

SHARING

SELF-ORGANIZED HETEROGENEOUS ADVANCED RADIO NETWORKS GENERATION

Deliverable D2.1

Dissemination and Exploitation Plan

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Abstract:

This document describes the dissemination and exploitation plan of the SHARING project. It details how project results and know-how will be exchanged among partners, as well as with external entities such as other European projects, scientific community, standardization bodies and other fora. The document also describes how individual partners could make use of the results and know-how generated during and after the project lifetime.

Keywords: Dissemination instruments, project workshops, scientific community, liaisons to standardization bodies and other fora.

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1 INTRODUCTION

Broadband networks are considered as an important stimulus to economic recovery in Europe. SHARING is a timely project to address the unprecedented challenge, faced by wireless industry, of spectrum and capacity crunch by 2020. The target of SHARING is to propose solutions coping with this expected traffic growth, with a particular focus on user experience improvement, through a set of new technologies and advanced techniques. The project aims at investigating factors that contribute to the non-linear traffic growth and heterogeneous nature of traffic demand dependent on usage, devices, environment (indoors, outdoors ...), and context (time of day ...). SHARING will investigate issues related to adaptive coverage/capacity techniques, efficient integration of relevant transmission systems (frequency bands, radio access technologies 2G, 3G, 4G, Wi-Fi), and cell densification towards smaller cells with efficient resource management.

The main goal of SHARING is to propose cost/power efficient and high capacity broadband solutions by: 1) enabling a flexible interference management concept in order to trigger spectral efficiency increase in future heterogeneous networks, 2) introducing smart and innovative offloading strategies, as well as joint RRM solutions across radio access technologies, 3) proposing a novel integrated architecture incorporating relays and device-to-device transmissions.

This first deliverable describes the plans for SHARING dissemination and exploitation activities during the project lifecycle, highlighting the approaches and audiences chosen for such activities. This plan includes an overview of the means of dissemination / exploitation of project findings within the project, as well as with related European projects, with the scientific and industrial community (highlighting SHARING sponsored workshops and special sessions), and with standardization bodies and other fora.

The document is organized as follows: section 0 gives an overview of the project structure. Section 3 summarizes the dissemination and exploitation objectives of SHARING. This is followed by the description of the used dissemination tools in section 4. Section 5 is dedicated to how information will be shared among the project partners. In sections 6 and 7, dissemination towards the industrial and scientific community is addressed respectively. Section 8 describes interactions with other European projects, alliances and actions/working groups. This is followed by section 9 where demonstration plans are outlined. A detailed description of the partners' individual dissemination and exploitation plans is given in section 10. Finally, section 109 gives the main conclusions.

2 PROJECT STRUCTURE

The project is structured around 7 Work Packages (WPs) whose descriptions are given below:

WP1 handles the global management of the project.

WP2 provides the technical directions of the project. It also coordinates the cross-WP and external communications (through dissemination and standardization). It defines the project scenarios, carries out market analyses and determines metrics, Key Performance Indicators and evaluation methodologies for technical WPs (WP3, WP4 and WP5).

WP3 proposes, on one side, different signal processing solutions to cope with interference, which represent one of the main capacity limitations, especially at the cell-edge. It defines and validates advanced multi-point transmissions with cooperation/coordination, enhanced by advanced receiver processing, in order to combine the merits of interference avoidance and interference exploitation. On the other side, cost-effective improved RF and antenna designs are WP3 key enablers for carrier-aggregation and multi-band exploitation by bringing flexibility in the exploitation of new bands and in the aggregation of contiguous and non-contiguous channels.

WP4 addresses the optimization of capacity, Quality-of-Service (QoS) and energy efficiency in advanced network topologies, where different nodes coexist and cooperate: macro cells, small cells (micro, pico and femto cells) and cells/access points from other Radio Access Technologies (RATs), typically Wi-Fi.

The objective of **WP5** is to address the optimization of capacity and QoS through the use of advanced relaying techniques and network-controlled Device-to-Device (D2D) communications. The studies include the improvements of meshed relay extensions and the use of D2D communications to decrease the traffic burden on the macro cell network, addressing issues such as interference and Radio Resource Management (RRM) and multi-hop management.

The goal of **WP6** is to evaluate the impact that the innovations stemming from other work packages produce on RAN architecture. WP6 carries on an analysis of the current 3GPP network architecture and assesses if it is capable of supporting these innovations, and what modifications and updates will be needed. This will include the support of the new algorithms and procedures proposed in SHARING, as well as communication procedures like D2D, or novel architecture paradigms like cloud RAN.

WP7 is the convergence point of the overall consortium since it brings to life the most innovative solutions from the key technical challenges faced throughout the project, keeping in mind the final target of proving the concepts behind the project-targeted deployment scenarios and use cases. WP7 also provides prototyping platforms or demonstrators to verify the feasibility of selected new advanced algorithms and concepts with real hardware and give indications on how efficiently implement these functions in future product hardware/software.

Figure Figure 1 depicts the transversal structure of SHARING through the matrix-like relations between the WPs:

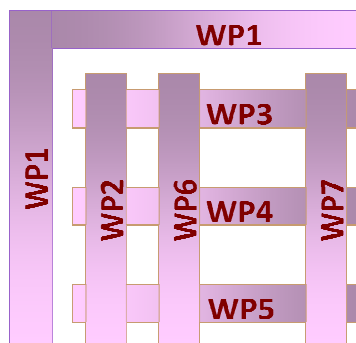


Figure 1: SHARING WP structure for non-management WPs

3 DISSEMINATION AND EXPLOITATION OBJECTIVES OF SHARING

The results of the SHARING project will contribute to the evolution of future mobile networks through the promotion of the project results with a medium-to-long term perspective. Many partners of the consortium are active in different standardization bodies and research fora; their collaborative work in SHARING will therefore support a coherent and consolidated development of system specifications. This will contribute to strengthen the scientific and technological foundations of the European community's communication industry and foster its international competitiveness.

SHARING will use different means for dissemination of project results within the project as well as towards external organizations, bodies and events. These will be detailed in the forthcoming sections. As for exploitation, the project consortium comprises partners belonging to different categories: industrial partners (operators, manufacturers, SMEs), academic partners (universities, engineering schools) and a public R&D centers. For each category, the exploitation strategy will be targeted to address specific needs. These three stakeholder groups are strongly involved in the development of concepts and systems. This will improve the chances of the adoption of the project concepts within international standards, and thus, of their economical exploitation. In addition, the partners will obviously have the results of the SHARING project available for further internal or multi-lateral research activities. Details of these exploitation strategies as well as each partner's dissemination and exploitation plan will be given in subsequent sections.

4 DISSEMINATION TOOLS

This chapter gives an overview of the dissemination tools (project website, press release, logo, project presentation and deliverable templates) as well as the Advisory Board that have been initiated as soon as the project activity has started.

Project website

The aim of the project website is to be the fundamental communication channel towards the public. It will act as the main source of information for external bodies which are potentially interested by the project work, activities and outcomes. Therefore, the project website has been initiated and launched right away at project kick-off. Its navigation mode will follow the structure below:

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

The website will be hosted and maintained by CEA (*Commissariat à l'Energie Atomique et aux Energies Alternatives*).

Press release

A 1-page SHARING press release has been created and agreed among the partners' for the purpose of informing the public of the launch of the project activities and introducing/disseminating the overall project objectives, its technical approach and expected impact to the public. The press release can be found in Appendix 1 of this deliverable.

Project logo

The project logo is an important item to set the identity of the project, which is used in all the *productions/outcome* of the project. For this purpose, a PowerPoint template for SHARING project logo has been agreed and integrated in the project templates (cf. Figure Figure 2).



Figure 2: SHARING project logo

Project presentation and deliverable templates

An initial SHARING project presentation, a slide template (which is used for the project presentation) and a deliverable template (which is used for this deliverable) have been created. The templates will be used for all the forthcoming project presentations and project deliverables. The initial project presentation has already been used several times (internally at Orange, clusters *-pôles de compétitivité-* in France, Public Administrations of the involved countries). The head slide of this presentation can be found in Appendix 2 of this deliverable.

Advisory Board

In order to guarantee the relevance of the project activities with the existing eco-system and maximize the project impact on this eco-system, it has been decided to seek advice from recognized experts external to the project. These experts will form the Advisory Board (AB) of the project. The AB will have access to public deliverables prior to their contractual delivery date, and will be asked to provide advice on matters such as, but not limited to, the technical content of deliverables, key technical decisions and means to optimize the project impact. These experts will also be asked for inputs when necessary and invited to attend formal Advisory Board meetings foreseen to be held regularly during the lifetime of the project. These meetings will be in the form of audio conferences since we are unable to cover travel costs for AB members.

The construction of the AB has started with the project activity launch. So far, two members have already been contacted, for whom the AB membership has been agreed: Thierry Lestable (Technology and Innovation Manager of SAGECOM) and Mathew Baker (Alcatel-Lucent, former 3GPP RAN1 chairman). Other candidates have been identified by the project board. These candidates will soon be invited to act as AB members.

5 INFORMATION SHARING AMONG THE PARTNERS

Project mailing list

To ease the communication among all partners, email lists have been created at the project start. These lists are closed-access lists that are provided by the Celtic office. To sum up, SHARING has nine mailing lists (called as *exploders* or *reflectors*):

sharing-board@celticplus.eu (for the project board)

sharing-GA@celticplus.eu (for the General Assembly)

sharing-plenary@celticplus.eu (for the plenary)

sharing-wp2@celticplus.eu (for WP2)

sharing-wp3@celticplus.eu (for WP3)

sharing-wp4@celticplus.eu (for WP4)

sharing-wp5@celticplus.eu (for WP5)

sharing-wp6@celticplus.eu (for WP6)

sharing-wp7@celticplus.eu (for WP7)

All reflectors are administrated by the Project Coordinator and the Technical Manager. The WP reflectors are additionally managed by the respective WP leaders.

Project teamsite

SHARING has decided to use Eurecom's BSCW server as a collaboration platform for document sharing. The server is accessible under the link www.bscw.eurecom.fr and all partners have received login details.

Internal reporting

WP leaders will provide a monthly report to the Project Board highlighting the work in progress and the encountered difficulties, including problems that could generate potential delays.

Regular meetings and phone conferences

The regular meetings include:

- The General Assembly (GA) meetings (face-to-face, once per year),
- Plenary meetings (face-to-face, three times per year),
- WP meetings (face-to-face, three times per year),
- Board meetings (face-to-face, three times per year).

In addition to the regular meetings, face-to-face and/or audio conference meetings are foreseen for special occasions (demos, visits, exhibitions etc.) and for special needs (cross WP meetings, deliverable planning etc.) Audio conferences will be held within each WP according to the needs of the ongoing/planned work in each WP. For the audio-Conference SHARING has obtained two audio conference IDs for telephone bridges:

ID 33225: CELTICPLUS SHARING

ID 33271: CELTICPLUS SHARING BIS

In addition to the telephone bridges, interactive distant presentation tools will be used.

6 DISSEMINATION TO THE INDUSTRIAL COMMUNITY

SHARING will create contacts and cooperate with the industrial community. Results and insights obtained within the project will be disseminated to the relevant industrial communities as well as the key players. This will be achieved through impact on standardization, and participation to important exhibitions/meetings organized in the industrial community.

6.1 Standardization and Other Fora

Below, you can find the short description of relevant standardization bodies (3GPP, IEEE), other fora/alliances (NGMN, Small Cell Forum, Wireless World Research Forum, ...) and their relevance to SHARING.

3rd Generation Partnership Project (3GPP)

Purpose of the 3GPP is to unite 6 telecommunications standard development organizations to provide an environment to produce reports and specifications that define 3GPP technologies such as GSM, WCDMA, HSPA and LTE. Since the completion of the first LTE and the Evolved Packet Core specifications (EPC), 3GPP has become the focal point for mobile systems beyond 3G. The 3GPP organization consists of four technical specification groups being Radio Access Networks (RAN), Service & Systems Aspects (SA), Core Network & Terminals (CT) and GSM EDGE Radio Access Networks (GERAN). Each of the four groups has a set of working groups focusing on different areas of the technology and meeting regularly several times a year to discuss and define the technological aspects of the developed system.

Currently the focus in 3GPP is on Release 12 specifications studying various technical topics which are relevant to SHARING project such as enhancements to mobility and load balancing in heterogeneous networks, enhancements for Device-to-Device communications and enhancements to interworking between LTE and WLAN.

One of the most relevant topics for SHARING on standardization is related to Device-to-Device communications features. As defined by SA1 group, Proximity Services (ProSe) are "services that could be provided by the 3GPP system based on UEs being in proximity to each other". SA1 has completed the operators' requirements work to TS 22.278. SA2 would complete the related study by December 2013 to TR 23.703. Proximity services support public safety regardless of network coverage (i.e., within and outside network coverage) as well as non-public safety use case. The latter use cases of the ProSe include commercial/social use and network offloading use. The Study Item proposal on Proximity Services in RP-122009 has been approved in RAN Plenary#58 December 2012 setting the initiation of the work in RAN1 beforehand. RAN2 also started to work on Device-to-Devices communications in RAN2#83 August 2013 meeting. RAN2 will focus on identifying and evaluating options, solutions and enhancements to the LTE RAN protocols within network coverage and out of coverage. Therefore, studies will essentially be focused on these priorities, which require that the newly developed concepts reach the appropriate level of progress, within the right time frame. SHARING will contribute to propose solutions on Device-to-Device communications with a special focus on 3GPP SA2 and RAN2 Working Groups.

IEEE 802.11

Wi-Fi is a very efficient technology, which can provide high throughput with a good reliability in certain conditions like in a home environment. In addition, current products are far from using the highest possible throughput. But Wi-Fi can become the victim of its own success, as its important growth and market adoption will lead, in the coming years, to the transformation of almost all environments into dense environments, subject to interference. This will be even truer for typical operator deployments. In order to prevent this situation and make Wi-Fi robust enough for its new usages in the long term, Orange has identified the main weaknesses of 802.11 standards and has pushed, with success, for the creation of a new group in 802.11, called **High Efficiency WLAN (HEW)**, which is now expected to become the next Wi-Fi generation.

The issues related to the offload of the LTE traffic through Wi-Fi identified in SHARING fall in the same line with those improvement directions identified in the new IEEE 802.11 HEW standardization group. With Orange being an active member of this standardization group, SHARING foresees a significant impact on it.

NGMN

The Next Generation Mobile Networks (NGMN) Alliance (www.ngmn.org) is a mobile telecommunications association predominantly consisting of operators, which acts as a pre-standardization forum by providing operator-oriented input to standardization bodies, and also to the mobile networks industry community within the scope of LTE and EPC (Evolved Packet Core). 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, organized workshops with related standardization and regulatory bodies as well as industrial stakeholders.

The relevance of NGMN on SHARING activities is mainly related to use cases and architecture requirements on Self-Organizing Network functionalities for next generation advanced cellular networks. The work carried on WP4 and the interaction of WP6 with WP4 has potential outputs which can be disseminated in NGMN through the project operator partners¹.

Small Cell Forum (Femto Forum)

The Small Cell Forum - formerly the Femto Forum - supports, promotes and helps driving the wide-scale adoption of small cell technologies to improve coverage, capacity and services delivered by mobile networks.

The Small Cell Forum is directed by an Executive Board which comprises the Chair and the Executive Board Members. The Chair is elected by the Members for one year and can be the representative of a Member or an independent non-Member. The Executive Board consists of a minimum of four Executive Board Members and a maximum of 15 Executive Board Members plus the Chair. Up to three Board positions are reserved for large system integrators/OEM (Original Equipment Manufacturers) from the mobile industry and up to three for licensed holders of spectrum.

The organization of the small cell forum is described by the following public chart that may be found in the small cell forum website (<http://www.smallcellforum.org>)

¹ It has to be noted however that the SON activity is on standby in NGMN for the moment.

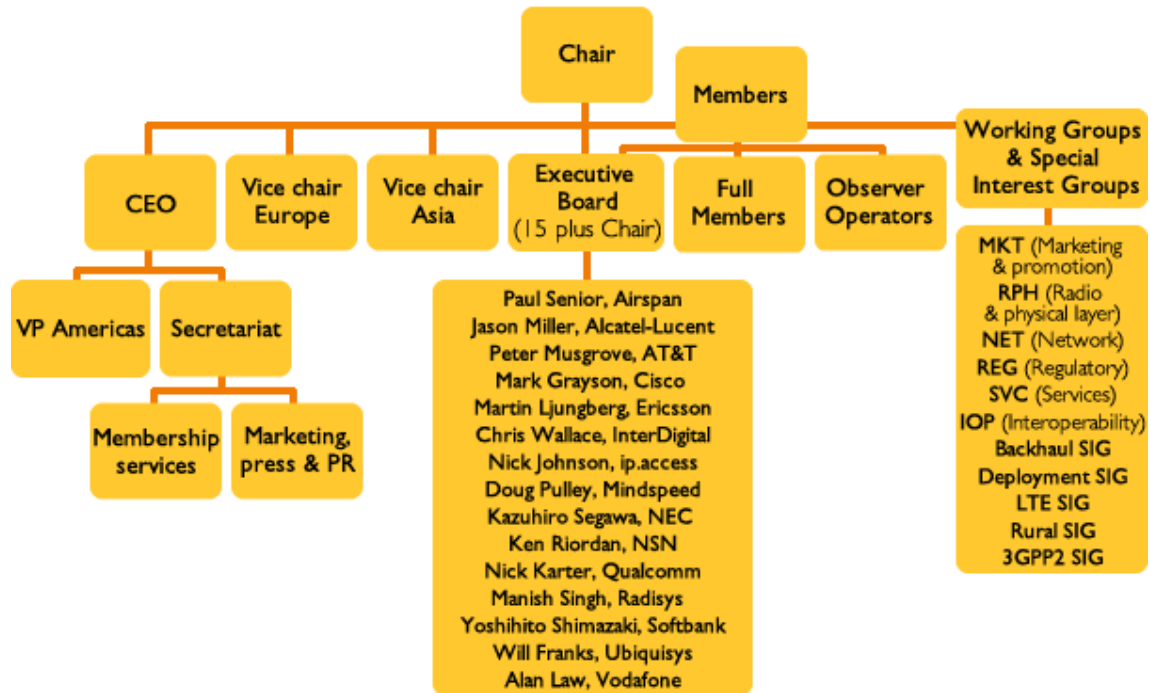


Figure 3: Small cell forum organization (July 2013)

Small cell forum is relevant to SHARING HetNet studies since it may provide requirements regarding the deployment scenarios involving small cells and high level service requirements that should be considered as a baseline for the definition of services and technologies for next generation HetNets.

6.2 Industry forums and events

In this subsection, you can find the short description of relevant industry forums (Mobile World Congress, exhibitions etc.) and their relevance to SHARING.

Mobile World Congress

- Mission/scope

The Mobile World Congress gathered more than 72,000 attendees in 2013 and represents the largest mobile telecommunications event around the World. It is both an exhibition of the latest products and software in the mobile sector and a world-class conference featuring visionary keynotes and panel discussions.

- Structure/organization

The Mobile World Congress is organized by the GSMA which is an association of mobile operators devoted to supporting the standardization, deployment and promotion of the GSM mobile telephone system. The GSM Association was formed in 1995.

- Relevance to SHARING

The exhibition area provides opportunities to meet and exchange with various experts. The conferences organized during the Mobile World Congress could provide opportunities for dissemination of SHARING results.

Orange Labs internal Research Exhibition

The Orange Labs internal research exhibition takes place annually, towards the end of each year (the beginning of December) at its major research center at Issy-les-Moulineaux/France. The aim of the exhibition is to have a dedicated time for sharing, enrichment and social

interaction. The research exhibition offers to the Orange Group employees and its partners a condensed view of its innovative strength and a look at the future service and technology trends. The 50 demonstrations and 12 conferences illustrating the major research domains allow the visitors to understand better the keys and issues of the research within the Orange Group and to discover the latest innovations from the group's researchers. The employees and partners, in France and abroad can see the recent innovations and the technological trends likely to change the landscape of telecommunications over the next ten years. This exhibition presents a unique opportunity for SHARING to generate awareness on its activities, findings and generated know-how.

7 DISSEMINATION TO THE SCIENTIFIC COMMUNITY

7.1 Scientific meetings, conferences, workshops, journals and magazines

SHARING partners will disseminate their scientific results in the following scientific and technical conferences, workshops, journals and magazines.

Conferences

IEEE WCNC

IEEE ICC

IEEE Globecom

IEEE ISIT

IEEE VTC (Fall & Spring)

IEEE PIMRC

IEEE ICASSP

IEEE SPAWC

EUCAP conference

Workshops

Celtic-Plus workshop at Future Network & Mobile Summit

Communication Theory Workshop (CTW)

Information Theory Workshop (ITW)

Other workshops and special sessions (co-)organized by SHARING (see the next subsection for details)

Journals

IEEE Journal of Selected Areas in Communications (upcoming Special Issue on 5G Wireless Communication Systems)

IEEE Transactions on Information Theory

IEEE Transactions on Wireless Communication

IEEE Transactions on Communication

IEEE Transactions on Signal Processing

IEEE Transactions on Vehicular Technology

EURASIP Journal on Wireless communications and networking

Magazines

IEEE Communications Magazine (upcoming issue on 5G Wireless Communication Systems: Prospects and Challenges)

IEEE Wireless Communication Magazine

7.2 SHARING Workshops and Special Sessions

Workshops and special sessions will be organized by SHARING. The goal is to create awareness and impact on the scientific community through dissemination of the project results. Towards this end, four workshops and one special session have already been programmed immediately at the project start:

2nd edition of the International Workshop on Small Cell and 5G networks (SmallNets2.0) co-located with ICC 2013.

Workshop on Self Organizing Networks (SONETs) co-located with WCNC 2014 at Istanbul, Turkey. This workshop is co-organized with partners from the French national (ANR) project IDEFIX.

Workshop co-located with the VDE ZdN conference 2014 in Braunschweig, Germany. This workshop is co-organized with the FP7 SEMAFOUR project.

SHARING Special Session co-located with European Wireless 2014 at Barcelona, Spain.

3rd edition of the International Workshop on Small Cell and 5G networks (SmallNets3.0) co-located with ICC 2014.

8 CONTACTS AND CO-OPERATIONS WITH OTHER EUROPEAN PROJECTS

SHARING has identified several European research projects with relevant scopes. Among those identified projects, there are some ongoing ones with whom collaborations in the form of joint workshop organizations (as mentioned in the above section) are foreseen. Some other are already finished projects intended to provide background knowledge for SHARING work.

Hereafter, a short overview of the identified projects as well as its relation to SHARING is given.

ARTIST4G

ARTIST4G FP7 project (ict-artist4g.eu) started in January 2010 and finished in July 2012. The main ARTIST4G project objective was to improve the ubiquitous user experience of cellular mobile radio communications systems by providing high spectral efficiency and user data rate across the whole coverage area, fairness between users, low cost per information bit, low latency. The technologies used to fulfill the above requirements are: interference avoidance, interference exploitation and advanced relay techniques.

SHARING will continue the work on relaying, going beyond LTE-A by combining LDPC codes with network coding at relay nodes. SHARING will also continue the work on interference mitigation by combining the existing methods with location and tracking information on the UEs.

BeFEMTO

BEFEMTO FP7 project (www.ict-befemto.eu) started in January 2010 and finished in July 2012. The aim of BEFEMTO was to develop evolved femto cell technologies based on LTE-A that enable a cost-efficient provisioning of ubiquitous broadband services and support novel usage scenarios like networked, relay and mobile femto cells. In particular, the project investigated the use of novel femto technologies in outdoor environments; with a maximum averaged transmit power of 10mW for indoor femto nodes. Worth mentioning is that BEFEMTO focused mainly on LTE radio access technologies.

In BEFEMTO, some preliminary studies about carrier aggregation were performed and SHARING will deepen in the design and implementation of RF front-ends supporting carrier aggregation. An overview of the challenges that the RF hardware has to face in order to cover the bandwidth and traffic demand was carried out. Furthermore, an analysis of the impact in the RF front-end architecture of one of the key features of LTE-A, which is the carrier aggregation, was performed identifying the additional hardware that should be incorporated to the RF front-end.

In addition, BEFEMTO project looked at several notions of self-organizing networks (SON), in which decentralized interference mitigation and energy efficiency algorithms were investigated using tools from machine learning, and game theory. SHARING will further advance these SON studies within the scope of multi-dimensional radio access technologies. Specifically, SHARING will investigate key issues related to time domain ICIC, carrier aggregation, multi-flow techniques, sleep mode strategies, LTE/WiFi offloading, among others. Further, SHARING will leverage novel notions of users' contexts, device-to-device communications, and so forth.

EARTH

EARTH FP7 project (www.ict-earth.eu) started in January 2010 and finished on June 2012. EARTH project investigated the energy efficiency of mobile communication systems. It applied an integrated approach and committed to the development of a new generation of energy efficiency equipment, comprising components, deployment strategies and network management solutions.

The target of EARTH was to enhance the energy consumption of mobile systems by a factor of at least 50%. The project was focused on mobile cellular systems of LTE, its evolution LTE-A and systems beyond.

SHARING project is related to energy efficiency techniques studied in EARTH. Different technologies were studied to improve energy efficiency: deployment strategies, network management concepts, radio resource management techniques and some proposal for future architectures that were inherently designed to be energy efficient. The impact of liaising with EARTH is the continuity in energy efficiency research.

SEMAFOUR

SEMAFOUR project is an FP7 project started in September 2012. It aims to design and develop a unified system of self-management, which allows operators to manage and operate complex heterogeneous mobile networks holistically. The project has two main objectives. The first objective is the development of new Self-Organizing features (or SON functionalities) for multi-technology (2G, 3G, 4G and Wi-Fi) and multi-layer (macro, micro, pico, femto) networks. The second objective is the design and development of a management system integrating self-organizing mechanisms that can take into account the high-level performance objectives defined by the operator. To evaluate the proposed improvements in terms of network performance, the developed management solutions will be evaluated by extensive simulation experiments and illustrated by demonstrations.

Within SHARING's WP4, SON-like solutions will be developed; but unlike SEMAFOUR, these solutions will focus specifically on intra-RAT (intra-HSPA and intra-LTE) and inter-RAT (LTE / Wi-Fi) offloading, energy savings and efficient spectral resource management.

IDEFIX

IDEFIX (Intelligent Design of Future Mobile Internet for enhanced eXperience) is a French public funded (ANR) cooperative research project that has kicked-off in October 2013. The project is coordinated by Orange with the participation of Alcatel-Lucent and several French academic partners (Telecom Institute, University Paris 6, INRIA, and University of Avignon). The goal of the project is to integrate traffic and services in the process of technological choice for LTE-Advanced and develop analytical methods for network design in presence of different mixes of services.

IDEFIX and SHARING will both work on the performance of transmitter cooperation schemes (Coordinated Multi Point, CoMP) in a context which takes into account higher layer effects: SHARING will investigate the effects of Radio Resource Management layer procedures, particularly mobility, and IDEFIX will study the impacts of service and application level phenomena, particularly elastic-like streaming services such as YouTube.

MOTO

The MOTO (Mobile Opportunistic Traffic Offloading, <http://www.fp7-moto.eu/>) 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 new network architectures 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.

MOTO's scope is related to the intra-system and inter-RAT offloading tasks of SHARING. The two projects have two partners in common: AVEA and TCS. This will ease interactions, exchanges and possible collaborations between MOTO and SHARING.

METIS

METIS (Mobile and wireless communications Enablers for Twenty-twenty Information Society) is a recently started (November 1st, 2012), 2.5-year FP7-ICT large scale (IP) project with 29 partners, led by Ericsson Sweden. The project aims at developing the technological building blocks for 5G to respond to the societal challenges of H2020. Another important goal of the project is to prepare and influence the 5G standardization process by consensus building

between the main stakeholders including operators and vendors. METIS envisages a mixture of revolutionary and evolutionary approaches to cope with the ambitious target of the project, i.e. 1000 times higher mobile data volume per area 10 times to 100 times higher number of connected devices, 10 times to 100 times higher typical user data rate, 10 times longer battery life for low power MMC (Micro Memory Cards), 5 times reduced End-to-End latency. Since several partners of SHARING are active in METIS, it will facilitate the synergy of the projects on the most promising evolutionary approaches to improve LTE advanced (which is the core goal of SHARING).

9 DEMONSTRATION DISSEMINATION PLANS

The demonstrations developed in WP7 will be disseminated through exhibition stands at conferences such as the major IEEE conferences such as Globecom, ICC, PIMRC, WCNC, or VTC, but also events such as the Future Networks Mobile Summit and the Celtic event.

A hardware demonstrator for carrier aggregation will be developed along the project, based on a reconfigurable RF front-end and antenna supporting inter/intra carrier aggregation. The hardware will cover LTE-A downlink in a small cell scenario. The development will investigate reconfigurable bandwidths and frequencies of operation to provide flexibility and use the available spectrum. The demonstrator could be showcased in Celtic Event, Future Network & Mobile Summit and any workshop organized by SHARING.

10 INDIVIDUAL PARTNER DISSEMINATION AND EXPLOITATION PLANS

In this chapter, each individual partner's dissemination and exploitation plans are detailed. Partners are grouped in each one of the following 3 categories: operators, manufacturers, SMEs, universities and research center(s).

10.1 Operators

Network operators involved in the SHARING project are well aware that standards will continue to play a significant role in market development strategies. The growing support of the industry to a reduced set of standards increases the operator's return on investments and potentially enlarges operator's customer basis. In general, operators will take advantage of the project results to help standardization bodies specify appropriate systems, in collaboration with the NGMN initiative when suitable.

10.1.1 France Telecom/Orange (FT)

France Telecom Group is contributing to innovation through Orange Labs in France and worldwide, in order to anticipate technological revolutions and new uses, to offer customers the best from telecommunications through perpetual innovation, and to imagine tomorrow's technologies. France Telecom - Orange Labs collaborates with operators, manufacturers, universities, and R&D centers in several European projects. It also contributes to standardization and regulation bodies such as 3GPP and ITU R. France Telecom - Orange Labs has been working for a number of years on PHY-MAC technologies for cellular radio communications. It has played a key role in the development of the OFDM/OFDMA technology, which has been adopted in a number of standards including 3GPP LTE. This experience has been shared through the participation to cooperative projects including 4-MORE, OMEGA, WINNER/2/+ and ARTIST4G.

France Telecom will coordinate the project, and work on interference avoidance, interference alignment, flexible interference control with advanced receivers, next generation SON functionalities for intra-LTE heterogeneous networks, smart and environment-aware radio resource management in multi-RAT heterogeneous networks, device-to-device communications, and on the corresponding architectural impacts. The knowledge, experience and know-how acquired as a result of these work will help France Telecom:

- analyze, anticipate and prepare the evolution of the mobile radio communications systems, particularly through standardization,
- enrich its pool of competencies on the leading edge wireless technologies.

Thus, the operator will be able to:

- increase its competitiveness in the world market,
- reduce the *time-to-market* that is required to progress from the concept to the product ready for the market.
- select, conceive, produce and bring to market innovative products and services.

France Telecom will disseminate SHARING work and results through publications, workshop organizations and demonstrations at its internal research fair.

10.1.2 Avea İletişim Hizmetleri (AVEA)

Avea, the sole GSM 1800 mobile operator of Turkey, was founded in 2004. Being driven by a spirit of innovation, Avea, the youngest operator of Turkey, has a nationwide customer base of 12.5 million as of the third quarter of 2011. Offering services to 97.4% of Turkey's population through its next generation network, the company is growing fast both in the corporate and individual services with the brand "Avea" and constantly investing in technology and infrastructure as well as in its management and around 2,700 employees. Having roaming agreements with 656 operators in 201 countries, the company continues to expand its roaming partnerships. Avea provides data and voice services to customers coupled with various value added services (VAS) and in order to strengthen its position in the market Avea has reorganized its R&D Center in 2009. There are more than 200 high skilled engineers

working in Avea R&D Center and Avea is the sole GSM operator in Turkey with a R&D certificate from Ministry of Industry and Commerce. Mobile health and mobile education are other important domains for Avea, where some novel solutions to be introduced to the market in 2011.

In SHARING, AVEA will be involved in WP2, WP4 and WP7. In all these WPs, AVEA will focus on cellular network based offload strategies and will input its research on access selection mechanisms in heterogeneous networks from cellular network point of view. AVEA will provide its know-how on data acquisition methods in cellular network (radio access and core networks) elements and will contribute to SHARING architecture design with its end-to-end (including radio access network, transmission network and core network) cellular network architecture design building experience. The obtained results are going to be disseminated in conferences, workshops and journal publications. Moreover, the main elements and new interfaces of the new SHARING architecture will also be identified and new functional requirements will be addressed for standardization contributions especially for 3GPP and IETF standardization bodies.

10.2 Manufacturers

The main objective of manufacturers and SMEs involved in SHARING is to benefit from the know-how acquired during the project to be ahead from their competitors when technologies dealt within the project come to real life. These partners are aware that products based on standards will become increasingly important for the industry in the coming years; consequently, the production of IPRs covering the most relevant technologies is essential to secure their future business, e.g. by the mean of cross-license agreements. As a consequence of their influence on early system specifications and thanks to their IPRs, manufacturers and SMEs will be in the position to exploit the project results by addressing the market with competitive products at the appropriate time.

10.2.1 Ericsson Finland (ERICSSON)

Ericsson is a world leading provider of telecommunications equipment and related services to mobile and fixed network operators. Ericsson systems handle about 40 percent of the world's mobile traffic. Oy LM Ericsson AB (Ericsson Finland) represents Ericsson in the SHARING project. Ericsson Finland has a long history of R&D in the telecommunication area and is currently focusing on 3G/4G and core network products. The research department at Ericsson Finland is strong in standardization, especially in 3GPP and IETF. The research group is strong in concept development and IPR creation.

In SHARING, Ericsson Finland will be involved in WP2 and in WP4. A clear majority of the work will be in WP4, where most of the contributions will be within the areas of HetNet mobility, interworking between small cells and macro networks, smart offloading techniques and energy efficiency. Ericsson Finland plans to disseminate the obtained results to selected telecommunications conferences, workshops and journals. Furthermore, relevant standardization contributions submitted to 3GPP are expected. The aim is also to collaborate as much as possible with the other SHARING partners working on similar topics.

10.2.2 NEC Technologies (NTUK)

NEC Technologies (UK) Ltd is a company registered in UK, with a French subsidiary in Nanterre, France. NTUK is fully owned by NEC CASIO Mobile Communications (Japan) and therefore is member of Japan's NEC Group. NTUK provides research and development services to the mobile device and mobile network entities within the group, in close collaboration with business units and central laboratories in Japan. NTUK has about 50 employees, 90% engineers and researchers, with the research team entirely located in France.

NTUK has extensive competences in wireless networking, system architecture, protocol design and validation, with direct contribution to standardization (3GPP RAN & CT working groups) and mobile industry initiatives (GCF, LSTI, NGMN, GSMA) where NTUK often holds official positions.

NTUK will contribute to activities related to device-to-device communications, looking for the optimal integration of the related technologies in the 3GPP Release 12 architecture (eUTRAN & EPC) and specifications. NTUK will contribute to requirements capture, architecture/enablers design as well as required innovations in radio resource management, mobility management, UE relay management, and network control and protocol design.

NTUK will lead Work Package 5 which hosts Device-to-device studies and also studies related to Advanced Relaying Techniques.

NTUK plans to provide results in Standardization, especially in the timeline of upcoming releases of LTE-Advanced as Device-to-device communications is in the focus of 3GPP work for Release 12. To this end, the most mature NTUK findings from the studies conducted in SHARING will be provided to 3GPP SA2 and RAN2 standardization bodies.

10.2.3 Mitsubishi Electric R&D Centre Europe (MER)

In 1995, Mitsubishi Electric, a leading company in electronics and telecommunication, created a research laboratory in France, formerly named ITE/TCL (Information Technology Europe - Telecommunication Lab) focused on future generations of wireless communication systems. This laboratory recently evolved to include technologies related to energy and environment, and is now named Mitsubishi Electric R&D Centre France (MERCE-France). This laboratory employs today about 25 engineers. Current activities in the telecommunication field cover short-term studies and developments addressing the fiber optic (EPON and evolutions) development in France and advanced research on future cellular systems (B3G 3GPP/LTE, 4G IMT-Advanced). MERCE has participated to various European and French RNRT projects, and is taking active part to relevant standardization bodies (SMG/3GPP, ETSI BRAN, IEEE, etc.). Moreover, direct collaborations with European universities and research laboratories are established.

In the field of mobile communications, MERCE developed an expertise that encompasses advanced architecture for mobile communication networks, digital communications (modulation, channel coding, equalization, smart antennas, space-time codes, etc.), protocols (multiple access protocols, error detection and correction, resource allocation, handover, etc.), implementation (hardware and software architecture and technologies). In particular, MERCE participated in numerous collaborative projects related to digital communications, including the European ASILUM project on smart antennas for 3G systems, the French RNRT TURBO-ACCESS on turbo techniques applied to wireless communications, the CELTIC WISQUAS and CELTIC-Plus ENGINES, and the European MATRICE, 4MORE, CODIV, WHERE, WHERE2, ARTIST4G and French RNRT OPUS and APOGEE, or ANR M3 projects, all of them targeting B3G and 4G cellular systems and based on MIMO and multicarrier technologies. MERCE was task leader in ARTIST4G-WP1 for the second half of the project.

MERCE will be mainly active in SHARING WP4 by providing a complete set of radio resources management algorithms for heterogeneous networks (HetNet) deployment scenarios and setting and leading task 4.3 on radio resources allocation and management for HetNets.

As a research laboratory of Mitsubishi electric, MERCE will disseminate the SHARING project results and contribute to the discussion of 3GPP RAN WG2 and RAN WG 3 on small cells optimization (small cell SI) within the framework of LTE/A- release 12.

MERCE is also planning to disseminate the most advanced results of the SHARING project in the relevant academic conferences.

10.2.4 Thales Communications and Security (TCS)

Thales Communications & Security S.A is a major subsidiary of the Thales Group.

Thales employs 68,000 persons; its revenues have reached 12.9 billion Euros in 2009, half from the commercial businesses and half from the professional and defense domains. Thales is the European technology leader providing safety and security, 40% in transport and

aerospace, 60% in Security and Defense. Thales is a world market leader in integrated transport systems, providing rail signaling, communication, supervision and fare collection requiring a lot of smart sensors. Thales is the first-tier supplier to Airbus, Boeing, Dassault, Eurocopter and other major commercial aircraft. In the European Defense sector, Thales provides the electronic and IT products and systems to support the different military and peace keeping platforms. In terms of security and information technologies, over half of the world's banks and busiest stock exchanges use Thales technologies to ensure the security of their transactions. Thales is also manufacturing detector technologies for health and holds a leading position in some products. One third of Thales staff is dedicated to innovation.

Within Thales Communications and Security (TCS), the R&D Signal Processing & Multimedia team performs advanced studies on signal and antenna processing techniques, digital wireless communication, cross layer optimization and cognitive radio. Platforms are developed for feasibility studies, including a MIMO OFDM bench used for real time field tests. The team maintains close links with the French administration, SMEs, University laboratories and European research actors.

TCS will mainly be active in SHARING WP3 with some studies of MIMO and interference cancellation techniques, and in SHARING WP5 about relaying. The initial exploitation plan related to these activities is detailed below and it is mainly in relation to PMR and robust/secure implementations of LTE and metrology.

TCS proposes TETRA solutions (Digicom25 and Digimax) for public safety operators needing to have a continuity of services even on the move like mobile access to centralized remote databases, to cameras for video surveillance, etc.. TCS proposes also PMR solutions based on WiMAX (TeMax). In May 2013 TCS announced the launch of NEXIUM Wireless, the new TCS PMR solution based on LTE. This new product provides high data rate to civilian security forces (firemen, police) or military ones (peace keeping, support to civilian forces, etc.). Nexium Wireless supports also TeSquad, a new hardened push-to-talk smartphone. Currently Nexium can be deployed in network mode (with a wired core network) or in isolated cell mode. The studies about clusterized mesh network in SHARING will allow TCS to acquire competences on clusterized mesh networks that will be beneficial also in the Nexium roadmap (deployment in mesh network mode, which is not available today).

TCS provides also a complete set of solutions for network metrology all over the world, in particular for regulators and national authorities interested in spectrum control. With the emergence of the new wireless standards LTE/LTE-A, TCS needs to support them in its portfolio of spectrum control products. The studies in SHARING will contribute to build the competences required for this renewal, in particular in the future HetNets scenarios in which macro/micro/femto/pico cells and relays can coexists and used advanced MIMO techniques.

TCS will disseminate the main results of its studies through adequate conferences. The cooperation with universities will be of particular importance to investigate the relevance of advanced processing of low Technical Readiness Level (TRL).

TCS will promote the exploitation of the results of SHARING in its portfolio products, and more especially regarding its activities linked to the next generation of high rate professional radios based on LTE-A and to its spectrum management. TCS also expects to reinforce its skills and Intellectual Property Rights in signal and antenna processing in relaying techniques, and in interference management MIMO techniques.

10.3 Small-to-Medium scale Enterprises

10.3.1 IDATE Consulting and Research (IDATE)

IDATE has established itself over the years as one of the leading centers for exchange and analysis in Europe, specializing in the Telecommunications, Internet and Media Industries and markets.

IDATE's vocation is to lead a number of original initiatives, a European Forum furthering the debate of ideas and the exchange of experiences between the players in these domains.

Highly reputed teams of consultants and analysts conduct numerous reports and consultancy missions and participate in the continual investment in a worldwide observatory on the markets and strategies of those players in the Information Technology and Communication sectors.

IDATE has established its credibility and independence in leading consultancy and study missions on behalf of its clients, for whom, its multi-disciplinary teams of economists and engineers are in a position to analyze the impact of market, regulatory and technological evolutions on their business and strategies. The intervention of IDATE's consultants relies on their in-depth knowledge of the markets and players, their extensive access to precise data as well as on their mastering of the specific methods of survey and analysis.

Reports and publications: a truly global Observatory on the Communications and Information Technology sectors. IDATE relies on its specialized teams and continuous investment in its information and strategic monitoring system in order to publish a thorough portfolio of sectorial and thematic reports, which are regularly up-dated.

In SHARING, IDATE will be the leader of WP2, and task leader for the scenarios and market analysis whose objective is the definition of service scenarios that could be envisioned in 5 to 10 years in order to extract the requirements on radio-access.

IDATE will take profit of SHARING results to foster its research activities in the small cells, HetNets and Wi-Fi areas. We will consolidate our expertise in these fields and this will help us for our consulting and research activities. Dissemination will be made through our research activities (market reports), our conferences (DigiWorld Summit) and our other publications (newsletter, blog, Communications & Strategies).

10.3.2 European Communications Engineering (ECE)

European Communications Engineering (ECE) Ltd was founded in Finland in 1998, and specializes in mobile network design and has worked with customers in more than 60 countries over the past 14 years. Today the company is proud to be a technical leader in the field of cellular planning and optimization. ECE Ltd offers services and software on the main mobile technologies: GSM, UMTS, HSPA, LTE, WiMAX and TETRA. ECE offers a unique, cloud based planning and optimization software solution called as eEPOS™ for assisting operators with their network deployment and maintenance processes.

In SHARING, ECE contributions and work are in WP2 and WP6 and attributed towards network planning and optimization. ECE plans in SHARING to exploit findings with research paper, presentation or practical case studies. Also, collaboration and networking with partners is part of ECE target, which also serve as opportunity for knowledge transfer.

10.3.3 MAGISTER Solutions (MAGISTER)

Magister Solutions Ltd. is a Finnish originated research and development partner at the forefront of information and communication technology. Its core competence team has long traditions in wireless communications system research, especially in development of system simulators supporting standardization activities for example in 3GPP. This had resulted in several patents covering HSPA and LTE technologies for our R&D partners and hundreds of scientific publications since 2005.

In SHARING, Magister contributes on studying the aspects of hybrid localization architecture for heterogeneous small cell networks by proposing enhancements for Minimization of Drive Tests (MDT) concept specified in 3GPP Release 10 and Release 11. Magister's purpose is to verify the localization concept by means of simulations and measurement campaign and exploit the research results in various scientific publications. Magister is looking for knowledge transfer especially from operators and network vendors for their views of usability and scalability of the autonomous drive test concept in planning and operation of next generation heterogeneous small cell networks.

10.3.4 Antenna Systems Solutions (ASYSOL)

ASYSOL (Antenna Systems Solutions) was founded in May 2010 as a Spin-Off of Radiation Group (GR) of the Technical University of Madrid. The ASYSOL team has over 30 years of experience in advanced communication systems, antenna measurements and antenna design for terrestrial and satellite areas. Its technical support group is a teachers team of the Radiation Group (www.gr.ssr.upm.es) which projection within the development and design of antennas for both ground and satellite communications segments is one of the most significant in Europe. Furthermore, it has participated in the research and development of standards for mobile broadband communications, channel characterization in MIMO systems, systems with beamforming antennas for mobile communications, and broadcast DVB-T and DVB-T2, Scenario analysis for WIMAX, proposing schemes and developing patents in these new areas of communications.

ASYSOL engage with its partners focusing on satisfying its customer needs. From the basis of ASYSOL, the Radiation Group, it has participated in the research and development of standards for mobile broadband communications, channel characterization in MIMO systems, systems with beamforming antennas for mobile communications, and broadcast DVB-T and DVB-T2, Scenario analysis for WIMAX, proposing schemes and developing patents in these new areas of communications.

ASYSOL is in a phase of expansion to increase its workforce with a mechanical technician and the incorporation of a Doctor. This expansion is supported by new projects such as the development of an antenna and a radar positioner installed by the Dutch firm METASENSING in the port of Rotterdam, and more than a dozen proposals under negotiation in Spain, France, Italy, UK, Russia, Sweden and Turkey related to their social target for development, manufacture and turnkey delivery of antenna measurement systems and professional development of antennas. On the other hand, ASYSOL has launch with the addition of a PhD for the research staff a R&D program about low profile antennas that are quite novel to install on all types of vehicles to give them broadband satellite mobile communications services via satellite in bands X, Ku and Ka.

ASYSOL will take profit of SHARING results to foster its activities, enrich its know-how, expand its staff volume and increase its visibility through SHARING dissemination events.

10.3.5 TTI Norte (TTI)

TTI is a SME that was founded in 1996 that comprises an expanding team of 100 highly qualified engineers well supported by key lab and fabrication assets. TTI works in the technological forefronts of space, military, telecommunications, science, and information technology sectors. Its main expertise is in communications, in areas like Microwave and RF technologies (active RF front ends elements, specific modules like SSPA&LNA, etc. as well as integrated equipment and systems), Active Antennas (Mobile and fix applications, Fully flat, electronic scanning from L to Ka bands), and Satellite Systems Engineering. TTI provides expertise in System Design, Prototyping, Integration and Testing of advanced RF and microwave components, providing added features like high miniaturization electronics, low power consumption, etc.

In this initial exploitation plan, we predict that the involvement in radio and network technologies activities of SHARING project, would keep the competitiveness of TTI products by means of innovation on reconfigurable RF front-ends. Furthermore, new partner alliances and the participation in technical and industrial forums, would help TTI to be involved in future projects with similar scope.

Based on the activities that TTI will carry out in WP3 and WP7 concerning reconfigurable RF front-ends, different achievements are expected that would be applied to different RF subsystems developed in TTI. The new techniques and approaches studied in SHARING to implement an RF front-end for intra band carrier aggregation and inter band carrier aggregation will provide to TTI a wide experience on this topic. This knowledge will increase the expertise of TTI on RF terminals for 4G cellular systems. Also a potential business for TTI

will be in the generation of reconfigurable terminals, because nowadays multi-band terminals are demanded.

Another topic that TTI will cover into SHARING is energy efficiency concept. Innovative energy efficiency techniques will be studied at network and component level. Real-time tuning techniques to optimize the power consumption will be studied in SHARING. TTI would exploit the results mainly for the development of a wide range of power amplifiers for cellular communications and satellite communications.

TTI will study as well several enhancements regarding protocols and algorithms able to enhance the flexibility and QoS of the radio access network. This is achieved by providing mechanisms to autonomously reconfigure the cells depending on the traffic handled and suggesting controlling algorithms based on standards so as to create a modular way to manage and add/remove new entities for a given deployment. This way TTI will position its software development capabilities and will be able to show these new proposals to operators/manufacturers both inside and outside the project, while acquiring the needed experience to include the studied protocols in future versions of TTI products.

TTI considers a key aspect the participation in national and international events in order to promote the know-how of the company in these fields and present as a provider in the European market for reconfigurable RF equipment.

10.3.6 SIRADEL

SIRADEL (<http://www.SIRADEL.com>) is a high-tech company (Small Medium Enterprise) created in 1994 and based in France, China (Hong-Kong) and Canada (Toronto). SIRADEL provides Products and Services for the ICT Industry and the Wireless Telecommunications in particular. SIRADEL's solution brings more reliable and realistic assessments of wireless network and wireless equipment performances, based on:

- Data: digital geographical 3D representation of environments, accurate and reliable RF measurements
- Software: edition and licensing of leading Scientific Tools (Volcano, VolcanoLab) to simulate the EM wave propagation (Radio Coverage of Wireless networks) and realistic channel models (System performances of radio access network and equipment)
- Consulting: technology (coverage analysis, emerging wireless systems) and management (organizational management) to optimize the wireless networks deployment and equipment design.

In the project SHARING, SIRADEL contributes to the WP2, WP3 and WP4 bringing its experience and expertise in HetNet deployment and optimization seen by the prism of realistic 3D wireless channel conditions at different frequencies. As such, in WP2 SIRADEL will propose some dynamic scenarios based on realistic channel assumptions. In WP3, SIRADEL will design advanced modules taking into account complex propagation channel characteristics to feed the system-level tools. Sophisticated interference management algorithms will benefit from these advanced inputs, and several QoS and QoE metrics will be thus assessed more reliably under those realistic assumptions. In WP4, SIRADEL will extend the simulation frameworks, and will contribute to KPI assessment and adjustment of offloading methods. This will lead to guidelines refinements on the wireless network HetNet design and deployment methodology.

Results and collaboration with SHARING partners will permit SIRADEL to consolidate its expertise in network design and enhance its tools and methodologies; this will finally benefit to its industrial customers, typically network operator's teams in charge of dimensioning, design and optimization.

10.3.7 Sequans Communications (SEQ)

Sequans Communications is a French SME, world-leading 4G chipmaker, supplying LTE and WiMAX chips to equipment manufacturers and mobile operators globally. Founded in 2003 to address the WiMAX opportunity where it is now a global leader, Sequans expanded in 2009 to address the LTE market. Sequans' chips are inside the world's leading WiMAX networks and

will soon be inside LTE networks. Sequans is based in Paris, with additional offices throughout the world, including USA, United Kingdom, Israel, Hong Kong, Singapore, and Taiwan.

Although created only 10 years ago, Sequans Communication has a long history of collaborative research. Sequans was leading WiMAGIC, a FP7, Call#1 proposal, and is currently involved in various Call#4 and Call#5 projects. This strong R&D spirit allowed Sequans to stay at the cutting edge of the innovation, accelerating the transfer of innovation from research to products. Sequans is monitoring standardization bodies (mostly 3GPP) and will bring to the consortium hints on what's going on in the cellular context. Sequans Communication participated in ARTIST4G.

Sequans will be involved in SHARING through its R&D department, located in Paris, La Defense. This department deals with the design of the next generation chipsets, covering aspects as advanced PHY layer algorithms to include in the base band, platform and SW development. Sequans is focused on the terminal side and its SHARING experience is expected to increase its expertise on their core business.

10.4 Universities

Academic partners participating in the SHARING consortium are naturally interested in building on and further developing their existing research achievements and know-how in radio communications. Their participation will allow them to keep track of the industrial realities, and therefore to address the relevant challenges in a realistic way. SHARING's academic partners already have long standing records of contributions in the field of mobile communications, as well as numerous collaborations with the industry in this field. Their expertise, enriched by the project, will permeate into the daily university life and will be disseminated within academia education, especially on Masters and PhD student level, to educate future European mobile communication experts.

10.4.1 University of Oulu (UOULU)

The Centre for Wireless Communications (CWC) operates as an independent research program within the Telecommunication Laboratory at the University of Oulu. The mission of CWC is to conduct both fundamental basic and applied research. CWC's fundamental research serves as the basis for developing the necessary competences that can be divided into future broadband transmission and radio access network techniques, wireless system planning, communication signal processing algorithms and architectures for wireless networks, sensor networks, channel modeling and measurements, as well as radio frequency technologies. CWC's applied research activities are divided into three major areas. Future broadband wireless solutions include areas such as next generation mobile cellular systems and evolution versions of wireless access. Research is also conducted on next generation wireless solutions for defense, security, crisis management and public safety. CWC's annual budget of approximately 5.5 million Euros, employing a staff of 110, consists only of external funding received for various research projects. In SHARING, UOULU is focusing on WP2 and WP4. The planned contributions pertain to inter- and intra- RAT offloading, Self-organizing networks and RRM, power control, coordination strategies for small cells, context-aware resource allocation, etc. UOULU will build on its expertise in HetNets, to tackle new challenges facing HetNets.

UOULU will disseminate its innovations to top conferences, journal submissions, as well as workshop organizations, and tutorials. Here, we will build on our expertise in the field of Heterogeneous and small cell networks. UOULU has already given 2 tutorials in IEEE ICC 2012 and IEEE PIMRC 2012, and is thus planning to continue this trend. Likewise, UOULU has organized two workshops in IEEE ICC 2012 and IEEE ICC 2013 on HetNets. By the end of 2014 UOULU will publish a book on recent advances on small cell networks.

10.4.2 Institut Eurecom (EUR)

EURECOM is a research and teaching institute located in Sophia Antipolis (France). It is a consortium under French Law with height industrial members and four academic members. EURECOM's research activity focuses on three domains corresponding to three research

departments: Networking & Security, Multimedia Communications, and Mobile Communications. EURECOM is a member of ETSI and Car2Car standard bodies.

The Mobile Communications Department has its focus on digital signal processing for mobile communications, multi-user information theory (including importantly MIMO systems, relaying, cooperative communications), 3rd and 4th generation cellular radio systems, wireless protocols (including resource control), mobile ad hoc networks, software radios, and S/W and H/W prototyping. It was involved in the FP5/FP6/FP7 IST programs, as a major partner of the MOBYDICK, DAIDALOS, DAIDALOS2, E2R, E2R2, WIDENS, CHORIST, MULTINET, COOPCOM, NEWCOM, CRUISE, UNITE, SENDORA, SAMURAI, SAPHYRE, SACRA, LOLA and more projects. It was a key member of the NEWCOM++ Network of Excellence. In addition to fundamental research, the department has strong expertise in open-architecture multi-way real-time radio platforms (4G MIMO-OFDMA).

In SHARING, EURECOM will lead WP7 on the proof of concepts. The main contributions of EURECOM in SHARING will be in WP3 (information theoretic and signal processing work related to cooperation and pre-coding in the presence of limited feedback and delayed/outdated feedback), WP5 (design and study of advanced relaying techniques and device-to-device communications) and WP7 (prototyping effort including hardware demonstrator showing key results from WP5 in real time under LTE-A type constraints).

Eurecom will contribute to the academic dissemination by writing and presenting papers at high quality conferences and journals. Eurecom will further present the developed testbed at selected conferences. Last but not least Eurecom will use this project to promote the use of OpenAirInterface in industry and academia.

10.4.3 Supelec - Ecole Supérieure d'Electricité (SUP)

SUPELEC (Ecole Supérieure d'Electricité (SUP)) is one of the top Graduate Engineering Schools (Grandes Ecoles) in France. With three campuses located at Gif-sur-Yvette, Metz and Rennes, SUPELEC has various cooperative agreements with top ranked ECE departments worldwide, including MIT, Columbia, GeorgiaTech, UT Austin, VirginiaTech, Tsinghua, and EPFL. SUPELEC is a founding member of two Thematic Advanced Research Networks (DIGITEO and Physics Triangle), and participates in several national innovation clusters (System@tic, Mov'eo, ASTech).

SUPELEC spans a broad range of expertise from information theory, advanced transceiver technologies to cognitive radio and wireless networking. Research teams work in close cooperation with industry through bilateral research contracts or collaborative European or French national projects. SUPELEC has been actively involved in numerous cooperative projects, including WiMAGIC, HIATUS, NEWCOM, NEWCOM++ and COST Actions. In SHARING, SUPELEC will participate in WP2, WP3, WP4 and WP7. The planned contributions will focus mainly on performance bounds for heterogeneous networks, relay-aided interference channels, and flexible interference management techniques. SUPELEC will disseminate the obtained results in top journals, conferences and workshops. In addition, SUPELEC is actively involved in numerous organizing and program committees of various IEEE conferences.

10.4.4 Imperial College of Science, Technology and Medicine (IMPERIAL)

Imperial College London (ICL) is a university of world class scholarship, education and research in science, engineering and medicine, with particular regard to their application in industry, commerce and healthcare. Established in 1907, it is located in the heart of London. It is consistently rated among the United Kingdom's top three universities, and was ranked 5th in the world by the Times Higher Education Supplement in 2009. ICL has over 3,000 academic and research staff and almost 14,000 students from over 120 different countries. Our reputation for excellence in teaching and research in science, engineering, medicine and business attracts students and staff of the highest international calibre. ICL nurtures a can-do entrepreneurial culture and as a result has an enormous amount of intellectual capital. ICL

has three Faculties, of Engineering, Natural Sciences, Medicine; the Imperial College Business School; and a Humanities Department. Interdisciplinary research is promoted through several Institutes.

The Communication and Signal Processing (C&SP) Group at Imperial College comprises 12 academic staff. Two main research activities in the group are digital signal processing and communications systems. The first area covers adaptive signal processing, stochastic filtering, signal modeling, spectral estimation, acoustic echo cancellation, speech enhancement, speech recognition, speaker identification, image processing and real-time signal processing. The area of communications systems includes the design and evaluation of communications and sensor networks, design and application of mobile communication systems, signal processing for wireless communications, multi-user information theory, MIMO and multi-point processing, antenna array processing and array communications, 4G cellular systems, mobile ad-hoc networks. The C&SP Group very much emphasizes and promotes cross area, synergistic approaches to tackling related research issues. The C&SP Group has been actively involved in a large number of cooperative projects sponsored among others by the Engineering Physical Sciences Research Council (EPSRC), Ministry of Defense (MOD), Defense Science and Technology Laboratory (DSTL), US Army, ERC grants, FP6, FP7 and many private companies.

The research results of the project will be communicated in the following manners:

1. By publication in leading international journals such as the IEEE Transactions on Information Theory and IEEE Transactions on Wireless Communications and in European journals as European Transaction on Telecommunications, EURASIP journal on wireless communications and networking, EURASIP journal on advances in signal processing
2. By presentation at premier international conferences such as IEEE International Symposium on Information Theory, and IEEE International Conference on Communications and at European conferences as EUSIPCO European Signal Processing Conference
3. By patenting the outcomes through Imperial Innovations and by contributing to international standards (e.g. 3GPP, IEEE) in conjunction with industrial partners.
4. By advertising the project's results through seminars given in industry and universities in America (e.g. Georgia Tech, Stanford), Europe (academic and industry partners of Imperial College) and Asia (e.g. ETRI, KAIST, LGE and Samsung).
5. By taking part in European workshops and collaborating with other EU funded consortiums.

10.5 Research centers

10.5.1 Commissariat a L'Energie Atomique et aux Energies Alternatives (CEA)

With a staff of approximately 2000 people, the Research and Technology department of CEA is one of the major applied research laboratories in Europe. CEA devotes about 85% of its activity to finalized research with external partners. One of its main vocations is to help companies to increase their competitiveness through innovation and research-to-industry technological transferring. CEA has also an active IP policy. Both on patents (portfolio of about 500 patents, and more than 140 filings/year) and the licensing of its technologies. CEA, which is actively engaged in research work extending from conceptual design of systems to pre-industrial prototypes, contributes to the transfer of technology and encourages innovation, particularly by assisting the emergence of new businesses.

The radio-communication systems division is composed of about 70 researchers, including PhD students and postdoctoral students. CEA skills cover 3G/4G (LTE, LTE-A) cellular technologies, wideband systems and short range communications (IEEE802.15.4 (Zigbee), 802.15.4a (UWB), 802.15.6 (BAN) and WirelessHD/Wigig). CEA has strong expertise on the physical and MAC layers of these systems and on their efficient implementation on hardware

platforms. In SHARING, CEA will work on various aspects of relaying, interference mitigation and carrier aggregation (from the antenna point of view) corresponding to WP2, WP3, WP5 and WP7. Results will be disseminated through publications in journal papers and major conferences (mainly IEEE).

11 CONCLUSIONS

This deliverable presents the dissemination and exploitation plans of SHARING project, providing an overview of how the project activities, results, findings and know-how will be shared among the partners, disseminated towards the public and external bodies; and also exploited by the individual partners. The dissemination towards external parties includes interactions/co-operations with related European projects (through joint event organizations), with the scientific community (through publications), with the industry (through exhibitions, fairs, etc.) and with standardization bodies (through contributions).

Dissemination and exploitation activities will be reported periodically through the periodic reports, and also will be summarized through two more dissemination/exploitation deliverables, one in the middle of the project lifetime and the other at the end of the project (deliverable D2.4v0 and D2.4 respectively).

APPENDIX 1– SHARING PRESS RELEASE

Celtic-Plus SHARING project – Press Release - October 2013

The Celtic-Plus collaborative research project SHARING – Self-organized Heterogeneous Advanced RadIo Networks Generation – opens up new perspectives for improvement of user experience in heterogeneous networks

Paris, October 2013. The SHARING Celtic-Plus project held its kick-off in September 2013.

The SHARING project aims at fostering the evolution of 4G mobile network standards, through the development of innovative technologies that will contribute to improve user quality of experience. The project follows the line of the FP7 and Celtic projects WINNER, WINNER+, ARTIST4G and BeFemto, which have proved the efficiency of European projects to leverage European expertise on mobile technologies and impact the standardization of mobile networks.

We are presently experiencing an unprecedented wireless traffic growth, essentially due to new usage of smart phones and tablets. To address this situation, in the current context of spectrum scarcity, a consensus has emerged that future networks should be heterogeneous (composed of macro, micro, pico and femto cells, plus WiFi access points). Obviously, managing and optimizing such networks is highly complex, in particular – but not only - due to the interference created by numerous neighbouring and overlapping cells. SHARING will provide spectrally and energy efficient solutions for such heterogeneous networks, contributing in this way to ensuring quality everywhere in future heterogeneous networks.

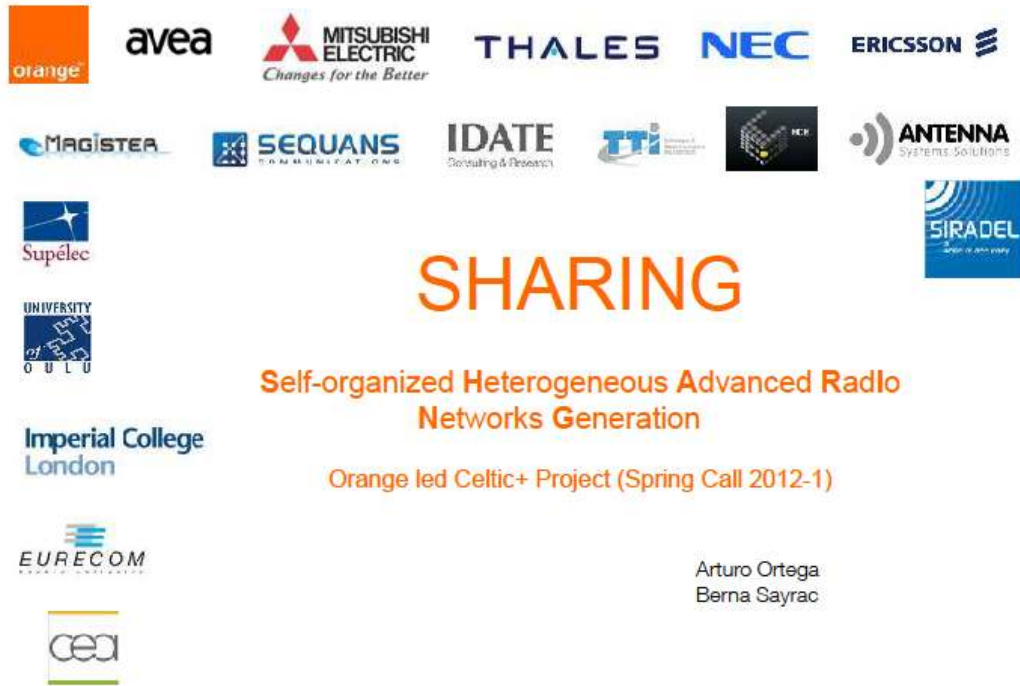
To this end, SHARING will address new concepts with special focus on interference management, cost-power efficient small cell deployments, LTE-A – WiFi convergence, network controlled device-to-device communications, meshed relay assisted networks, Self-Organized Network (SON) features and architecture evolutions for heterogeneous networks.

Expected outcomes include improved overall quality of service and network capacity, enhanced spectral efficiency for the benefit of the less favoured users, as well as a harmonious co-existence of different technologies and network layers.

SHARING brings together major actors from the mobile industry and the academic world to build consensus on standards development and the design of future networks. The project partners are: Antenna Systems Solutions (Spain), Avea Itetisim Hizmetleri (Turkey), Commissariat à l’Energie Atomique et aux Energies Alternatives (France), ERICSSON Finland (Finland), Eurecom (France), European Communication Engineering (Finland), France Telecom-Orange - project coordinator – (France), IDATE Consulting and Research (France), Imperial College London (UK), MAGISTER Solutions (Finland), Mitsubishi Electric R&D Centre Europe (France), NEC Technologies (France), Sequans Communications (France), SIRADEL (France), Supelec (France), Thales Communications and Security (France), TTI Norte (Spain) and the University of Oulu (Finland). The project will finish in February 2016.

APPENDIX 2 – SHARING PROJECT PRESENTATION

The head slide of the initial project presentation is depicted below.



The slide features a central title 'SHARING' in large orange letters, with the subtitle 'Self-organized Heterogeneous Advanced Radlo Networks Generation' below it. Underneath the subtitle is the text 'Orange led Celtic+ Project (Spring Call 2012-1)'. The slide is surrounded by logos of various partners and sponsors, including Orange, AVEA, Mitsubishi Electric, Thales, NEC, Ericsson, Magistera, Sequans, IDATE, JTI, Antenna Systems Solutions, Supélec, University of Oulu, Imperial College London, EURECOM, and cea.

SHARING

Self-organized Heterogeneous Advanced Radlo
Networks Generation

Orange led Celtic+ Project (Spring Call 2012-1)

Arturo Ortega
Berna Sayrac

GLOSSARY

ACRONYM	DEFINITION
3GPP	Third Generation Partnership Project
ABS	Almost Blank Sub-frame
ACTS	Advanced Communications Technologies and Services
ADSL	Asymmetric Digital Subscriber Line
AMC	Adaptive Modulation and Coding
ANR	Agence Nationale de la Recherche
AP	Access Point
ARPU	Average Revenue Per User
ASIC	Application Specific Integrated Circuit
BAN	Body Area Network
BBU	Base Band Unit
BeFEMTO	Broadband evolved FEMTO
BRAN	Broadband Radio Access Network
BS	Base Station
BTS	Base Transceiver Station
CA	Carrier Aggregation
CAPEX	Capital Expenditure
CCIR	Comité Consultatif International des Radiocommunications
CDMA	Code Division Multiplexing Access
CEPT	Conférence Européenne des Postes et Télécommunications
CO	Confidential
COMP	Coordinated Multi-Point
COST	european Cooperation in Science and Technology
CRC	Cyclic Redundancy Check
CRS	Common Reference Signal
CS	Coordinated Scheduling
CSG	Closed Subscriber Group
CSI	Channel State Information
CSIT	Channel State Information at Transmitter
CT	Core network and Terminals
CTO	Chief Technical Officer
CTU	Chief Technical Officer
CWC	Centre for Wireless Communications

CoMP	Coordinated Multi-Point
D2D	Device to Device
DARPA	Defense Advanced Research Projects Agency
DL	Downlink
DRX	X-Ray Diffraction (in French)
DSL	Digital Subscriber Loop
DSTL	Defense Science and Technology Laboratory
DVB	Digital Video Broadcasting
EC	European Commission
eICIC	Enhanced Inter-Cell Interference Cancellation
eNB	evolved Node B
EPC	Evolved Packet Core
EPON	Ethernet Passive Optical Network
ETSI	European Telecommunications Standards Institute
EU	European Union
FDD	Frequency Division Duplex
FPGA	Field Programmable Gate Array
FRN	Fixed Relay Node
GA	General Assembly
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile
GSMA	GSM Alliance
GW	Gateway
HARQ	Hybrid Automatic Repeat reQuest
HDR	Habilitation à Diriger les Recherches
HF	High Frequencies
HO	Hand Over
HSDPA	High Speed Downlink Packet Access
HSPA	High Speed Packet Access
HW	Hardware
HeNB	Home eNB
IA	Interference Alignment
IC	Interference Cancellation
ICIC	Inter-Cell Interference Cancellation
IMT	International Mobile Telecommunications

IP	Internet Protocol
IPR	Intellectual Property Rights
ITU	International Telecommunication Union
JP	Joint Processing
KPI	Key Performance Indicator
LAN	Local Area Network
LDPC	Low Density Parity Check
LTE	Long Term Evolution
LTE-A	Long Term Evolution - Advanced
MAC	Medium Access Control
MC	Multi Carrier
MIMO	Multiple Input Multiple Output (MU-MIMO see MU)
MME	Mobility Management Entity
MRN	Mobile Relay Node
MS	Mobile Station
MTC	Machine Type Communications
MU	Multi-User
NAS	Network Access Server
NFC	Near Field Communications
NGMN	Next Generation Mobile Networks
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	OFDM Access
OPEX	Operational Expenditure
OSTBC	Orthogonal Space Time Block Code
PAPR	Peak to Average Power Ratio
PC	Personal Computer
PDCP	Packet Data Convergence Protocol
PHY	Physical Layer
PM	Project Manager
PU	Public
QMR	Quarterly Management Report
QoS	Quality of Service
RAN	Radio Access Network
RAT	Radio Access Technology
RF	Radio Frequency
RLC	Radio Link Control

RN	Relay Node
RNC	Radio Network Controller
RRC	Radio Resource Control
RRM	Radio Resource Management
RTD	Research and Technical Development
SC	Single Carrier
SME	Small and Medium Enterprise
SNR	Signal to Noise Ratio
SON	Self Optimizing/Organizing Network
SW	Software
TA	Tracking Area
TCO	Total Cost of Ownership
TD	Time Division
TDD	Time Division Duplex
TM	Task Manager
TR	Technical Requirement
TTI	Transmission Time Interval
TX	Transmit
UE	User Equipment
UK	United Kingdom
UL	Uplink
UMTS	Universal Mobile Telecommunication System
UT	User Terminal
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Access Network
UWB	Ultra Wide Band
VNI	Visual Networking Index
VPL	Vehicle Penetration Loss
WCDMA	Wideband Code Division Multiplexing Access
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Network
WP	Work Package
WPL	Work Package Leader