



## INFSO-ICT-316384 SEMAFOUR

### D6.3

#### *Dissemination Plan*

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#### **Abstract**

This document contains the dissemination plan of the SEMAFOUR project. It describes how results and knowledge will be exchanged among the partners of SEMAFOUR, with other European projects, with the scientific community and with standardisation bodies and other fora.

#### **Keywords:**

Dissemination instruments, project workshops, liaisons to standardisation bodies and other fora.

## **Executive Summary**

This document contains the dissemination plan of the SEMAFOUR project. It describes how results and knowledge will be exchanged among the partners of SEMAFOUR, with other European projects, with the scientific community and with standardisation bodies and other fora.

Dissemination of the project results is an important activity within SEMAFOUR. It draws upon the results in all technical work packages and all partners are involved in the dissemination process. The dissemination activity is part of Work Package 6 ('Dissemination and Exploitation') and runs over the total duration of the project.

The SEMAFOUR project already developed several dissemination instruments, such as a website, a leaflet, a mailing list, etc. Some of these are used for introducing the SEMAFOUR project to the public, while others are instruments for the easy exchange of information among the project partners.

Dissemination to peers in research will be achieved through presentations at conferences, publications in journals, etc. To date, a number of contributions have already been made, though it is anticipated that the most significant publications will occur when technical results become progressively available.

Further dissemination of the project results to the scientific community will occur through the two public workshops the SEMAFOUR project has planned, and through cooperation with related projects in the 'Future Networks' FP7 project portfolio.

Since the challenging topic of self-management in heterogeneous networks is also covered in various standardisation bodies and other fora, like 3GPP and NGMN, SEMAFOUR identified a number of fora as potentially interesting initiatives to liaise with and to make contributions to.

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## List of Acronyms and Abbreviations

3G	3rd Generation mobile wireless communication system (UMTS, HSPA)
3GPP	3rd Generation Partnership Project
ANR	Automatic Neighbour Relations
CFP	Call For Papers
COST	European Cooperation in Science and Technology
EDGE	Enhanced Data rates for GSM Evolution
EPC	Evolved Packet Core
FP7	Seventh Framework Program
FTTX	Fibre To The X
HSPA	High Speed Packet Access
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IPR	Intellectual Property Rights
KPI	Key Performance Indicator
LAN	Local Area Network
LTE	Long Term Evolution
LTE-A	Long Term Evolution – Advanced
M2M	Machine to Machine communication
MAN	Metropolitan Area Network
MAC	Medium Access Control layer
MDT	Minimisation of Drive Tests
MRO	Mobility Robustness Optimisation
NGMN	Next Generation Mobile Networks
O&M	Operation & Management
OB	Operating Business
OSS/BSS	Operations Support System / Business Support System
PB	Project Board
PCI	Physical Cell ID
PHY	PHYSical layer
RAN	Radio Access Network
RAS	Radio Access and Spectrum
RAT	Radio Access Technology
RDC	Radio Design Council
RRM	Radio Resource Management
SON	Self-Organising Network
VAS	Value Added Services
WG	Working Group
WiMax	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Network
WP	Work Package
WWRF	Wireless World Research Forum

## List of References

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- [11] <http://www.futurenetworksummit.eu/2013/>

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## 1 Introduction

Dissemination is an important aspect within the complete life cycle of a research project.

Dissemination allows:

- During the initial project phase: that the project goals, project plan and project objectives become known, and that external opinions and input are received.
- During the intermediate project phase: that it helps to check if the project is on track, if the conditions, requirements and project goals are still valid and in line with other comparable projects and research activities, or if counteractions need to be taken.
- During the life time of the project: that results are distributed, discussed and pushed to standardisation and other fora, and serve as input to other projects.

Also within the SEMAFOUR project, dissemination is an important activity. It draws upon the results in all technical work packages and all partners are contributing to its achievements. The dissemination activity (Activity 6.1), being part of Work Package 6 ('Dissemination and Exploitation') and running over the total duration of the project, consists of the following sub-activities:

- Development of a dissemination plan
- Construction and maintenance of a project website
- Presentation of results to the scientific community
- Establishment and maintenance of relations with related projects
- Preparation and realisation of two workshops
- Liaising with standardisation bodies and other fora
- Demonstration of the project results

This deliverable contains the *dissemination plan*. This plan gives an overview of the SEMAFOUR dissemination means and describes how the exchange of results and knowledge among the partners, with related European projects, with the scientific and industrial community, and with standardisation bodies and other fora, will be handled. Further it also discusses the two public workshops SEMAFOUR plans to organise.

The structure of this document is as follows. First, in Chapter 2, the major dissemination instruments that have been created (website, leaflet, etc.) are described. Chapter 3 is devoted to the means that are used to facilitate the exchange of information among the SEMAFOUR partners. Chapter 4 refers to dissemination of project results to the scientific and to the industrial community through presentations and publications at conferences, workshops and in journals, and through contacts and cooperation with other European projects. Chapter 5 gives information about the two workshops the SEMAFOUR project will organise, while Chapter 6 discusses how dissemination and liaisons to standardisation bodies and other fora will be organised. In Chapter 7, the dissemination of results and the contact with the Advisory Board is described, and in Chapter 8 the demonstration of the project results through the demonstrator that will be developed in Work Package 3 ('Demonstrator') is described. The document is concluded in Chapter 9.

## 2 Dissemination instruments

This chapter gives an overview of the dissemination instruments (website, project presentation, logo, slide template) that have been developed during the first months of the project.

### 2.1 *SEMAFOUR website*

A project website has been created and launched at project kick-off. It is accessible at:

<http://www.fp7-semafour.eu>.

The project website is intended to be the main dissemination channel towards the public. It serves as a source of information for external parties that are interested in the work, results and events of the SEMAFOUR project.

The website navigation structure is the following:

- About SEMAFOUR
  - Objectives
  - Work Packages
  - Project Facts
- Consortium
- Presentations
- Publications
- Public Deliverables
- News
- SEMAFOUR Events
- Contact

The website is hosted by the University of Antwerp and maintained by iMinds. Statistics about its visitors are collected using Google Analytics [1].

It is a dynamic environment to which information will be added as it becomes available. All partners provide content to keep the information on the website up-to-date. In particular, the sections ‘Presentations’, ‘Publications’, ‘Public Deliverables’, ‘News’ and ‘SEMAFOUR Events’ will be updated frequently.

Figure 1 shows a screenshot of the main page of the SEMAFOUR website.





Figure 1: Screenshot of the main page of the SEMAFOUR website.

## 2.2 SEMAFOUR project presentation

A 2-page SEMAFOUR project presentation [2] has been created to introduce the SEMAFOUR project and to disseminate its main objectives, its technical approach and expected impact. This document is available for download on the SEMAFOUR website (<http://fp7-semafour.eu/en/public-deliverables/>) and printed copies will be made available at events where SEMAFOUR will participate. The SEMAFOUR project presentation can also be found in Appendix A.

## 2.3 SEMAFOUR logo and slide template

An important item to establish the project's identity is the project logo. This logo will be used in all presentations, posters, the website, etc. A PowerPoint template that includes the logo and that can be used to develop slides for SEMAFOUR presentations has been designed (see Figure 2).

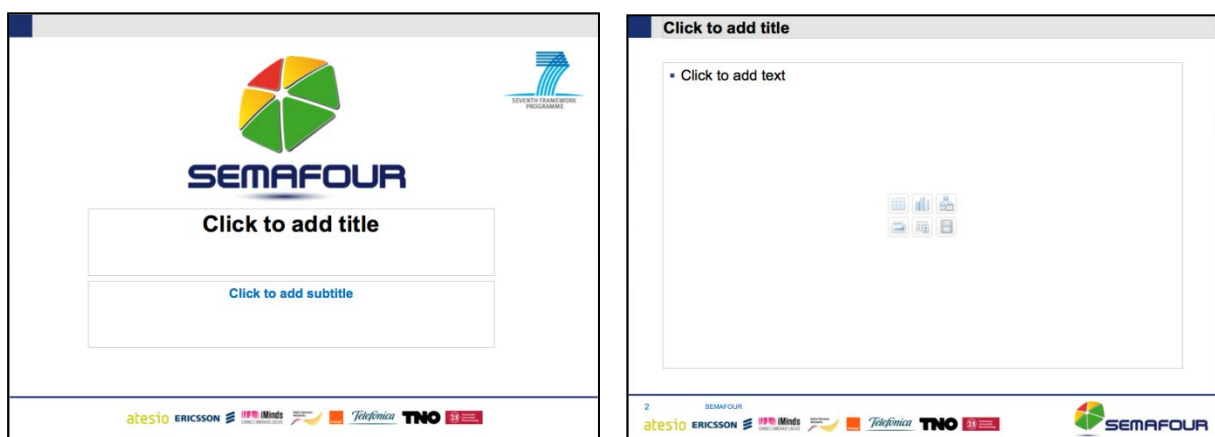


Figure 2: SEMAFOUR slide template including the SEMAFOUR logo.

### **3 Dissemination among the partners**

Collaboration and exchange of information among the project partners is a daily aspect of the SEMAFOUR project. This chapter discusses how SEMAFOUR handles dissemination among the partners.

#### ***3.1 SEMAFOUR mailing list***

For easy communication among all project members, closed-access email reflectors have been installed by TUBS. In total there are nine reflectors which forward e-mails to the subscribed members:

- A general reflector which forwards e-mails to all SEMAFOUR members
- A reflector for each of the SEMAFOUR work packages (WP1 – WP6)
- A reflector for the SEMAFOUR project board
- A reflector for the SEMAFOUR advisory board.

#### ***3.2 SEMAFOUR team site***

For safe and easy sharing of documents among the project members, TUBS has set up a team site for the project to which SEMAFOUR members can subscribe, using the Alfresco platform, which is an enterprise content cloud platform. Access to the site is password protected. This site is intended to be the main dissemination channel among the project partners. It is used for collaborating on deliverables, reports, publications, etc. Besides this, the site is also used for management and financial reporting.

The SEMAFOUR team site is typically exploited in combination with the SEMAFOUR mailing list: after a member has uploaded a document on the site, he/she sends out an email, using the reflectors as described above, including a link to the document on the site. Applying this policy avoids sending around large documents, but also makes sure that at the same time all project documents are archived.

#### ***3.3 Regular meetings and phone conferences***

The SEMAFOUR mailing list and team site are very useful tools for collaboration and dissemination among the partners. But from time to time also ‘live’ interaction is needed. Therefore regular meetings among all project partners lasting 2 or 3 days are planned every 3 months. These regular meetings include plenary sessions, WP meetings and a Project Board meeting. To optimise the possibility for all partners to be present, dates and places of the meetings were already established during the first project month until the beginning of 2014. Below is the list of the plenary meetings.

- September 17<sup>th</sup> – 19<sup>th</sup>, 2012, NSN – Munich (project kickoff meeting)
- December 10<sup>th</sup> – 12<sup>th</sup>, 2012, TUBS – Braunschweig
- March 11<sup>th</sup> – 13<sup>th</sup>, 2013, TID – Madrid
- June 17<sup>th</sup> – 19<sup>th</sup>, 2013, EAB – Linköping
- September 16<sup>th</sup> – 18<sup>th</sup>, 2013, iMinds – Antwerp
- December 10<sup>th</sup> – 12<sup>th</sup>, 2013, ATE – Berlin
- March 17<sup>th</sup> – 19<sup>th</sup>, 2014, FT – Paris

Besides the planned regular project meetings, there will also be intermediate (WP) meetings or phone conferences among the partners as the need arises. Every third Monday of the month, a Project Board meeting is scheduled. Additionally, phone conferences are set up for technical discussions among all partners or among a subgroup of the partners, if required. For this purpose, NSN provides a phone conference platform and, if required, a Cisco WebEx solution for the sharing of documents.

## 4 Dissemination to the scientific and industrial community

Throughout the duration of the project, SEMAFOUR will disseminate the obtained results and knowledge to the relevant scientific communities as well as key players of the industrial community. This will be done by contributing through papers and presentations to scientific meetings, conferences, workshops and journals in the field and by organising exhibitions and meetings with important entities in the industrial community. In addition, SEMAFOUR will establish and foster relations with other related European projects, e.g., via participation in the concertation meetings organised by the EU.

### 4.1 Scientific meetings, conferences, workshops, journals and magazines

Dissemination to peers in research will be achieved through the usual publication and presentation means.

Until now, a number of contributions have already been made. As the project is still in an early stage, the aim of most of these contributions has been to introduce SEMAFOUR to the scientific community. The contributions discuss the drivers, expected gains, state-of-the-art and challenges of the use of self-management in heterogeneous wireless networks. Table 1 below summarises the contributions already made.

Partner	Event	Contribution
NSN	Future Networks 10th FP7 Concertation meeting (RAS cluster), Brussels, Belgium, October 10-11, 2012	Presentation. 'Self-management for unified heterogeneous radio access networks' Christoph Schmelz
TNO	3rd annual Self-Organising Networks, Cannes, France, October 3-4, 2012.	Presentation. 'Analyzing SON from a deployment perspective – Why, when and how' Ljupco Jorguseski
TNO	International Workshop on Self-managing and Autonomous Networks (SAN 2012), Krakow, Poland, September 3, 2012.	Invited presentation. 'Development on self-organisation in mobile access networks' Hans van den Berg
TUBS	2nd International Workshop on Self-Organising Networks (IWSON), Paris, France, August 28 <sup>th</sup> , 2012	Technical paper. 'SON Laboratory: A Multi-Technology Radio Network Simulation Environment for the SON Analysis'. J. Baumgarten, A. Eisenblätter, T. Jansen, T. Kürner, D.M. Rose, U. Türke
iMinds	3rd annual Self-Organising Networks Conference, Cannes, France, October 3-4, 2012.	Presentation. 'Handover parameter optimisation in LTE Self-organising networks' Irina Balan
TNO	19th IEEE Symposium on Communications and Vehicular Technology in the Benelux (SCVT 2012), Eindhoven, Netherlands, November 16, 2012	Presentation. 'Self-management in cellular networks – Achievements and challenges' Remco Litjens
TNO	Mobile Network Optimisation 2012, Amsterdam, Netherlands, November 20-21, 2012	Invited presentation. 'Understanding why SON and the three key areas in which SON operates offer benefits to the operator' Hans van den Berg

*Table 1: Scientific contributions during the first four months of the project*

It is anticipated that most publications will be delivered during the second and third year of the project, when detailed technical results become progressively available. During the project kick off meeting in September 2012 it was already decided that a project vision paper will be drafted with the provisional title ‘*Self-Management for Unified Heterogeneous Radio Access Networks*’, describing the vision and goals of SEMAFOUR. The following four conferences have already been targeted for the submission of the SEMAFOUR vision paper:

- COST IC1004 ‘Cooperative Radio Communications for Green Smart Environments’, February 2013, Malaga, Spain [8]
- WWRF #30, ‘Wireless World Research Forum’, April 2013, Oulu, Finland [9]
- ‘International Workshop on Self-Organising Networks’, May 2013, Dresden, Germany [10]
- ‘Future Network & Mobile Summit’, July 2013, Lisbon, Portugal [11]

Other forthcoming workshops, conferences, journals, etc., identified as being particularly suitable for (possible) SEMAFOUR publications are:

- IEEE Global Telecommunications Conference (GLOBECOM)
- IEEE International Conference on Communications (ICC)
- IEEE International Symposium on Personal Indoor and Mobile Radio Communications (PIMRC)
- IEEE Wireless Communications and Networking Conference (WCNC)
- IEEE Vehicular Technology Conference Fall (VTC Fall)
- IEEE Vehicular Technology Conference Spring (VTC Spring)
- 3rd IWSON Workshop [3]
- FNMS, 3-5 Jul 2013 Lisbon [4]
- European Wireless 2013 [5]
- IEEE Transactions on Wireless Communications,
- IEEE Wireless Communications Letters,
- IEEE Transactions on Vehicular Technology,
- IEEE Transactions on Communications,
- IEEE Communications Letters
- EURASIP Journal on Wireless Communications and Networking (EURASIP JWCN)

The list will be updated regularly during the next years when new interesting CFPs become available. Apart from targeting for publications in the above mentioned conferences, journals, etc., some SEMAFOUR partners also aim at giving plenary/keynote talks and participating to panel discussions at international events, related with the SEMAFOUR subject.

When publishing or presenting results, the handling of IPR issues shall follow the established guidelines and processes laid out in the consortium agreement. A balance between the business interests of the partners on the one hand, and the need to publish information and results on the other hand, will be sought.

## ***4.2 Contacts and cooperation with the industrial community***

Apart from the contributions to the scientific community, the two operators participating in the SEMAFOUR consortium (France Telecom (Orange) and Telefónica) will use their substantial business contacts to make sure that SEMAFOUR remains in contact and establishes good cooperation with operators, vendors and other interested commercial parties. Apart from the operators directly involved in the project, the mobile network operators represented in the project advisory board (namely, Vodafone UK, Telenor (Norway), TeliaSonera (Sweden), KPN (The Netherlands) and

Deutsche Telekom (Germany), see also Chapter 7) will provide input to the project, for example, through providing feedback to the selection of SON use cases and functions.

More specifically, France Telecom will organise the Orange Labs Research Exhibition. The Orange Labs Research Exhibition is a very important meeting point for researchers and managers from different Orange Group entities, whether they work in operations, technology, marketing, communication, strategy, or finance. It highlights for the visitors the technological breakthroughs and the new developments in the digital world, as well as the opportunities and the corresponding risks for the Group. More than a thousand internal visitors come to the Exhibition each year, and increasingly outside visitors have been invited, mainly corporate clients, or academic and delegations from industrial partners.

The Orange Labs Research Exhibition is a good opportunity for dissemination, as the demonstrations are visited by Orange Group people, but also by representatives from French academic operational people, delegations from equipment vendors and from the European Commission. FT aims at disseminating SEMAFOUR work at this event through demonstrations/simulations.

Telefónica aims at giving a presentation at the RDC (Radio Design Council) of Telefónica, introducing the SEMAFOUR project. The RDC is a group within Telefónica devoted to ratifying Telefónica-wide radio design and strategic policies, sharing best practices among the different Operating Businesses (OBs).

Moreover, Telefónica participates in the Telecoms IQ conferences [6]. Telecoms IQ provides a range of carefully focused conferences that examine a specific technology or issue from an international perspective. Key focus areas include:

- Network evolution and optimisation: LTE, HSPA+, EDGE, WiMAX and FTTx
- Network management: revenue assurance, OSS/BSS, cost management, business process excellence and managed services
- Service development and revenue generation: mobile broadband, mobile VAS, mobile marketing, mobile money and M2M
- Customer management: customer experience, loyalty and profitability

The results and the achievements of the SEMAFOUR project could be of interest for the attendees to these conferences and Telefónica plans to do a presentation at one of the Telecoms IQ events next year.

### ***4.3 Contacts and cooperation with other European projects***

A number of European research projects that consider topics relevant to the content of the SEMAFOUR project have been identified. It concerns projects that recently started or will start soon (iJOIN, METIS, MOTO, SHARING and TROPIC), projects that have already intermediate or mature results available (COMMUNE, COST IC 1004, GreenNets and UniverSelf), as well as projects that have already finished (BeFemto, SAPHYRE and SOCRATES).

Outputs of these projects will be considered for exploitation in the technical work of SEMAFOUR, and with the ongoing projects more close contacts to exchange knowledge will be set up. A couple of the mentioned projects have one or more partners in common with the SEMAFOUR consortium, which will ease the liaison with these projects. Just like SEMAFOUR, the ongoing FP7 projects in the ICT Future Networks area participate in the RAS cluster. Contacts and cooperation with these projects will be facilitated by activities organised by the European Commission, like the Future Networks FP7 concertation meetings that take place twice a year, and the ICT Future Network and Mobile Summit conference.

In the remainder of this section, an overview of the identified projects will be given, focussing on what each project is (was) about, how this relates to SEMAFOUR, and how the liaison between SEMAFOUR and the particular project will be ensured.

### **BeFEMTO**

BeFEMTO (Broadband evolved FEMTO Networks) was an FP7 Integrated Project, which started in January 2010 with a duration of 30+1 months. The BeFEMTO consortium included 12 partners and was also supported by an Advisory Board. Although the project is officially finished, its results might be interesting for SEMAFOUR. As Telefónica I+D (TID) participated in BeFEMTO, TID will act as an interface between SEMAFOUR and BeFEMTO projects.

BeFEMTO has developed evolved femtocell technologies enabling the cost-effective provisioning of ubiquitous broadband services with the aim of accelerating the uptake of next generation mobile broadband in support of the desirable roll-out of broadband access across Europe.

The project provides both near-term and longer-term solutions: with its strong industry-led consortium, the BeFEMTO project had a real impact on the development and standardisation of the next generation femtocell technologies based on LTE-A. As for longer-term solutions, the project has devised and promoted novel concepts and usage scenarios such as self-organising and self-optimising femtocell networks, outdoor relay femtocells as well as mobile femtocells.

Taking into account the scope of the SEMAFOUR project, the achievements accomplished in the framework of BeFEMTO WP4 “Self-Organising Radio Access for Networked, Mobile and Fixed Relay Femtocells” deserve special attention:

- Finalisation of SON-enabling techniques, covering the important spectrum of algorithmic approaches.
  - One of these techniques was the automatic location determination of femto base stations as well as their associated mobile terminals. Some SON algorithms may require the location of femto BSs in the network as one of the inputs, for example, for the dynamic spectrum allocation and LTE/Wi-Fi load sharing use cases of SEMAFOUR.
  - The stability issue has also been studied in BeFEMTO WP4, since in future wireless cellular systems multiple SO algorithms could be operating simultaneously using common parameters of control at different time scales. There is a need to investigate their mutual dependency and effect of potential overlapping that might cause instability. This work could be of interest for the integrated SON management use cases identified by the SEMAFOUR project.
- Finalised RRM framework, with a clear understanding of interference from macros (cross-tier interference) as well as between femtos (co-tier interference), for maximum capacity at minimum interference.
  - The cross-tier concept fits the multi-layer approach defined in SEMAFOUR. Dynamic spectrum and interference management, active/reconfigurable antenna systems and other use cases identified in SEMAFOUR could benefit from the results related to multi-cell RRM for networked femtocells.
- Innovative SON approaches, ranging from game theoretical to machine learning approaches, with direct impact on performance, robustness, energy efficiency.

Based on the NGMN/3GPP terminology, the SON algorithms in WP4 of BeFEMTO have been classified according to "local algorithms", "distributed algorithms between eNBs and HeNBs", "distributed algorithms between HeNBs", and "centralised algorithms". A detailed description of each SON algorithm is provided in the BeFEMTO deliverable D4.4 “Integrated SON Techniques For Femtocells Radio Access”.

The traffic management, the mobility management, the network management, and the security aspects of stand-alone, networked and mobile femtocells were also covered by BeFEMTO. The outcome of the work performed on these fields could be a priori significant for SEMAFOUR’s purpose, for example, with reference to the automatic traffic steering use case and in relation with some of the activities that will be carried out in the use cases for integrated SON management.

BeFEMTO website: <http://www.ict-befemto.eu>

### **COMMUNE**

COMMUNE (COgnitive network ManageMent under UNcErtainty) is a research project under the CELTIC initiative, that started in October 2011. Among the 12 project partners are Nokia Siemens

Networks Finland, Ericsson Finland, and Orange Poland. COMMUNE has the main objective to develop a cognitive management framework that uses knowledge-based reasoning techniques in order to avoid or resolve uncertainty in network management and operation. COMMUNE thereby has five major objectives:

- The analysis of representative scenarios and identification of causes of the uncertainty in the networks.
- The analysis of knowledge-based reasoning techniques under uncertainty: how can network management decisions be based on knowledge-based reasoning techniques in case of unreliable or incomplete data sets, and how can this knowledge be enhanced using machine learning algorithms
- The definition of a decentralised cognitive management framework to deploy the developed reasoning techniques, in particular with respect to distributed reasoning.
- The application of the combination of reasoning techniques and the COMMUNE cognitive framework to both network management and network operation in representative Future Internet scenarios, including an LTE network scenario.
- The validation of the project approach and technology findings through simulations and experimentation.

Regarding the interrelation with SEMAFOUR, COMMUNE is in particular interesting for some of the WP5 objectives, such as the Decision Support System, but also the SON Coordinator, for example, in order to be able to make coordination decisions in case of incomplete information or missing measurements.

COMMUNE website: <http://projects.celtic-initiative.org/commune/>

### ***COST IC 1004***

IC1004 is a COST Action on Cooperative Radio Communications for Green Smart Environments and belongs to the ICT Domain. This Action addresses research issues in the field of cooperative radio communications to make our society cleaner, safer, and more energy efficient. The action started on May 19, 2011 and runs until May 18, 2015. Among the 105 institutions participating in this action are atesio and TU Braunschweig.

The work in the action is organised in three working groups, two sub-working groups and five topical working groups (TWG). Of specific interest to SEMAFOUR is TWG Urban, which is co-chaired by Thomas Jansen (TU Braunschweig) and which aims to address the following topics:

- Coexistence of different RATs (GSM, UMTS, LTE, ...) and cell types (Macro, Micro, Pico, Femto)
- Energy efficiency and performance enhancement of wireless networks
- Smart cities dealing with the establishment of mesh networks
- Multiple antenna technology including co-located and distributed MIMO
- Reference simulation scenarios
- Path loss prediction through simulation, measurements and path loss models
- Measurement based mobility modelling for cars, pedestrians and indoor users
- Network traffic models
- Interference: indoor to outdoor, outdoor to outdoor, indoor to indoor, and outdoor to indoor

Most of these topics are of general interest to SEMAFOUR since they have the potential to provide important input to the simulators and demonstrators to be developed in SEMAFOUR. Since the TWG Urban is working also on a reference scenario of system-level simulations of radio networks, which will be made publicly available. Potential interaction between SEMAFOUR and COST IC 1004 will be mutually beneficial. SEMAFOUR may provide input and requirements for the set-up of this scenario on one hand and may benefit by using the scenario within the SEMAFOUR simulators and demonstrators.

COST IC 1004 website: <http://www.ic1004.org>



### *GreenNets*

GreenNets (Power consumption and CO2 footprint reduction in mobile networks by advanced automated network management approaches) is an FP7 project running within the FP7-SME scheme. Among the six partners in GreenNets are atesio and TU Braunschweig. The project started on September 1, 2011 and runs until August 31, 2013. The GreenNets research aims at developing novel network management functionalities that provide seamless transition from one network topology and configuration setup to another one depending on the temporary and spatial traffic load situation while optimising energy consumption.

The specific goals within GreenNets are:

- Development of advanced automated network management tools with integrated optimisation engines for energy efficient network operations
- Providing a solid methodology and sophisticated toolsets for the assessment of energy consumption of planned network extensions / enhancements in the context of a dramatic increase in demand for service and radio spectrum in order to provide support to network operators for energy-efficient radio deployment

The GreenNets results will contribute to improve network energy efficiency, support operators on a daily basis and will be used for planning purposes or network layout transformation.

The outcome of GreenNets is of specific interest to SEMAFOUR especially for some use cases in WP4 like Dynamic Spectrum Allocation and in WP5 like the Decision Support System or the SON coordinator, where some interaction with a parallel running SON activity on reduction of energy consumption may be expected.

GreenNets website: <http://www.greennets.eu>

### *iJOIN*

The iJOIN (Interworking and JOINT Design of an Open Access and Backhaul Network Architecture for Small Cells based on Cloud Networks) project is a FP7-ICT STREP, with 12 partners (Institute IMDEA Networks is the coordinator), supported by an advisory board. The project has started recently (November 1<sup>st</sup>, 2012) and its duration is 30 months. As Telefónica I+D (TID) participates in both iJOIN and SEMAFOUR, they will perform the liaising between the two projects.

iJOIN introduces the novel concept RAN-as-a-Service (RANaaS), where RAN functionality is flexibly centralised through an open IT platform based on a cloud infrastructure. iJOIN aims for a joint design and optimisation of access and backhaul, operation and management algorithms, and architectural elements, integrating small-cells, heterogeneous backhaul and centralised processing. This solution will optimise the RAN system throughput and provide services instantly and efficiently in cost, energy, complexity and latency wherever and whenever the demand arises. Additionally to the development of technology candidates across PHY, MAC, and the network layer, iJOIN will study the requirements, constraints and implications for existing mobile networks, specifically 3GPP LTE-A.

The scope of iJOIN in terms of RATs and layers is smaller than that of SEMAFOUR, as it targets mainly outdoor small-cell deployments. There are some topics to be developed within the different work packages of iJOIN project that could be of interest for the SEMAFOUR project, as they have been identified as study items in both of them:

- Coordinated beam forming: the expected work in iJOIN will be at the physical layer. In SEMAFOUR there is a specific use case devoted to “Active/Reconfigurable Antenna Systems (AAS)”.
- Interference management: iJOIN will go beyond the state of the art by utilising the central processing power supplied by the RANaaS environment to apply scalable ICIC algorithms across a relatively large number of interfering small cells. This could be of interest for SEMAFOUR use case “Dynamic spectrum and interference management”.

iJOIN includes a work package devoted to Network-Layer Solutions and System Operation and Management, in which they will develop new joint and self-organised management approaches for heterogeneous backhaul technologies and very dense networks, considering energy efficiency aspects. Some of the mentioned mechanisms are more efficient load balancing concepts (on both access and



backhaul layers), mobility management and traffic off-loading. These mechanisms are use cases to be studied in SEMAFOUR as well; therefore a tight collaboration between the two projects is expected.

iJOIN website: <http://www.ict-ijoin.eu>

### ***METIS***

The METIS (Mobile and wireless communications Enablers for Twenty-twenty Information Society) is a recently started (November 1<sup>st</sup>, 2012), 2,5-year FP7-ICT large scale (IP) project with 29 partners, led by Ericsson Sweden.

The overall objective of METIS is to prepare the migration from today's, human communication driven mobile wireless communications towards the integration of machine communication with the wirelessly connected Internet of Things, which is expected to increase the wireless traffic volume until 2020 by a factor of 1000, compared with 2010. METIS aims at the development and evaluation of a system concept addressing the requirements regarding efficiency, versatility and scalability on such future wireless communication systems. Topics addressed within the METIS system concept are, for example, Device-to-Device communications, Massive Machine Communications, Ultra-Dense Networks, Moving Networks and Ultra-Reliable Communication. The technology components aiming at solutions for these topics include, for example:

- Air-interface design, waveforms and multiple access
- Multi-node coordination, multi-antenna, and multi-hop communications
- Heterogeneous multi-layer and multi-RAT deployments
- Frequency band analysis, scenarios, flexible spectrum access, coexistence.

Two major research questions to be resolved within METIS are thereby, which of these technology components require an evolution or revolution from LTE-A, and how beyond 2020 cellular mobile wireless network systems will look like, or which of the requirements they will meet.

One of the METIS objectives is to provide solutions for heterogeneous multi-layer and multi-RAT networks. The particular potential interaction with SEMAFOUR is thereby the investigation of fundamental trade-offs in the design of future networks, such as decentralised vs. hierarchical vs. centralised interference management and mobility management. Work Package 4 of the METIS project is led by Nokia Siemens Networks.

METIS website: <http://www.metis2020.net>

### ***MOTO***

The MOTO (Mobile Opportunistic Traffic Offloading) project is a recently started (November 1, 2012) 3-year FP7-ICT STREP with 8 partners. The objective of the MOTO project is to support the booming demand in mobile 4G data services, by designing, dimensioning, implementing and evaluating a new network architecture in support of dynamic traffic offloading strategies to relieve a congested 4G/LTE network. MOTO will take an operator point of view to opportunistic networking by keeping terminal based offloading under the control of the operator's infrastructure, and also plans to carry out practical experimentations on an operator's large scale integrated test bed for architecture and protocol validation.

The topic of MOTO is related to SEMAFOUR's use case on 'Automatic traffic steering', which includes a sub use case on 'Multi-layer LTE/Wi-Fi traffic steering'. The SEMAFOUR and MOTO consortia have no partner in common, but both projects participate in the EU RAS cluster meetings. So contacts and information exchange with MOTO will mainly happen in these meetings. At the RAS cluster meeting in October 2012, the idea has been raised to classify the projects in the RAS cluster in working groups, based on the topics of the projects. It is likely that SEMAFOUR and MOTO will be part of the same working group, which will further facilitate the information exchange and exploration for cooperation possibilities between both projects.

MOTO website: <http://www.fp7-moto.eu/>

### **SAPHYRE**

The SAPHYRE (Sharing Physical Resources; Mechanisms and Implementations for Wireless Networks) project is a nearly finished FP7 project (01/2010 - 12/2012) with 10 partners. As TNO participates in both SAPHYRE and SEMAFOUR, TNO is the obvious liaison. The focus of the SAPHYRE project is on spectrum and infrastructure-shared wireless networks, and the key objectives of the project are

- To develop and assess new radio resource management approaches and transmission schemes for orthogonal and non-orthogonal spectrum/infrastructure-sharing in multi-operator scenarios (including test bed-based demonstrations);
- To develop and assess business models for spectrum/infrastructure sharing among operators, as well as regulatory approaches to allow significant sharing gains while still stimulating competition.

Similar to SEMAFOUR, the SAPHYRE project has set-up an advisory board. The SAPHYRE advisory board was a stable group of operators, regulators and some other organisations. Actually it was a member of the SEMAFOUR advisory board who suggested that some of the SAPHYRE results might be interesting as input for SEMAFOUR. SEMAFOUR's foreseen WP4 use case 'Dynamic spectrum allocation' targets the development of both orthogonal and non-orthogonal (ICIC) spectrum sharing mechanisms in LTE networks. SAPHYRE considered similar mechanisms with a primary focus on more academic work on developing advanced beam forming/transmission modes (non-orthogonal sharing) in generic and somewhat idealistic scenarios, i.e., not LTE-specific. In addition some orthogonal sharing schemes were developed and assessed. Although from its name SEMAFOUR's foreseen WP5 use case 'RAN sharing in LTE' seems to match well with the SAPHYRE scope, the SEMAFOUR focus in this use case is not so much on the sharing mechanisms themselves (as is the case in SAPHYRE), but rather on considering the coordinated deployment of network-specific SON functions such as PCI, ANR and MRO, which played no role in SAPHYRE. SAPHYRE website: <http://www.saphyre.eu>

### **SHARING**

SHARING (Self-organised Heterogeneous Advanced RadIo Networks Generation) is a Celtic-Plus project which has recently got the Celtic label, and plans to kick-off in the beginning of 2013. The project duration is 30 months. The main goal of SHARING is to propose cost/power efficient and high capacity broadband solutions by

- Enabling a flexible interference management concept in order to trigger spectral efficiency increase in future heterogeneous networks,
- Introducing smart and innovative offloading strategies, as well as joint RRM solutions across radio, core and backhaul networks,
- Proposing a novel integrated architecture incorporating seamless Inter-Radio Access Technology (RAT) service continuity, fixed/wireless convergence, device-to-device transmissions, last mile broadband backhaul, and efficient licensed/license-exempt/unlicensed spectrum usage.

The scope of SHARING is larger than that of SEMAFOUR, with a strong component on physical layer. Nevertheless, SHARING contains an important package of activities related to next generation SONs. These activities aim at investigating/finding novel SON solutions for future network scenarios such as HetNets, and multi-RAT deployments including Wi-Fi traffic offload. These scenarios are closely related with the SEMAFOUR WP4 work; hence a tight liaison with SHARING is foreseen. This tight liaison will be ensured particularly by FT, since FT is the coordinator of SHARING.

SHARING website:

<http://www.celtic-initiative.org/Projects/Celtic-Plus-Projects/2012/SHARING/sharing-default.asp>

### **SOCRATES**

The FP7 project SOCRATES (STREP, January 2008 - March 2011) can be considered as the predecessor of SEMAFOUR. The initiatives for the SEMAFOUR project proposal were taken by the SOCRATES partners extending the scope from self-organisation in LTE to self-management of

heterogeneous mobile networks. Regarding the consortium there were a few changes: Orange and Telefónica entered the consortium as new members, while Vodafone left the consortium.

SOCRATES has developed, evaluated and demonstrated methods and algorithms for self-organisation in LTE access networks. The project focused on the macro layer, although in a few use cases also home eNodeBs were taken into account. Besides individual SON functions, also couples of SON functions working in parallel have been considered, and a basic coordination framework for handling multiple SON functions has been defined. Next to that, the work within the SOCRATES project has revealed a number of challenges where further studies are needed: e.g., when more SON functions will be introduced, a careful design of a high-level operator policy and its conversion into SON specific policies is key, as well as a broadening of the scope of self-organisation to address multi-RAT and multi-layer networks. SEMAFOUR took these challenges into account when defining its scope. As six partners of the SEMAFOUR project have also been involved in the SOCRATES project, it is a natural evolution that the SEMAFOUR project will exploit the results and expertise gained in the SOCRATES project.

SOCRATES website: <http://fp7-socrates.eu>

### **TROPIC**

Tropic is an FP7-ICT STREP which started at the same time as SEMAFOUR (September 2012). The project duration is 30 months, and the consortium consists of 10 partners. The main goal of TROPIC is to bring femtocell networking and cloud computing within a common framework in order to enable a capillary distribution of cloud computing capabilities closer to a potentially huge number of mobile users. The project will focus on two questions:

- What are the communication and computational technologies required to exploit the convergence of pervasive femto-network infrastructure and cloud computing paradigms for virtualisation/distribution of applications and services?
- What is the advantage in terms of spectral/energy efficiency and service effectiveness that can be achieved by the synergic femto-cloud approach?

The scope of TROPIC is much more focused towards femtocells than that of SEMAFOUR, which considers heterogeneous mobile networks comprising a multitude of cellular hierarchical layers, among which the femto layer. It needs to be investigated further once both projects have further defined their scenarios in more detail how much the TROPIC scope matches that of SEMAFOUR. There is no SEMAFOUR partner that also participates in TROPIC, but both projects participate in the EU RAS cluster meetings.

TROPIC website: <http://www.ict-tropic.eu>

### **UniverSelf**

UniverSelf (Universal Self-management) is an FP7-ICT Integrated Project with 17 partners. It started on September 1, 2010, and has a duration of 36 months. The main objective of the project is to design a Unified Management Framework (UMF) that aims at the unification and establishment of autonomies of networks and services. Although UniverSelf has similar targets as SEMAFOUR, its scope is much larger than radio access networks, and structured around the umbrella topic of *autonomics*. The project is built around six use cases, on which six white papers have been recently published (<http://www.univerself-project.eu/white-papers>):

- Use Case #1 - Self-diagnosis and self-healing for IMS VoIP and VPN - Case study Part 1
- Use Case #2 - Networks' Stability and Performance - Case study Part 1
- Use Case #3 - Dynamic Virtualisation and Migration of Contents and Servers - Case study Part 1
- Use Case #4 - SON and SON Collaboration according to Operator Policies - Case study Part 1
- Use Case #6 - Operator-governed, end-to-end, autonomic, joint network and service management - Case study Part 1
- Use Case #7 - Network and Services Governance - Case study Part 1

As can be observed from the above list of use cases, the 4<sup>th</sup> one is dedicated to SON in the context of mobile networks. It focuses on SON coordination within the UMF framework where different simulation platforms and three test-beds are being developed. The leader of the use case is FT, with an important participation to the SON coordination problem. This work will serve as a basis for further SEMAFOUR work.

The foundation of the liaising between the two projects was set at the second IWSON workshop, which was held on August 28, 2012, in Paris, hosted by the conference ISWCS 2012. The workshop was organised by FT, Alcatel-Lucent (UniverSelf partner), NSN, EAB, TUBS and UPRC (UniverSelf partner). More details can be found at <http://www.iswcs2012.org/workshop>. The next workshop, IWSON 2013, is scheduled for May 2013 (hosted by VTC Spring 2013) in Dresden.

UniverSelf website: <http://www.univerself-project.eu>

## 5 SEMAFOUR workshops

Two public dissemination workshops will be organised by SEMAFOUR. The goal of these workshops is to disseminate and demonstrate the project's results towards the different stakeholders and to stimulate feedback. The first workshop will be scheduled around mid-project, the second workshop near the end of the project.

Different formats for the workshops are possible, e.g., a workshop in conjunction with a larger conference, a joint workshop with other related projects, a SEMAFOUR workshop on its own, a track of a conference dedicated to SEMAFOUR, etc. Whatever the final format will be, it is clear that enough time needs to be allocated to present SEMAFOUR results, and to make demonstrations with the SEMAFOUR demonstrator that will be developed in Work Package 3.

Concrete options and decisions on the workshops will be investigated and taken during future project meetings, and reported on in the future deliverables D6.4 ('Report on dissemination, exploitation, and liaison activities during Year 1'), D6.5 ('Report on dissemination, exploitation and liaison activities during Year 2') and D6.8 ('Final report on dissemination and liaison activities'), which are due in August 2013, 2014 and 2015 respectively.

The organisation of the two dedicated SEMAFOUR workshops does not exclude the involvement of SEMAFOUR in other workshops, like for example the 3rd International Workshop on Self-Organising Networks (IWSON 2013), of which four SEMAFOUR partners are co-organisers. Additionally, first contacts with the COMMUNE and UniverSelf consortium have been established to investigate the possibility to organise a joint workshop.

## 6 Liaisons to standardisation and other fora

The challenging topics of self-management and self-optimisation/configuration of HetNets is also covered in various standardisation bodies and other fora. The exchange of information between the SEMAFOUR project and these standardisation bodies and fora will primarily be established by the industrial partners in the SEMAFOUR consortium, via liaison persons.

The following fora were identified by SEMAFOUR as potentially interesting initiatives to liaise with:

### *3rd Generation Partnership Project (3GPP)*

Dissemination of radio network results towards 3GPP RAN working groups will concern mainly RAN WG2, WG3 and SA-WG5. These work groups have been engaged in SON standardisation work since 2009, providing solutions for several SON use cases, energy saving (ES), minimisation of drive test (MDT), but also analysing mobility robustness in HetNet environment. In the next years, this work is likely to be continued and extended, e.g., toward Wi-Fi (as part of the Release 12 of the specification), and these topics can be used for dissemination of relevant SEMAFOUR results. It has to be considered though that, besides of the specific topics, the standardisation groups continue developing LTE features within their scope of competence. Therefore, any idea developed in SEMAFOUR, that fits that competence area, even if not explicitly mentioned below, may be promoted in 3GPP. The subjects that are discussed in each of these three working groups, and the relation of SEMAFOUR with them, are presented below:

- **RAN2:** In RAN2, the main topics related to the scope of SEMAFOUR are expected to be MDT, coexistence of LTE and Wi-Fi and mobility in HetNets. MDT is going to focus on QoS reporting, data filtering (relevant in case of smart phones) and new measurements relevant for so called “small cell” deployments (i.e. deployments based on pico or home eNBs, but enhanced with optimised routing of local data traffic). It is also possible that location information in MDT logs will be considered. The mobility enhancements for HetNet deployments will likely focus on mechanisms making mobility in such deployments more robust. This is beyond the typical scope of SON studies, but the mechanisms may create new tools or needs for SON (e.g. traffic steering control, to allocate properly users of different services, capabilities or speeds in multi-layer network). Similarly, the study on possible cooperation between Wi-Fi and LTE may become relevant. This is a new topic in 3GPP though, and therefore the methods studied (and later perhaps specified) are expected to be rather basic (e.g. an important scenario is automatic configuration of a device via LTE signalling to use selected WLAN Access Points).

The above focus area seems especially suitable for dissemination of topics related to data collection for the Decision Support Systems, as planned in WP5. Ideas concerning the metrics or information feedback that are found needed may be submitted to the MDT discussion (including inter-RAT). Also, the ideas concerning inter-RAT Automatic Traffic Steering (WP4) may be disseminated via discussions concerning LTE-Wi-Fi coordination (coordination between 3GPP RATs is inherently present in the 3GPP specification and therefore may be proposed to be enhanced, if needed, irrespectively of MDT).

- **RAN3:** RAN3 is the group where the main SON work has been done and it is expected to be continued. The topics proposed for future work are SON for active antennas, dynamic spectrum allocation and SON for “small cells”. Also, one more iteration of enhancements for existing SON solutions has been proposed with the focus on user differentiation (SON for user groups). From the perspective of SEMAFOUR the most interesting are the three new topics:
  - SON for active antennas addresses the dynamic reconfiguration of cells and sectors: merging, splitting and redirection. Each of those actions triggers changes in the network topology, and their dynamism may not be possible to be handled with existing SON solutions, like ANR – hence the need for new solutions.
  - Dynamic spectrum allocation addresses the typical deployment of HetNet, where different tiers of cells use different bands and frequencies (e.g. HeNB band, macro band etc.). Typically, configuration of the tiers was planned in a fixed manner and then cells were allocated to them permanently (and manually) when they were deployed. The only degree of

freedom was provided with cell switching on/off for energy saving or interference mitigation reasons. However, in future both, allocation of new cells and configuration of resources per tier may be subjects of SON.

- Enabling network sharing at the network side is also within the responsibility of the RAN3 working group. This has not been included in the SON considerations so far, but the topic may be always addressed, if any issues are found.

The SEMAFOUR project considers multi-RAT and multi-layer issues as the main topic, especially in the context of network sharing; therefore the planned SON discussions will create a very well suited dissemination channel for the project results. In particular, solutions related to the dynamic spectrum and interference management (WP4) can be proposed almost directly in the dynamic spectrum allocation discussions. Then, the solutions related to automatic cell sectorisation and other features expected to be developed for Active/Reconfigurable Antenna Systems (AAS; WP4) can be promoted in RAN3 as part of the SON for active antennas discussions. At more general level, if the existing features of LTE or UMTS are not sufficient for the Policy Enforcement and SON coordination and management (planned in WP5), enhancements may be provided at any time as a contribution concerning network sharing. Also some aspects of the traffic steering (WP4), e.g. related to high mobility users, fit into RAN3 scope of competence. As in case of dissemination in RAN2, those contributions will be made from individual project consortium members.

- **TSG-SA WG5:** The Technical Specification Group Service and System Aspects (TSG-SA) is responsible for the overall architecture and service capabilities of systems based on 3GPP specifications [7]. In SA Working Group 5 (SA WG5, or SA5), requirements, architecture and solutions for provisioning and management of the network and its services are specified, with focus on the interface Itf-N between the Network Manager (also referred to as OSS) and the Domain Manager. The subjects in SA5 closely relate to the activities of the SEMAFOUR work package 5.

To ensure the information flow in both directions between the SEMAFOUR project and SA5, a liaison actively participating in the SA5 meetings has been appointed (see Table 2). Through this liaison, the SEMAFOUR project will continuously be informed of on-going activities and important milestones achieved in SA5. The information will be presented in SEMAFOUR plenary meetings and, if needed, also in dedicated phone conferences.

### ***NGMN***

The Next Generation Mobile Networks (NGMN) Alliance ([www.ngmn.org](http://www.ngmn.org)) is a mobile telecommunications association predominantly consisting of operators, which acts as a pre-standardisation forum by providing operator-oriented input to standardisation bodies, and also to the mobile networks industry community within the scope of LTE and EPC. This input includes requirements, use cases, performance targets, guidelines on equipment, and deployment preferences for a cost-effective network evolution through raised awareness on high customer benefit. NGMN achieves these tasks through liaison statements, organised workshops with related standardisation and regulatory bodies as well as industrial stakeholders.

Within the context of SON, NGMN has published white papers and provided a valuable input to the first wave of SON standardisation in 3GPP. These include a list and description of operator-oriented SON use cases together with recommendation on SON and OAM requirements.

For the moment, the SON activity is on standby in NGMN. Considering that discussions on SON management and coordination has started within 3GPP (especially within the SA5 WG), it is time for NGMN to assume its role of carrying out pre-standardisation work and providing operator-oriented input to 3GPP for this new upcoming wave on new generation SON and SON management. Therefore, SEMAFOUR targets at disseminating (particularly) the use case and requirement work towards NGMN to initiate and be part of this pre-standardisation work.

### ***IEEE 802 LAN/MAN***

The IEEE 802 LAN/MAN Standards Committee develops and maintains networking standards and recommends practices for local, metropolitan, and other area networks. The family of standards relevant for SEMAFOUR is Wireless LAN, which becomes relevant of all aspects with respect to Off-

Loading via WLAN. WLAN is standardised within the Working Group IEEE 802.11. Prof. Kürner (TUBS) is a voting member of IEEE 802.15 and regularly attends the plenary meetings of IEEE 802, following also the progress and activities within IEEE 802.11. This will enable him to report on ongoing activities relevant for SEMAFOUR and, if appropriate, submit and present input documents from SEMAFOUR to IEEE 802.11, e. g., to the 802.11 WNG (Wireless Next generation) standing committee.

The website for IEEE 802.11 is <http://www.ieee802.org/11/> and all input documents are publicly available via IEEE mentor at <https://mentor.ieee.org/802.11/documents>

Forum	Partner	Representative	Contact person in SEMAFOUR
3GPP RAN2	NSN	Colin Willcock Colin.willcock@nsn.com	Malgorzata Tomala Malgorzata.tamala@nsn.com
3GPP RAN3	NSN	Colin Willcock Colin.willcock@nsn.com	Krzysztof Kordybach Krzysztof.Kordybach@nsn.com
3GPP SA5	EAB	Per Elmdahl per.elmdahl@ericsson.com	Kristina Zetterberg kristina.zetterberg@ericsson.com
NGMN	FT	Berna Sayrac Berna.sayrac@orange.com	Berna Sayrac Berna.sayrac@orange.com
IEEE 802.11	TUBS	Thomas Kürner kuerner@ifn.ing.tu-bs.de	Thomas Kürner kuerner@ifn.ing.tu-bs.de

**Table 2: SEMAFOUR liaisons to standardisation and other fora**

Table 2 shows the SEMAFOUR liaisons that were set up. Representatives are persons within the partners' companies who are actually participating in the meetings of the standardisation bodies. The representative role is only defined within SEMAFOUR, and all contacts between the representatives and SEMAFOUR will pass via a contact person within SEMAFOUR, who is in all cases one of the active participants of the project. Activities of the representatives include the monitoring of activities in the fora and feedback of the relevant information to SEMAFOUR. As one of the objectives of the SEMAFOUR project is to disseminate its results, the role of the representatives also includes the coordination of the SEMAFOUR generated input documents towards these fora.

It was decided within the SEMAFOUR consortium that contributions to 3GPP and NGMN will not be made in the name of SEMAFOUR, but in the name of those partners involved in the contribution, with reference to the SEMAFOUR project.



## 7 SEMAFOUR advisory board

The SEMAFOUR project has set up an advisory board consisting of key European operators outside the project, i.e., Deutsche Telekom (Germany), KPN (Netherlands), Telenor (Norway), TeliaSonera (Sweden), and Vodafone (UK). The aim is to ensure that, besides the opinion of the two major mobile operators involved in the project (Telefónica and France Telecom); also a broad spectrum of opinions from European operators outside the project is taken into account.

The SEMAFOUR advisory board is a voluntary group and the advice and suggestions from the board are non-binding. The input is expected to be on a more strategic direction rather than on technical details, and has relevance predominantly for the definition of use cases and requirements in Work Package 2. Within WP 2, an activity is defined in which the advisory board members are consulted by way of a questionnaire on how radio network management should be done in RANs and on the use cases that were defined in the first months of the project. The meetings with the advisory board will be planned in accordance to milestone moments of the SEMAFOUR project.

On October 15, 2012, a first phone conference with the advisory board members has been organised, during which an introduction to the SEMAFOUR project and an overview of the initial SEMAFOUR use case ideas have been presented. Also the questionnaire has been announced towards the advisory board members during this call. The questionnaire itself has been delivered to the advisory board in the second week of November, and the answers will be collected at the end of November. An anonymised compilation and analysis of the collected answers will be reported in D2.3 ('State-of-the-art in radio network management: feedback from the advisory board members').

## 8 SEMAFOUR demonstrator

An important SEMAFOUR deliverable that will be extensively used for dissemination purposes, of both the SEMAFOUR vision and its achievements, is the demonstrator. Considering the deemed importance of conveying the project's vision and achievements, and understanding that a good demonstrator may be able to fulfil this role better than any other dissemination form, the development of the demonstrator is given a chief role within the project, by dedicating a separate work package (WP3) with a suitable amount of effort to the work. In this chapter, we give a high-level description of the envisioned demonstrator and scenarios, as well as the dissemination plan for the demonstrator.

### 8.1 Demonstrator functionality and demonstration scenarios

Well within its first year the SEMAFOUR project will deliver a vision-oriented demonstrator. Not yet including any of the project's targeted self-management solutions, this demonstrator is likely to take on the form of an advanced animation of what the intended, results-oriented demonstrator will look like. In our current view and from an audience perspective, the demonstrator itself will comprise different components:

- The demonstration unit allows the demo-giver to select one among several prepared demonstration scenarios, e.g. to demonstrate the developed self-management solutions for automatic traffic steering between LTE and Wi-Fi cells, or for spectrum management among different network layers and technologies, or for the unified effectuation of formulated high-level performance objectives in terms of e.g. coverage and service quality. Besides scenario selection, the unit will also have some demonstration controls, e.g. to set the speed of time.
- The operator control unit models the stylised interface to the network operator as would exist in a true self-management implementation. Considering the self-management system and the underlying cooperating networks as a black box, the operator control unit manages the input and output of this black box. The input primarily comprises the high-level performance objectives that the operator needs to specify. Further inputs may include the degree of freedom the operator allows the self-management system to take control actions, of possibly manual approval of requested control actions that fall outside the specified self-management freedom. The output consists of two key aspects: (i) the self-management system reports on the achieved performance in the form of KPIs (see KPI unit below); which KPIs are reported, in what form and with what spatial-temporal scope, can be specified via the operator control screen; (ii) the output from the Decision Support System (DSS) that is envisioned to be part of the self-management system; an example task of such a DSS is the indication that in a certain area the self-management system is no longer able to satisfy service quality targets, along with a concrete suggestion to e.g. add a specific piece of hardware (e.g. an LTE femtocell) at a proposed location.
- The network visualisation unit shows the operator's multi-layer/RAT network, or a selected fragment there-off on one integrated or multiple separate screens. This visually presents the location-specific self-management actions and their consequences, in terms of network configuration, traffic handling, and performance effects. These effects are shown via playback of recorded actual simulations that are conducted within the project.
- The KPI unit depicts the KPIs in the form as specified in the operator control unit.
- Although likely the most suitable manner to observe the performance effects of the targeted self-management solutions is at the KPI level, the demonstrator will also involve actual user terminals, which, for specific scenarios can be fed with real-time performance metrics as experienced by selected users in the displayed playbacked simulations. The terminals will then use this performance input, e.g. packet losses, packet delays, to emulate an actual communication session, e.g. a video stream, in order to exemplify the user-level experience from the developed self-management solutions.

The simulators to be used have not been determined yet, but whatever simulators are used in the WP4/5 work, will need to be slightly adapted to allow the generation of simulation traces in a format specified by WP3. Hence whatever the underlying simulator, the recorded simulation traces will be of

a uniform format. Then the demonstrator will comprise a playback engine for those recorded traces. Furthermore, besides working with pre-recorded simulation traces, the demonstrator will also support on-line simulations, which are currently intended to also use the same playback engine (to ensure the same look and feel). In that case, the simulations will produce simulation traces in an on-line fashion which are automatically fed into the playback module for visualisation purposes.

The demonstrator will be developed such that it can sensible run on a single laptop, for highly portable small-scale demonstrations, or on a connected system with potentially multiple laptops, tablets, user terminals, LCD screens and/or beamers, targeting more large-scale demonstrations.

## ***8.2 Demonstrator dissemination plan***

The vision-oriented demonstrator will be delivered by M10 (June 2013), an intermediate version of the results-oriented demonstrator will be delivered by M21 (May 2014), and the final version of the results-oriented demonstrator will be delivered by M30 (February 2015).

Demonstrations are planned to be organised at a variety of occasions, where at each event the latest release of the three planned demonstrator releases will be used. Below, a list of targeted occasions for SEMAFOUR demonstrations is shown:

- Annual project reviews – As currently scheduled, in the month of November of 2013, 2014 and 2015 annual project reviews are to be held at the EU offices in Brussels, Belgium. The deliverable planning of the demonstrator work package was (intentionally) set such that the three subsequent demonstrator releases will be available in time for demonstration at the annual review meetings.
- Concertation meetings – If suitable and allowed, one or two SEMAFOUR demonstrations will be given during the concertation meetings as regularly held at the EU offices in Brussels, Belgium.
- SEMAFOUR workshops – As mentioned in Chapter 5, the SEMAFOUR project will organise two project workshops, possibly in collaboration with related FP7 projects. Besides giving ‘regular’ technical presentations of the achieved results, also a demonstration of the project achievements will be given.
- (Inter)national conferences and workshops – Often technical papers covering SEMAFOUR results will be submitted to and presented at (inter)national conferences. Either combined with such contributions or as a stand-alone contribution, the SEMAFOUR demonstrations are also targeted to be present at such fora. Candidate conferences/workshops for such contributions include CCNC, COST IC1004, FMNS, IWSO, IWSOS, PIMRC, VTC, WCNC (See also Section 4.1).
- ‘Home demonstrations’ will be given by the different project partners, either for an audience of management, colleagues or customers.
- SEMAFOUR web page – Upon each new release of the SEMAFOUR demonstrator, a video clip of a demonstration will be recorded and made available for download or –streaming from the project’s web page.

## 9 Concluding remarks

This deliverable provides the dissemination plan for the SEMAFOUR project. It provides an overview of the means that are used for dissemination and describes how the exchange of results and knowledge among the partners, with related European projects, with the scientific community, with the industry, and with standardisation bodies and other fora, is handled. Moreover, it also discusses the two public workshops the project plans to organise, the role of the advisory board, and the use of the SEMAFOUR demonstrator for different demonstration scenarios.

Although reports on the dissemination activities will be provided within the yearly dissemination activities reports (deliverable D6.4, due September 2013; deliverable D6.5, due September 2014; deliverable D6.8, due September 2015), the present document also gives an impression of the already performed actions to present the SEMAFOUR project to the ‘outside world’. Up to now, most of these actions have focused on presenting the SEMAFOUR vision on self-management. As the project matures, it will move from presenting a vision to presenting and demonstrating technical results.

## Appendix A SEMAFOUR project presentation

This appendix shows the SEMAFOUR project presentation (see Section 2.2).

SEMAFOUR


FUTURE NETWORKS

# Self-Management for Unified Heterogeneous Radio Access Networks

*SEMAFOUR aims at taking the operation and management of mobile wireless networks to the next level, by the design and development of a self-management system which enables the mobile network operators to manage and operate their heterogeneous radio access networks in a unified manner.*

**At A Glance: SEMAFOUR**

**Self-Management for Unified Heterogeneous Radio Access Networks**



SEMAFOUR

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**Project website:** [www.fp7-semafour.eu](http://www.fp7-semafour.eu)

**Duration:** 09/2012 – 08/2015

**Total Cost:** ! 6.12m

**EC Contribution:** ! 3.82m

**Contract Number:** INFISO-ICT-316384

### Main Objectives

The first steps towards a self-management system have already been taken with the standardised self-organising networks (SON) solutions in 3GPP. These solutions mostly target individual radio access technologies (RATs) and layers, and are missing a system-level perspective.

The overall objective of the SEMAFOUR project is to design and develop a **unified self-management system** for heterogeneous radio access networks, comprising **multiple RATs and multiple layers** of cellular hierarchy. This unified self-management system should represent the complete environment as one single network towards the operator through a unified view.



*The unified self-management system should represent the complete environment as one single network towards the operator*

A first key objective of the project is the development of **multi-RAT / multi-layer SON functions** that provide a closed loop for the configuration, optimisation and failure recovery of the network across different RATs and cell layers. Such coordinated adaptation of radio (resource management) parameters is imperative for the global optimisation of the network performance.

The second key objective is the design and development of an **integrated SON management system**, which interfaces between operator-defined performance objectives and the set of multi-RAT / multi-layer SON functions. This new management system will provide a unified view on the performance of the heterogeneous network environment and allow its efficient control and operation. It will enable operators to move their operational focus towards a higher, more global level, which is more transparent to the specifics of the underlying network technologies and cellular layout.

In order to assess the achievable improvements in terms of network performance and manageability, the developed solutions will be evaluated through extensive simulation experiments and visualised by a **demonstration system**.

Further SEMAFOUR aims at **influencing future standardisation content and directions**, by having a bi-directional communication with 3GPP, especially with the RAN3 group.

### Technical Approach

The SEMAFOUR technical activities are organised into three work packages (WPs):

**WP 2: Requirements, use cases and methodologies.** In work package 2, the use cases for which technical solutions will be developed are defined, together with their requirements.

**WP 4: SON for future networks.** In this work package, SON functions for multi-layer LTE networks, for multi-RAT networks and for integrated multi-RAT, multi-layer networks are developed.

**WP 5: Integrated SON management.** In work package 5, concepts, methods and algorithms for an integrated SON management consisting of policy transformation and supervision, operational SON coordination, and monitoring, are developed.

The results of WP 4 and WP 5 will be evaluated by means of simulation. The reference scenarios, modelling assumptions and methodologies for performing simulations are defined in WP 2. The main results of WP4 and WP5 will form the basis for a demonstrator to be developed in WP3. All these WPs will provide input to the dissemination and exploitation activities in WP6. WP1 takes care of the overall management of the project.

### Key Issues

The figure shows the key elements of the SEMAFOUR technical approach.

A major step forward in the management of mobile networks would be that network operators do not have to analyse, control and optimise a multitude of RATs and layers individually and in isolation from each other, but are able to interact with this complex heterogeneous environment through a **unified self-management system** that represents the complete environment through a unified view. Once general network-oriented objectives and the desired network-wide performance and behaviour have been specified, in line with the operator's operational strategy, the SON paradigm enables autonomous operation, configuration and optimisation of the networks such that the general network-oriented objectives are met. The SON paradigm thereby requires a

multitude of **multi-RAT and multi-layer SON functions** to be operational in the network. Furthermore an **integrated SON management** is required that integrates and coordinates this multitude of SON functions and provides a **common means of control and feedback** on the specified general network-oriented objectives towards the operator.

### Expected Impact

The targeted unified self-management system addresses an extremely important need for the operator with high-added value, as it will considerably improve the manageability of the network, provide performance and capacity gains, and reduce the network management costs.

The involvement of two major mobile operators and two major infrastructure vendors within the project, together with an advisory board that

enables input and feedback from major European operators outside the project, ensures that SEMAFOUR is industrially driven and will consider and solve the real issues European operators are facing today and in the future.

The SEMAFOUR project addresses in this way the expected impact of the EU FP 7 ICT work programme 2011 and will contribute (i) to the development of technology for the future generations of European high-speed mobile networks; (ii) to an

increased economic efficiency of radio access infrastructure; (iii) to a strengthened position of European industry in the fields of mobile and wireless broadband systems and network management technologies; (iv) to the industry adoption of spectral-efficient broadband wireless systems; and (v) to standards and IPRs, with a predominant role for Europe in standardisation bodies and fora.

