becker | IEEE/IFIP IM 2009 | June 09 | | Long Island (NY-USA) | 2009 | | | |
| 19 | Using Game Theory to configure P2P SIP | S. Becker | IPTComm 2009 | July 2009 | | Georgia, Atlanta | 2009 | | | |
| 20 | Joint Throughput Maximization and Fair Uplink Transmission Scheduling in CDMA Systems | S. Papavassiliou | EURASIP Journal on Wireless Communications and Networking, Vol. 2009 Art. ID: 564692 | 2009 | | | 2009 | | | |
| 21 | QoS-Driven Uplink Power Control in Multi-Service CDMA Wireless Networks - A Game Theoretic Framework | E.E. Tsiropoulou | Accepted to appear in Journal of Communications (JCM) | 2009 | | | 2009 | | | |

Table 1: List of scientific (peer reviewed) publications: M1 – M18

2.4.2 Future publications, submitted or under review

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|-----------|---|---------------------|--|------------------|--|-----------------------------|-------------|--------------|-----------------------------|--------------------|
| 1 | An Autonomic QoS-centric architecture for integrated CDMA/WLAN networks | FLE, ICCS | Wireless Communication Magazine. Under Review | | IEEE. | | | | | TBD |
| 2 | Non-cooperative power control in CDMA wireless networks | E.E. Tsiropoulou | Game Theory for Wireless Communications and Networking | | Auerbach Publications, CRC Press, Taylor & Francis Group | | 2009 | | | |
| 3 | Enabling Efficient QoS-Driven Resource Management in Heterogeneous Wireless Networks via Autonomicity | G. Aristomenopoulos | | | Journal, Under submission | | | | | |
| 4 | Intrinsic Monitoring using Behaviour Models in IPv6 Networks | E. Höfig | Submitted to MACE 2009 (part of Manweek) | Oct. 09 | | | 2009 | | | |

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|----|---|------------------|---|-----------|-----------|----------------------|------|-------|----------------------|-------------|
| 5 | Model-based integrated management: applying autonomic systems engineering to network and systems management | E. Höfig | Will be printed by the Int. J. Autonomous and Adaptive Communications Systems | | | | 2009 | | | |
| 6 | Implementing Autonomic Fault-Management and Reactive Resilience following the GANA Architectural Design Principles | R. Charparadza | Submitted to IPOM 2009 (part of Manweek) | Oct. 09 | | | 2009 | | | |
| 7 | An approach to designing and implementing Autonomic Forwarding in the GANA based Self-Managing Future Internet Architecture | R. Charparadza | Submitted to IPOM 2009 (part of Manweek) | Oct. 09 | | | 2009 | | | |
| 8 | Monitoring within an Autonomic Network: A GANA based Network Monitoring Framework | A. Zafeiropoulos | Submitted to IPOM 2009 (part of Manweek) | Oct. 09 | | | 2009 | | | |

| No | Title | Main author | Title of periodical | Date / No | Publisher | Place of publication | Year | Pages | Permanent identifier | Open access |
|-----------|--|--------------------|--|------------------|------------------|-----------------------------|-------------|--------------|-----------------------------|--------------------|
| 9 | Technological Challenges for Assuring Business Benefits of Future Internet | S. Naqvi | Submitted to IPOM 2009 (part of Manweek) | Oct. 09 | | | 2009 | | | |
| 10 | A holistic Reference Model for Self-Management within Node and Network Architectures | R. Charparadza | Submitted to the IEEE Communications Magazine (under revision). | | | | 2009 | | | |
| 11 | OSPF for Implementing Self-adaptive Routing in Autonomic Networks: a Case Study | G. Rétvári | The fourth IEEE International Workshop on Modelling Autonomic Communication Environments (MACE 2009) | Oct. 09 | | | 2009 | | | |

Table 2: Future publications, submitted or under review

2.4.3 Demonstration of SHIM6 at IETF/ICT Lyon

TSSG showed an implementation of SHIM6 at the IETF meeting in Dublin in 27.07.-01.08.2008. SHIM6 was also presented at the ICT Summit in Lyon (25-27 November 2008) as part of the IPv6 showcase.

SHIM6 is an IETF proposed protocol for site multi-homing in an IPv6 environment; allowing hosts on multi-homed sites to use a set of provider-assigned IP address prefixes and switch between them without upsetting transport protocols or applications. The presentation from the EFIPSANS project will show an initial implementation of this protocol used in a policy management environment. The policy contains the criteria to be used by the system to autonomically select the "best" service provider.

This presentation was provided by the TSSG research organisation at the Waterford Institute of Technology in Ireland.

2.4.4 Contributions to White Papers

Contribution to the eMobility White paper: Standardization and Regulatory Roadmaps: Questionnaire to EC FP7 D1 Projects

Contribution to the Self-Management White paper (Future Internet Assembly Initiative – FIA): The perspective of focus in EFIPSANS with regards to Future Internet Design is Self-Management of the Future Internet as powered by autonomic Decision-Making-Elements (DMEs) embedded within the nodes/devices of the Future Internet architecture. Therefore, EFIPSANS plans to contribute to the Self-Management White paper to be drafted soon.

2.5 Dissemination of Knowledge

The following table (Table 3) summarises the conferences and workshops EFIPSANS participants attended. All the listed events provided opportunities for EFIPSANS participants to introduce the work carried out as part of the project and disseminate the accumulated knowledge to scientists and professionals. This was performed either during their Keynote speeches or simply by introducing the EFIPSANS concept to people working in the relative fields.

| Date | Location | Topic | Participants |
|------------|------------|--|---|
| 24.01.2008 | Luxembourg | Kick-off meeting | UL, Ericsson, Fokus, ALL |
| 02.02.2008 | Boston | MIT OLPC Project | Latif Ladid |
| 24.02.2008 | Tel Aviv | Internet Society Israel IPv6 Conference - Keynote speech | Latif Ladid |
| 14.03.2008 | Abu Dahbi | Keynote Speech at the Gulf IPv6 Summit | Latif Ladid |
| 31.03.2008 | Berlin | Workshop on Resource Allocation in Wireless Networks | Symeon Papavassiliou, Timotheos Kastrinogiannis |
| 12.04.2008 | Beijing | Beijing IPv6 Summit; Speech at BUPT | Latif Ladid |
| 30.04.2008 | Bled | Future Internet Bled Conference | Latif Ladid, Andras Toth, Thomas Engel, Ranganai Chaparadza |

| | | | |
|----------------|-------------------|--|--|
| 28-30.04.2008 | Princeton | IEEE Sarnoff Symposium on Advances in Wired and Wireless Communications | Vassilis Karyotis |
| 06.05.2008 | Berlin | Keynote Speech at the Berlin IPv6 Summit | Latif Ladid |
| 08.05.2008 | Berlin | IPv6 and Autonomic Networking at the Berlin IPv6 Summit | Ranganai Chaparadza |
| 07-09.05.2008 | Santorini | International Symposium on Wireless Pervasive Computing | Symeon Papavassiliou, Timotheos Kastrinogiannis |
| 19.05.2008 | Manila | Keynote Speech at the Manila IPv6 Summit | Latif Ladid |
| 27.05.2008 | Stockholm | EFIPSANS GA | All |
| 30.05.2008 | Brussels | European IPv6 day | LL, AT, RC, KQ, ML, VK (FLE) |
| 11.06.2008 | London | Informa conference "IP Netowrk Transformation Forum 2008" | TSSG (Speaker) |
| 16.06.2008 | Seoul | Eur-Korea Cooperation Conference | Latif Ladid |
| 17.06.2008 | Seoul | OECD Ministerial Meeting Seoul | Latif Ladid |
| 18.06.2008 | Seoul | Seoul IPv6 Summit | Latif Ladid |
| 10-12.09.2008 | Sophia, Antipolis | Conference on Ad-Hoc, Mobile, and Wireless Networks, ADHOC-NOW 2008 | Symeon Papavassiliou, E.E. Tsiropoulou |
| 30.09.2008 | Brussels | Self-Management Workshop - 2nd Concertation Meeting | FOKUS (Workshop Organizer) |
| 12.+13.01.2009 | France | SON Workshop (3GPP) | FLE (Attendee) |
| 22+23.01.2009 | Brussels | Paradiso conference "ICT for a global sustainable future" | Latif Ladid |
| 28.01.2009 | Dublin | IPv6 Summit | TSSG (Organizer) |
| 28.01.2009 | Luxembourg | IPv6 conference for Luxembourg with the Lux government in the presence of Minister Schiltz, Ministry of Communications | UL |
| 26+27.02.2009 | Sophia Antopolis | ETSI ISG AFI Meeting | TSSG, TARC-PL, Fokus, ALF, Ericsson (Irl), GRNET, UL, FLE, |
| 14.03.2009 | Abu Dahbi | Keynote Speech at the Gulf IPv6 Summit | Latif Ladid |
| 23.03.2009 | Brussels | IPv6 Workshop (Chair) | Latif Ladid |
| 24.03.2009 | Boston | Meeting with Tim Berners-Lee | Latif Ladid |
| 15.+16.04.2009 | Beijing | Self-Managing Future Internet Workshop - "Self-Managing Future Internet powered by IPv6/IPv6++" | Ericsson AB, FOKUS (Workshop Organizer), BUPT, UL |
| 16.04.2009 | Beijing | QoS Mobility Management in Autonomic Networks | ICCS, BUPT, FLE |
| 11.+12.05.2009 | Prague | FIA Prague | TSSG, Latif Ladid |
| 14+15.05.2009 | Berlin | German IPv6 Summit 2009 (Chairman) | Latif Ladid |
| 18-20.05.2009 | Athens | International Conference on Mobile Lightweight Wireless Systems | G. Aristomenopoulos |
| 10-12.06.2009 | Santander | ICT Mobile Summit 2009 - "Self-organization for Beyond 3G Wireless Networks" | FOKUS (Workshop Organizer) |
| 14.+15.06.2009 | Dresden | IEEE ICC 09 – NGN Symposium (Chair) | Latif Ladid |
| 15-16.06.2009 | Kos | Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM). | E,E. Tsiropoulou |

| | | | |
|---------------|---------|---|---------------------------------------|
| 15.06.2009 | Kos | Workshop on Autonomic and Opportunistic Communications | Symeon Papavassiliou (Panel Speaker) |
| 21-24.06.2009 | Leipzig | International Wireless Communications and Mobile Computing Conference | G. Aristomenopoulos, E.E. Tsiropoulou |

Table 3: Conferences: Participation and (Co) organization

2.5.1 Co-operation with other projects/Liaisons

EFIPSANS established a number of liaisons for exchange of know-how, joint trials, dissemination and training events with the US and Japan.

- **Autonomic networking**

Joint workshops were held at different Future Internet events together with E3, SOCRATES, 4WARD, AUTOI, AUTONETS, etc. Exchanging ideas, presenting results, aligning concepts is the major goal for these meetings. Evaluation for possible closer collaboration is in progress.

- **IPv6**

A worldwide cooperation effort with similar Asian projects has been started especially with Korea, India, Taiwan and Australia under the auspices of the IPv6 Forum (Figure 3).



Figure 3: Overview of IPv6 cooperation

3 Standardisation

The EFIPSANS Group has taken a bold step in forming an ETSI Industry Specification Group (ISG) after a number of negotiation steps with the ETSI Strategy leader. This initiative has taken effect in its first meeting at the ETSI facilities in February 26-27, 2009 in Sophia-Antipolis.

This ISG is called: **Autonomic network engineering for the self-managing Future Internet** a.k.a. **“Autonomic Future Internet” (AFI)**. One of the Sub-Groups of the ISG will focus on the Definition of a viable roadmap of an evolutionary path for today’s network models, architectures, protocols such as IPv6 (towards IPv6++) and paradigms as necessitated by the Generic Autonomic Network Architecture (GANA) being introduced by EFIPSANS. The definition of a roadmap of an evolutionary path should be achieved through recommendations that can then be considered by the relevant bodies towards the evolution of the protocols recommended for evolution or extensions. For this, the ISG will liaise with relevant bodies such as IETF, 3GPP, etc.

The reason for this initiative is that the landscape of autonomic networking is crowded with researchers with no industrial exploitation plans and no vision for business opportunity and lacking a platform for a harmonized and pragmatic strategy towards establishing European leadership in designing the future internet.

ISG AFI officials:

- Ranganai Chaparadza, Fokus, was appointed as chairman of ISG AFI.
- Kevin Quinn, Waterford Institute (WIT), was appointed as Secretary of AFI ISG by the Chairman

ISG website: http://portal.etsi.org/portal_common/home.asp?tbid=727

4 Exploitation

All EFIPSANS project partners have clear ideas about how to use the know-how obtained from the EFIPSANS project in short term network deployment and operation.

This section will present results which are considered by the partners to have potential for exploitation, defined as knowledge having a potential for industrial or commercial application in research activities or for developing, creating or marketing a product or process or for creating or providing a service.

It provides a brief summary, per exploitable result, of how the knowledge could be exploited or used in further research.

| Exploitable Foreground | Exploitable products or measures | Sectors of application | Timetable for commercial use | Patents or other IPR exploitation | Owner and other beneficiaries |
|---|---|-------------------------------|---|--|--|
| AFI Industry Standardisation Group in ETSI | Participation to bring about industry specification standards | Telecoms industry | TBA | None | TID and Telefónica's Business Units (Telefónica Wholesale Services, Telefónica España, O2, Telefónica in Latin America), WIT/TSSG Fraunhofer FOKUS |
| Understanding of likely standardisation activities regarding autonomic networks | Standardisation of EFIPSANS activities on autonomic networks via the Telefónica standardisation committee, which has a presence in all the countries where Telefónica operates | Telecoms industry | TBA | None | TID and Telefónica's Business Units (Telefónica Wholesale Services, Telefónica España, O2, Telefónica in Latin America) |
| Results and outcomes of research into autonomic systems - research papers (see entries in list of publications) | Development of ideas and knowledge within WIT leading to increased participation in research in this area The work on the Admission Control algorithm is already being used in the taught master's research course | Telecoms industry | Current and ongoing | None | WIT/TSSG |
| SHIM6 Presentation Demo | Implementation of the SHIM6 protocol code | Telecoms industry | Current. The demo will be developed further and used at future events | None | WIT/TSSG |
| Results and outcomes of research into autonomic networks (see entries in list of publications): | Involvement of students as part of their diploma thesis Use of project results in teaching | Telecoms industry | Current and ongoing | None | ICCS |

| Exploitable Foreground | Exploitable products or measures | Sectors of application | Timetable for commercial use | Patents or other IPR exploitation | Owner and other beneficiaries |
|--|---|--|------------------------------|-----------------------------------|-------------------------------|
| <p>1) Autonomic QoS-aware resource management in CDMA, WLAN and OFDMA networks</p> <p>2) Autonomic joint resource management over heterogeneous wireless networks (both theoretical and architectural level)</p> <p>3) Autonomic QoS-driven power and rate control in CDMA ad-hoc networks</p> <p>4) Autonomic mobility and QoS management architecture over an integrated heterogeneous environment in line with 3GPP/LTE</p> | <p>undergraduate and graduate students.</p> <p>To contribute part of the developed architecture to ETSI 3GPP standardization bodies.</p> <p>(See Note 1 for further explanation)</p> | | | | |
| Use of cross-layer technology for integration of overlay protocol data IPv6 extension headers to improve P2P network security and systems performance | A native IPv6-ready P2P system implemented under GNU GPL, directed at end users | Telecoms End-user | 2010 and beyond | None | UL |
| The main outcome of the ASP protocol (Task 3.1), to ensure autonomous and efficient sleep scheduling of sensors in a mobile environment | An improved product/service which extends the lifetime of the network | Environmental monitoring, industrial monitoring critical infrastructures, road traffic management | 2010 and beyond | None | BME |

| Exploitable Foreground | Exploitable products or measures | Sectors of application | Timetable for commercial use | Patents or other IPR exploitation | Owner and other beneficiaries |
|---|--|---|------------------------------|-----------------------------------|-------------------------------|
| The main outcome of the LUD protocol (Task 3.1), the ability to disseminate emergency-related messages among vehicles in an effective manner using the digital map instead of signalling to determine the zone of relevance | Extension of the capabilities of existing products and enabling the deployment of more sophisticated traffic control applications | Road traffic management | 2010 and beyond | None | BME |
| Output of the topology-aware P2P applications in Task 3.5: (1) the (generic) understanding of how network topology information can be gathered; (2) understanding of how topology information can be used in the Kad network; (3) the (generic) understanding of how network topology information can be used in different peer-to-peer architectures to provide topology-awareness | A generic framework and interfaces for topology-aware peer-to-peer applications and interaction with network operators A topology-aware Kad client, compatible with the current Kad network | Internet applications (P2P: mainly file sharing, but applicable to other data-intensive P2P applications) | 2010 and beyond | None | BME/ open source |
| GANAs Architectural Reference Model | Contribute the GANA Specifications to the AFI Industry Specification Group in ETSI. (See Note 2 for further explanation) | Fixed, wireless and mobile networks | 2010 | TBA | FOKUS |

| Exploitable Foreground | Exploitable products or measures | Sectors of application | Timetable for commercial use | Patents or other IPR exploitation | Owner and other beneficiaries |
|-----------------------------|---|-------------------------------------|------------------------------|-----------------------------------|-------------------------------|
| DE Specifications | Contribute the DE Specifications to the AFI Industry Specification Group in ETSI (See Note 2 for further explanation) | Fixed, wireless and mobile networks | 2010 | TBA | FOKUS |
| Requirements specifications | Contribute the Requirements Specifications to the AFI Industry Specification Group in ETSI (See Note 2 for further explanation) | Fixed, wireless and mobile networks | 2010 | TBA | FOKUS |

Table 4: Exploitation plans

Notes and detailed exploitation intentions

Note 1:

As a direct result of work undertaken within the EFIPSANS project, the involved partners are using the knowledge gained as follows:

- To involve students in the field of electrical and computer engineering - as part of their diploma thesis – in the design and evaluation of several components (i.e. algorithms, architectures, software) associated with autonomic networking and IPv6 networks. This will help highly qualified students to get familiar with and further exploit the potentials and benefits offered by the evolving area of autonomic networks.
- To contribute part of the developed architecture to ETSI 3GPP standardization bodies via its close collaboration and joint developments with industrial partners (such as FLE).

- Furthermore, ICCS has been involved for a considerable number of years in wireless network research and design and many of the ensuing problems, a fact that can further benefit EFIPSANS' development in a real world context. We believe however that the benefits will be both way: EFIPSANS offers the right cooperative background for ICCS to further develop and implement research ideas in the area, and therefore realize the aforementioned targets.

Note 2:2.1 Exploitable foreground

EFIPSANS targets IPv6 as the starting point for engineering autonomicity in networks and services, in which case the protocol features that form the ground for engineering autonomic behaviours are explored, exposed and or extended with complementary protocol and or architectural features as explained in the EFIPSANS vision. The vision of EFIPSANS is accepted by the Future Internet Community as what realistically creates a Evolution Path towards the Self-Managing Future Internet powered by IPv6/IPv6++(an evolved IPv6), because the Networking Community is much in favor of hearing about Evolutionary approaches towards the Future Internet. EFIPSANS is now producing a number of Extensions to IPv6 towards IPv6++ (see D2.2 and D2.3).

Over the years, the industry (both in Germany and across the globe), has benefited a lot from co-operative research with Fraunhofer-FOKUS. FOKUS has played and continues to play a significant role in fostering new technologies that benefit a wide range of industrial sectors. The plan is to continue that trend by fostering technologies related to the emerging and evolving area of Autonomic (Self-managing) Systems to our customers and partners through showcases using our Demo facilities in FOKUS. We also plan to use the results of EFIPSANS to strengthen our competitiveness and share knowledge related to Autonomics with other Researchers and the industry in order create further research projects. Currently, a number of partners from the industry come to use the FOKUS testbeds such as the 3Gb testbed and the E-government lab, which are considered well equipped to demonstrate advanced scenarios in relevant technologies. Our plan is to make our Autonomic Communication Lab (ACLab) a competitive lab for showcasing Autonomic Scenarios from a very practical point of view. This is why we plan to exploit all the frameworks developed in EFIPSANS to strengthen our competitiveness.

2.2. Exploitable product(s) or measure(s)

EFIPSANS invented and introduced the **GANA Architectural Reference Model** for autonomic network engineering/Self-Management within Node/Device and Network Architectures of the Future Internet. The GANA and the Decision Elements that EFIPSANS is developing opens a lot of opportunities to bring the field of Autonomics/Self-Management to Standardization Bodies for industrial exploitation by the wider community. Fraunhofer FOKUS is chairing the newly established Industry Specification Group in ETSI. Together with other EFIPSANS partners, Fraunhofer will exploit EFIPSANS innovations as follows:

1. Continue to evolve GANA and contribute the GANA Specifications to the AFI Industry Specification Group in ETSI for input to the Group Specifications to be produced and made public by AFI in 2010, in particular, to **AFI Work Item (WI) #2: Generic Autonomic Network Architecture (GANA)**.
2. Contribute the DE Specifications to the AFI Industry Specification Group in ETSI for input to the Group Specifications to be produced and made public by AFI in 2010, in particular, to **AFI Work Item #2: Generic Autonomic Network Architecture (GANA)**.
3. Contribute the Requirements Specifications to the AFI Industry Specification Group in ETSI for input to the Group Specifications to be produced and made public by AFI in 2010, in particular, to **AFI Work Item #1: Scenarios, Use Cases, and Requirements for Autonomic/Self-Managing Future Internet**.

2.3. Sectors of application

The main sector of Application is the Networking Sector, covering diverse types of networks: fixed, wireless and mobile networks.

2.4. Timetable for use

The following are the Milestones defined by the AFI, to which Fraunhofer plans to contribute EFIPSANS innovations, in parallel with internal exploitation of the EFIPSANS results.

AFI Work Item (WI) #1: Scenarios, Use Cases, and Requirements for Autonomic/Self-Managing Future Internet.

WI Leader: France Telecom (the Rapporteur).

The following are the Milestones associated with this Work Item.

| Status | Milestone | Action | Action Nb | Target | Achieved | Version |
|------------|-----------------------------------|--------|-----------|------------|------------|---------|
| 0 | Creation of WI by WG/TB | | | 2009-02-27 | 2009-02-27 | 1.1.1 |
| 0 a | TB adoption of WI | | | 2009-02-27 | 2009-02-27 | |
| 1 | Start of work | | | 2009-02-27 | 2009-02-27 | |
| 8 | TB approval | | | 2010-03-31 | | |
| 8 A | Draft receipt by ETSI Secretariat | | | 2010-04-14 | | |
| 12 | Publication | PU | | 2010-05-15 | | |

Table 5: Milestones Work Item 1

AFI Work Item (WI) #2: Generic Autonomic Network Architecture (GANA)**WI Leader: Alcatel-Lucent (the Rapporteur).**

The following are the Milestones associated with this Work Item.

| Status | Milestone | Action | Action Nb | Target | Achieved | Version |
|------------|-----------------------------------|--------|-----------|------------|------------|---------|
| 0 | Creation of WI by WG/TB | | | 2009-02-27 | 2009-02-27 | 1.1.1 |
| 0 a | TB adoption of WI | | | 2009-02-27 | 2009-02-27 | |
| 1 | Start of work | | | 2009-02-27 | 2009-02-27 | |
| 8 | TB approval | | | 2010-06-30 | | |
| 8 A | Draft receipt by ETSI Secretariat | | | 2010-07-14 | | |
| 12 | Publication | PU | | 2010-08-11 | | |

Table 6: Milestones Work Item 2

2.5. Patents or other IPR exploitation

We plan to identify the solutions from our RTD work in WP1, WP2 and WP4 for which we can apply for Patents.

2.6. Other Exploitable product(s) or measure(s)

EFIPSANS is developing Decision Elements (DEs) that govern the autonomic behaviors of nodes/networks. The following listed functionalities will have Decision Elements (DEs) prototyped and validated such that partners involved can exploit them.

- Routing and Autonomicity.
- Auto-Discovery, Auto-Configuration/Self-Configuration and dynamic Re-Configuration.
- Mobility Management and Autonomicity.
- QoS Management and Autonomicity.
- Resilience, Survivability, and/or Autonomicity.
- Autonomic Fault-Management.
- The role of Monitoring in enabling Autonomicity, and Self-Monitoring/Autonomic Monitoring as an autonomic feature.

5 Further Plans

5.1 Publications

As the project proceeds, so the number of publications will grow with the majority of publications being submitted in the last 12-15 months of the project. While having 21 publications until now (see Table 1), the aim of the project is to demonstrate 70 peer-reviewed papers, conference contributions or book chapters by the end of the project.

At least five publications will be submitted to trade magazines or other more general publications in order to make information on the project accessible more widely.

5.2 Dissemination

The project aims to maintain the same high level of engagement as shown with 39 dissemination events during the first 18 Month (see Table 3) with a target of at least 20 dissemination events per year. Already planned event participations are:

- 07-09 September 2009: Broadband World Forum 2009. Paris, France (Fokus, VELTI, All)
- 24-27 November 2009: ICSOC & ServiceWave 2009 – 2nd Workshop on Service Monitoring, Adaptation and Beyond (“Mona”). Stockholm, Sweden (Fokus, VELTI, All)

To allow the involvement of the interested parties with less expertise in the area, and even the general public, a video presentation is planned which will demonstrate the value of the work within the EFIPSANS project and the positive impact which the resulting technology will have on everyday life.

In addition, a “real life” scenario demo is planned, optimally related to the video presentation, to show the relevance of the developed approaches to future network requirements. This demo could be shown together with another, more practical EU project for instance to improve inter-project collaborations.

General future dissemination activities of the partners:

- Submit Conference/Workshop/Journal Papers from the content in the Deliverables and RTD achievements from all WPs
- EFIPSANS will seek to co-organize a Workshop with FP7 projects such as Self-Net (FIRE) to exchange knowledge on applicable solutions to addressing Stability in control-loops, including the approaches EFIPSANS has identified as viable approaches.
- Participation in FIA meetings
 - Contribute Requirements, Use Cases and Scenarios to the AFI Work Item (WI) #1: Scenarios, Use Cases, and Requirements for Autonomic/Self-Managing Future Internet.
 - Contribute the GANA concepts to AFI Work Item (WI) #2: Generic Autonomic Network Architecture (GANA).
 - Contribute to the Future Work Items to be defined by the AFI, especially on the definition of an Evolution Path for today’s protocols (in particular IPv6), network models and paradigms.

- Participation in IETF meetings
 - Submit IETF Draft RFCs on the EFIPSANS developments such as extensions to Ipv6 protocols (see also Deliverable D2.3)

In addition the following dissemination activities are planned from individual partners:

VELTI tries to organize (as EFIPSANS) a workshop in VELTI premises inviting technical people from Telecom and IT industry to interact with EFIPSANS technical experts and other researchers from autonomic computing sector. Such an interaction is expected to benefit EFIPSANS working groups by clarifying problematic parts and implementation issues, evaluate concept acceptability and get feedback about immediate commercial deployment.

They also try to organize project internal training events (e.g. schools) where EFIPSANS partners will have the opportunity to better comprehend underlying concepts, get trained in practices and methodologies applied by different work groups, get answers in specific individual problems and exchange ideas on important issues (e.g. real system application and deployment, existing infrastructures expandability, implementation and integration requirements, expected problems, etc).

TID will promote EFIPSANS project concepts and commercial deployment towards Telefónica's business units. This will be done through TID representation in Telefónica's internal Standardization Committee. This committee is responsible for setting out the international strategy for Telefónica's work in standards.

5.3 Standardisation

Our ISG initiative will facilitate harmonisation towards achieving meaningful specifications for the Self-Managing and Autonomic Future Internet that could be adopted by the industry. Consequently, the Generic Autonomic Network Architecture (GANA) shall be set as general Reference Model for Autonomic Network Engineering.

The EFIPSANS Group has also taken steps engaging some IETFers to collaborate with them in preparing RFC proposals addressing the autonomic features. The first expert has been invited to speak at the next General Assembly in Athens, Greece in October.

5.3.1 IETF RFC Draft proposal

Within T4.1, TSSG has defined a number of Hop-by-Hop extension headers for the purpose of Intrinsic Monitoring in accordance with the EFIPSANS monitoring framework. The detailed definition of extension headers have been defined in an Internet Draft proposal entitled IPv6 Hop-by-hop monitoring option header. The security issues faced by the deployment of such extensions within an operational network environment are also considered and some initial thoughts have been proposed. A publication discussing these issues have been is submitted to the IPOM conference as a work in progress paper, entitled "Security Considerations for Intrinsic Monitoring within an Operational Network"⁴.

⁴ Lei Shi and Alan Davy, "Security Considerations of Intrinsic Monitoring within an Operational Network", submitted to IEEE International Workshop on IP Operations and Management", Venice, Italy, October 29 - 30, 2009.

From the implementation viewpoint, the network simulation tool OPNET has been enhanced to allow for tests with the designed hop-by-hop headers. The user-space application utilizing the proposed extension headers and adoption of Linux kernel are currently in progress. The experimental results are vital for performance evaluation. Demonstrating the advantages of the proposed mechanisms is the base for convincing real deployment. During this phase, initial contact with the Working Group chairs of the v6OPS group within the IETF has begun.

In addition, Deliverable **D2.3 - Initial Draft Specification of the required extensions to IPv6 protocols** describes possible extensions to IPv6 with the aim to create an RFC proposal later on. Proposed extensions include:

- IPv6 extensions for Dynamic Resource Configuration
- IPv6 Extension Header for Intrinsic Monitoring
- ICMPv6 extensions for DE to DE communication
- NDv6 extension for Auto-configuration in Multi-hop Set-ups
- DHCPv6 extension for Accessing ONIX Services
- DHCPv6 extension for Autonomic DHCP Relaying

6 Conclusion

The project used several channels for dissemination and awareness creation activities to raise the visibility of the project. The scientific and technical achievements of the project are getting a good level of momentum in the right direction, with usage and exploitation routes directly into the development departments of major industrial companies and key people and organisations in the standards arenas.

In summary, EFIPSANS produced in the first 18 month:

- 21 reviewed publications
- 11 papers that are already submitted or under review
- EFIPSANS partners went to 38 conferences as, amongst others, keynote speaker, chairman, panel speaker, etc.
- Creation of an ISG: Autonomic network engineering for the self-managing Future Internet a.k.a. “Autonomic Future Internet” (AFI)
- Defined one IETF RFC Draft proposal, and currently defining more extensions related to IPv6, ICMPv6 and DHCPv6, with the aim to create one or more additional RFC proposal(s)