Cognitive Radio Experimentation World

Project Deliverable D8.1
First Promotion and Dissemination Status Report

Contractual date of delivery:	30-09-2011
Actual date of delivery:	30-09-2011
Beneficiaries:	IBBT – IMEC – TCD – TUB – TUD – TCF – EADS
Lead beneficiary:	TCF
Authors:	Danny Finn (TCD), Justin Tallon (TCD), Luiz DaSilva (TCD), Jono Vanhie - Van Gerwen (IBBT), Stefan Bouckaert (IBBT), Ingrid Moerman (IBBT), Christoph Heller (EADS), Alejandro Sanchez (TCS), Sofie Pollin (imec), Peter VanWesemael (imec), Jan Hauer (TUB), Daniel Willkomm (TUB), Nicola Michailow (TUD)
Reviewers:	Christoph Heller (EADS), Nicola Michailow (TUD)
Workpackage:	WP8 – Promotion and Sustainability
Estimated person months:	3
Nature:	R
Dissemination level:	PU
Version	1.0

Abstract: This deliverable compiles all the promotion and dissemination activity accomplished within the scope of WP8 during the first year of the project. Hence, the document lists and describes to some extent each of the actions performed. Those include (as introduced in the DoW), general presentations, demonstrations, publications and standardization activities. The document also provides some details on the open call announcements strategy and content.

Keywords: network testbeds, federation, wireless networks, cognitive radio, cognitive network, benchmarking

REVISION HISTORY

Version	Date	Author	Description
0.0	06/06/2011	Alejandro SANCHEZ (TCS)	Initial draft from CREW documents template
0.1	16/08/2011	Alejandro SANCHEZ (TCS)	Document layout revamped and some sub-sections filled
0.2	05/09/2011	Alejandro SANCHEZ (TCS), Stefan BOUCKAERT (IBBT)	IBBT Contributions added
0.21	08/09/2011	Sofie POLLIN (imec)	Imec contributions added
0.3	13/09/2011	Alejandro SANCHEZ (TCS)	TCD contributions added, TUB new presentation action included. V0.3 released.
0.31	15/09/2011	Christoph HELLER (EADS)	EADS contributions added
0.4	16/09/2011	Alejandro SANCHEZ (TCS)	ToC updated
0.5	21/09/2011	Alejandro SANCHEZ (TCS)	TUD contribution added
1.0	27/09/2011	Alejandro SANCHEZ (TCS)	Final version

Executive Summary

The DoW document presents, in its WP8 description, a complete list of the dissemination activities envisioned for the CREW project. As a dissemination report, the present document compiles all the related achievements. Thus the promotion and dissemination activities are classified as “general presentations”, “demonstrations” and “publications”, as corresponding to the tasks of WP8. The document also addresses, the standardization work and provide details on the open calls announcements. Sustainability and business model issues are covered in a separate document.

D8.1 is therefore organized into five chapters:

- General presentations chapter: compiling all the information related to the general presentations
- Demonstrations chapter: this chapter describes all the demonstrations performed
- Publications chapter: listing all the publications. The text from the abstract of the paper is provided as well
- Open calls chapter: dedicated to outline the main effort towards external dissemination of the open call existence and requirements to attract experimenters
- Standardization chapter: overview of the standardization efforts done within the consortium.

List of Acronyms and Abbreviations

CR	Cognitive Radio
CMOS	Complementary Metal Oxide Semiconductors
DoW	Description of Work
DVB-T	Digital Video Broadcasting – Terrestrial
FIRE	Future Internet Research & Experimentation
ISM	Industrial Scientific Medical
LTE	Long Term Evolution
OFDM	Orthogonal Frequency Division Multiplexing
PFA	Probability of False Alarms
RF	Radio Frequency
RFIC	Radio Frequency Integrated Circuit
ROC	Receiver Operating Characteristics
SDR	Software Defined Radio
USRP	Universal Software Radio Peripheral
WSN	Wireless Sensor Network

Table of contents

1 Introduction

1.1 Scope

The present document is intended to provide a complete summary of all the WP8 activity accomplished during the first year of the project. It compiles all the publications and dissemination outcomes described in the WP8 DoW. This includes:

- General presentations: Public presentations of the CREW project itself or its achievements. They take place generally at public events or conferences and may be given by one or several of the project partners.
- Demonstrations: Public activities in which CREW features or functionalities are showcased to a wide audience.
- Publications: Mostly papers submitted to international conferences or journals. They respect the classic paper layout, with an abstract, a limited number of pages and a template provided by the conference organizers.

Together with this primary dissemination works belonging to tasks 8.1.1 “Demonstrations” and 8.1.3 “Dissemination” the document also gives some details on the procedures performed so far for open calls announcements and the standardization endeavours.

1.2 Document purpose and intended audience

D8.1 is a public deliverable. It is primarily targeting the European Commission staff as a report of external activities towards dissemination and external reaching of the project. It can help in measuring the impact of the project on the scientific community.

Moreover, it can provide good insights on the major outstanding contents to anyone interested in CREW.

2 General presentations

The following table lists all the presentations of the CREW project or related to the CREW project performed so far (M12). The table highlights the attended event, its date and the consortium partner representing the CREW activities.

Event	Date & Location	Title
Wireless Innovation Forum working meeting	21-23 June, 2010, Mainz, Germany	CREW presentation (TCS)
ICT2010	27-29 Sept. 2010, Brussels, Belgium	Networking session and CREW presentation (IBBT)
FIRESTATION Workshop on Experiment Management Tools for Federated Testbeds	23 Nov. 2010, Brussels, Belgium	Experimental Management Tools Future Challenges. CREW Presentation (IBBT)
FIRE Conference	15 Dec. 2010, Gent, Belgium	Panel – Experimentation in FIRE, Views of experimental facilities projects on how to stimulate use and populate facilities: CREW presentation (IBBT, EADS)
FIA: Future Internet Assembly	17 Dec.2010, Gent, Belgium	Presentation during FIA on Friday December 17, in session X on Experimentation (IBBT)
CISCO research, invited talk	22 April, 2011, San José, California	Wireless Networking: Towards More Flexibility and Cooperation (TUB – Adam Wolisz)
SDR'11 – WInnComm – Europe	23 June, 2011, Brussels, Belgium	CREW general presentation (IMEC – Sofie Pollin)
ICT proposers info day	20 May 2011, Budapest	Session on benchmarking (IBBT)
1st Workshop on Cognitive Radio and Dynamic Spectrum Access	15 June 2011, Campinas, Brazil	CREW presentation (TUD)
Fourth Academia To Business Forum	22 September 2011, Leuven, Belgium	Presentation on CREW targeting industry, also introducing open call (IBBT)

Table 1: Compilation table for presentations during the first year

2.1 Wireless Innovation Forum working meeting

The CREW project was presented within the scope of the Transceiver Interface Subsystem Task Group. A general overview of the project was provided, highlighting the innovative aspects of CREW with special emphasis on the virtual components feature and the usage of the Transceiver API.

2.2 ICT2010

During the ICT2010 event, the first information on the CREW project and the plans for the future were shared with the audience. After the talk, CREW organized a short panel where CREW members

from IBBT, imec and TUB were present. The networking session was also used as a way to promote the CREW booth.

2.3 FIRESTATION Workshop on Experiment Management Tools for Federated Testbeds

During the workshop on experiment management tools, organized by FIRESTATION, an attempt was made to identify common interests between the different FIRE projects related to experimental tools. During the workshop, CREW was (re)presented by IBBT. The conclusion of the workshop was that although different testbeds in the projects use similar concepts to reserve, configure, operate, and monitor testbeds, moving towards one, single testbed tool is far from easy, as each testbed is still different in one way or another, and a one-fit-for-all tool does not exist. Designing new tools requires huge efforts, and then still it would be difficult to support all "special" behaviour of the individual testbeds. Therefore, the most realistic expectation is to define a minimum set of features to support between the different testbeds, with efforts mainly going to large-scale federation of testbeds located at different sites.

For wireless testbeds in general, and the CREW testbed specifically, such large scale federation with the goal of increasing the scale by running multiple experiments in parallel at different locations, is not the target. This is because in cognitive radio networks, interference is one of the key issues to be solved. As interference is a localized phenomenon, this type of federation is not the type of federation pursued by CREW.

2.4 FIRE Conference

During this session, it was discussed how the different FIRE facilities could be promoted. General information on the CREW project and ideas on how to attract people to the CREW infrastructure were presented.

2.5 FIA Future Internet Assembly

As for the presentation part at this conference, a general introduction to the CREW project was presented. People were invited to meet CREW members at the booth at the same venue, for more discussions and more information.

2.6 CISCO research, invited talk

CREW general presentation. Speech during the conference "Wireless Networking: Towards More Flexibility and Cooperation".

2.7 SDR'11 – WInnComm – Europe

A general introduction to the CREW project was presented, in a special session that gave an overview of multiple funded projects related to SDR and CR. Special interest was given to the open call, and to the CREW enlarged. People were also invited to the presentation of the paper about the first CREW experiments in another session at the same conference.

2.8 ICT proposers info day

General presentation on the CREW project.

2.9 1st Workshop on Cognitive Radio and Dynamic Spectrum Access

TUD has been invited for a key note at the 1st Workshop on Cognitive Radio and Dynamic Spectrum Access at CPqD, Campinas, Brazil on June 15, 2011. Steffen Watzek, Program Manager at TUD, used this opportunity to present the CREW project as a superior example of collaborative experimental research. The auditorium, consisting of more than 200 people from Brazilian government bodies, industry and academia were really impressed by the testbeds and the federation thereof. An outlook for the Open Calls was given and raised a lot of interest for further collaboration between Brazil and Europe.

2.10 Fourth Academia-to-Business Forum

At the fourth Academia-to Business forum, CREW was presented to a mainly business oriented audience. The details on the open call were shared as well.

3 Demonstrations

The following table lists all the events to date (M12) at which demonstrations of testbeds or functionalities of the CREW project have been accomplished. The table highlights the event, its date and the consortium partner attending (please note that some of the demonstrations took place in the same event where a presentation was performed).

Event	Date & Location	Title
ICT 2010 event	27-29 Sept 2010, Brussels	Demo: "FP7 CREW project" (IBBT, IMEC)
ServiceWave conference during the FIREweek	13-17 Dec. 2010, Gent, Belgium	Demo&publication: Spectrum Sharing in Heterogeneous Wireless Networks: An FP7 CREW Use Case (IBBT, IMEC)
DySPAN 2011	3-6 May 2011, Aachen, Germany	Demo&publication: An integrated reconfigurable engine for multi-purpose sensing up to 6 GHz" (IMEC)
Future Networks and Mobile Summit 2011	15-17 June 2011, Warsaw	Demo: "FP7 CREW project: Cognitive Radio Experimentation World (Booth)" (IBBT, IMEC, TUD)

Table 2: Compilation table for demonstrations during the first year

3.1 ICT 2010 event

Exhibit and network session on cognitive networking. During the demonstration track, a live demonstration of the IBBT testbed was shown. Also, the imec spectrum sensing engine hardware was shown to the public. The other testbeds of the CREW consortium were promoted via a poster.

Figure 1: The CREW booth is the rightmost booth on the wall behind the trees

3.2 ServiceWave conference during the FIREweek

The main goal of this demonstration was to showcase the possibilities of the Belgian branch of the CREW federation. Following features were demonstrated: Firmware images containing an interference avoidance scheme were deployed to sensor nodes in the IBBT testbed. Based on a local

noise scan, each IEEE802.15.4 node determined on which channel it wants to receive. This channel configuration was visualized in real time using the monitoring functions of the testbed. Next, a Wi-Fi access point was activated in the environment of the sensor nodes. In response, the sensor network reconfigured itself to avoid the generated interference, which was again visualized. The imec sensing engine was demonstrated as follows: first, the scanning procedure was started, which resulted in a periodogram, plotting the signal power over time and frequency. For different configuration options, the power consumption of the scanning procedure was estimated. The influence of an access point on the spectrum was demonstrated.

Figure 2: discussing the CREW project with visitors at the ServiceWave conference

3.3 DySPAN 2011

CREW was well presented during the DySPAN 2011 conference in Aachen, which is the major conference related to cognitive radio and dynamic spectrum access. The DySPAN conference is organized in a demo, policy and technical track, and CREW was presented in each track. The imec sensing engine was demonstrated during the demo track. In the policy track, a joint imec-IBBT paper discussed the techno-economic viability of cognitive solutions for a factory scenario, that requires cognitive sensor networks enhanced with sensing engines as represented by the IBBT-imec federated testbed. Two papers were further presented during the technical track. A first paper, performance evaluation of sensing solutions for LTE and DVB-T, characterized sensing performance of the imec sensing engine for those two scenarios, and was work in preparation for D6.1. A second paper, reliable power control for secondary users based on distributed measurements, studies how distributed sensing could be used to improve the reliability of spectrum sharing between primary and secondary users. This was a theoretical study to prepare for distributed sensing experiments in CREW during year 2.

3.4 Future Networks and Mobile Summit 2011

During the event, the delegates got the opportunity to discuss and learn more about the different aspects of the CREW project, and saw a demonstration of the integration of the imec spectrum sensing solution in the IBBT wireless network testbed. The demo showed the advantages of adding a flexible spectrum sensing device to a wireless experimentation environment where usually only packet level information is available. In a way, this demonstration can be seen as an evolution of the demonstration at Servicewave 2010: the sensing component and network testbed were now really integrated, showing real-time spectrum visualization using the testbed visualisation tools.

4 Publications

The following table lists all papers and their authors published by M12. The sub-sections following provide the abstracts of the papers.

Event	Date & Location	Title
ServiceWave conference during the FIREweek	13-17 Dec. 2010, Gent, Belgium	"Spectrum Sharing in Heterogeneous Wireless Networks: An FP7 CREW Use Case" (IBBT, IMEC)
COST action IC0902 - Cognitive Radio and Networking for Cooperative Coexistence of Heterogeneous Wireless Networks	23-25 Nov. 2010, Bologna, Italy	"CREW: Building a cognitive radio federation" (TCD)
DySPAN 2011	3-6 May 2011, Aachen, Germany	Tech Track "Performance Evaluation of Sensing Solutions for LTE and DVB-T" (IMEC)
		Policy Track "Techno-economical Viability of Cognitive Solutions for a Factory Scenario" (IBBT-IMEC)
		Demo Track "An integrated reconfigurable engine for multi-purpose sensing up to 6 GHz" (IMEC)
		Tech Track "Reliable power control for secondary users based on distributed measurements" (IMEC)
2011 Wireless Innovation Forum European Conference on Communications Technologies and Software Defined Radio (SDR'11 – WInnComm – Europe)	22-24 June 2011, Brussels, Belgium	"A Performance Comparison of Different Spectrum Sensing Techniques" (TUB, IBBT, IMEC, EADS, TCD)
Future Networks and Mobile Summit 2011	15-17 June 2011, Warsaw, Poland	"Testbed Federation: An Approach for Experimentation-Driven Research in Cognitive Radios and Cognitive Networking" (All)
SensorCom2011	21-27 August, Nice, France	"Benchmarking for Wireless Sensors Networks" (IBBT)
Wintech 2011	19 Sept. Las Vegas, Nevada	"Experimental Assessment of Tradeoffs among Spectrum

		Sensing Platforms" (TCD)
CoRoNet 2011	19 Sept. Las Vegas, Nevada	"Versatile sensing for mobile devices: cost, performance and hardware prototypes" (IMEC)

Table 3: Compilation table for papers during the first year

4.1 ServiceWave conference during the FIREweek "Spectrum Sharing in Heterogeneous Wireless Networks: An FP7 CREW Use Case"

"Cognitive radio (CR) techniques and cognitive networks aim at optimizing the use of the wireless spectrum, by observing the wireless environment and intelligently configuring radio settings and network parameters. The aim of the FP7 CREW project is to establish an open federated test platform in order to facilitate experimental research on advanced spectrum sensing, CR and cognitive networking strategies. The main goal of this demonstration is to showcase the possibilities of the Belgian branch of the CREW federation. A first aspect is the demonstration of the IBBT w-ilab.t testbed [3] which will be incorporated in the CREW federation, through an example CR set-up where Wi-Fi interference is avoided by an IEEE802.15.4 network using distributed channel selection. Secondly, a high-performance advanced spectrum sensing design by imec, based on reconfigurable analog and digital building blocks is demonstrated, showing the feasibility of spectrum sensing using low-cost low-power handheld devices. Within the CREW project, the integration of the advanced spectrum sensing component and the testbed (i) generates advanced possibilities for executing and monitoring reproducible testbed experiments, and (ii) allows the optimization of horizontal resource sharing between heterogeneous networks".

4.2 COST action IC0902 "CREW: Building a cognitive radio federation"

The publication presented the CREW project and federation to participants in the COST IC0902 1st workshop in Bologna, Italy. This contribution was submitted to Working Group 4 – Definition of mechanisms for intersystem coexistence and cooperation.

4.3 DySPAN 2011

4.3.1 "Performance Evaluation of Sensing Solutions for LTE and DVB-T"

"Since the introduction of the Opportunistic Spectrum Access paradigm, focus has been on the development of sensing algorithms. Many of those techniques have been verified only through simulations. A small set of the techniques has been verified using off-the-shelf hardware, with limited capabilities, and spectrum analyzers with very good performance, however not realistic for low-power handheld solutions. In this paper, we propose sensing functionality for sensing of LTE and DVB-T signals. This functionality is then verified using a prototype RF front-end that is a realistic candidate for future Software Defined Radio (SDR) handheld solutions. The performance achieved with this front-end is also compared with the spectrum analyzer performance, for the same functionality. We conclude that the prototype achieves a sensing performance within 12dB of the performance achieved by the test equipment when using simple energy detection functionality. In the case of feature based sensing both systems achieve similar performance. In terms of sensitivity, the considered DVB-T sensing functionality achieves the target detection performance up to -102dBm with the sensing prototype over a bandwidth of 8 MHz and averaging 9 OFDM symbols".

4.3.2 "Techno-economical Viability of Cognitive Solutions for a Factory Scenario"

"Recent advances in wireless communication theory and semiconductor technology had tremendous positive effect on the usability of wireless. As a result, wireless is embedded in virtually every aspect of our life, and this trend is expected to continue to increase in the future. Unfortunately, the electromagnetic spectrum is a scarce resource. As the number of wireless applications grows, the same

spectrum is reused over and over again, resulting in increased interference, which jeopardizes the prospect of wireless meeting its high expectations.

Dynamic Spectrum Access is one class of mechanisms proposed to mitigate this problem. It uses various technologies to adapt the operational parameters of wireless networks, to protect them from varying interference or to avoid interfering other networks. However, it naturally increases the cost of equipment, thus potentially reducing the benefit of wireless in different environments.

In this paper we examine the economic balance between the added cost and the increased usability of DSA. We focus on a particular real-life scenario – the production floor of an industrial installation. In this scenario there is extensive utilization of the ISM electromagnetic band. Production machinery is equipped with numerous IEEE 802.15.4 sensors; management offices on the same floor are equipped with IEEE 802.11 WLAN; and operators of production machinery use various types of handheld, IEEE 802.11 equipped accessories. We model the performance improvements of adding sensing technology as channel state detector to the IEEE 802.15.4 sensors or IEEE 802.11 devices in terms of reliability gains and battery lifetime improvements. We then estimate the total financial impact of interference in this scenario, and the potential gains of introducing sensing technology to the costs of operation. Based on the techno-economic analysis, this research concludes that, from a business perspective, spectrum sensing can be a viable solution in the given factory setting with coexisting 802.15.4 and 802.11 networks, if the WiFi nodes are equipped with sensing engines".

4.3.3 "An integrated reconfigurable engine for multi-purpose sensing up to 6 GHz"

"We demonstrate a reconfigurable engine for multi-purpose spectrum sensing within the cost and power constraints of mobile devices. The analog part builds up on the Scaldio reconfigurable analog front-end. The digital part is an innovative Digital Front-end for Sensing capable of performing a range of sensing algorithms, which has now been fully implemented as a chip. These components are integrated within one hardware setup, enabling real-time validation of the sensing engine. The setup is validated for DVB-T and LTE, two important candidates for future DySPAN networks, as well as for very fast spectrum sweeping".

4.3.4 "Reliable power control for secondary users based on distributed measurements"

"We study the use of distributed sensing for improving the reliability of spectrum sharing between primary and secondary users. Special focus is on spatial smoothing of the unreliable measurements and outlier detection. These techniques will be a good starting point for the distributed measurement experiments during the second year of the CREW project".

4.4 SDR'11 – WInnComm – Europe "A Performance Comparison of Different Spectrum Sensing Techniques"

"In this work we present a set of experiments that have been carried out in the scope of the CREW project to evaluate and compare different spectrum sensing approaches. By bringing together sensing solutions from the different CREW partners, it becomes possible to make a cross-platform study of the use of sensing, and the usefulness of various sensing solutions that range from inexpensive off-the-shelf solutions, to expensive monitoring equipment, to dedicated sensing equipment developed by the CREW consortium. Each of the solutions offers different RF flexibility, sensing speed and accuracy, and varies in the way the samples are processed and stored.

The presentation focuses on two different sets of simultaneous experiments that were carried out within CREW using different hardware platforms. These platforms include dedicated integrated sensing hardware, USRP software-defined radios (SDRs), small, low power sensor nodes, off-the-shelf, low cost USB spectrum analysers as well as high cost, high precision spectrum analysers. During the experiments, an 8 MHz DVB-T signal was generated in the 2.4 GHz ISM band. Sensing measurements for varying transmit power, varying distances between transmitter and sensors, and line-of-sight and non-line-of sight scenarios were recorded. All platforms were capable of recording basic energy levels allowing for the comparison of energy detection. Some of the dedicated sensing

solutions additionally employed more advanced techniques such as feature detection on the DVB-T signals.

The results of the conducted experiments allow us to compare the performance of the investigated sensing hardware and algorithms. Although the investigated scenarios were rather simple, we believe that they provide an important first step for a standardized, systematic comparison of different sensing solutions. We will extend these initial experiments and define benchmarks to objectively compare different sensing solutions".

4.5 Future Networks and Mobile Summit 2011 "Testbed Federation: An Approach for Experimentation-Driven Research in Cognitive Radios and Cognitive Networking"

"The sub-optimal exploitation of radio spectrum is widely accepted. Cognitive radio is a technology that aims to address this issue and improve the overall efficiency of radio spectrum utilization. However, this promising technology is far from being mature at present. In addition to theoretical research, experimentally-driven research is needed to convince industry and regulators of the benefits of cognitive radio. Several initiatives in this direction are taking place or are currently operational in both Europe and the United States. Most of them feature testbeds devoted to a specific radio access technology, network topology or application. A "federation" of testbeds, addressing different applications or technologies each, can offer a richer and more powerful framework to tackle the large variety of challenges of experimentally-driven research in cognitive radio. The approach proposed in this paper combines the existing capabilities of several testbeds to build a "federation". Through intelligent combination of hardware and software components originating from different testbeds and linking them together via standardized interfaces, new components with enhanced capabilities are created. Another key feature of the "federation" is the establishment of a benchmarking framework, enabling repeatable and reproducible results in a controlled wireless environment and allowing a fair comparison between experiments".

4.6 SensorCom2011 "Benchmarking for Wireless Sensors Networks"

"While the number of Wireless Sensor Network (WSN) protocols steadily increases, the evaluation methods have largely remained the same. Although experimentally supported research is gaining popularity, protocol evaluation and comparison remains difficult due to a lack of performance analysis methodologies. This work introduces a wireless-benchmarking workflow that is designed to support experimentally-driven analysis of WSN protocols. This methodology and the accompanying benchmark concepts are designed to increase the value of experimental performance evaluation compared to the current ad-hoc approaches applied by many researchers. Finally, we present a proof of concept implementation used to perform experiments based on the proposed workflow".

4.7 Wintech 2011 "Experimental Assessment of Tradeoffs among Spectrum Sensing Platforms"

"This paper reports experimental results comparing the performance of four platforms employed in spectrum sensing and dynamic spectrum access research: a sensing engine developed at imec and built around a prototype RFIC; the Universal Software Radio Peripheral (USRP) with the Iris software defined radio (SDR) solution; the TelosB sensor network platform; and the Wi-Spy low cost spectrum sensor solution targeted at the ISM band. We use experimental data to derive the receiver operating characteristics (ROC) of each of the four platforms. We observe that for low signal powers, narrow bandwidth signals, high shadowing, or stringent probability of false alarm (PFA) requirements tradeoffs among the platforms tested are most pronounced, whereas for high signal powers, large bandwidths, stable environments, and more exible PFA requirements less expensive, commercial-off-the-shelf equipment performs sufficiently well".

4.8 Coronet 2011 "Versatile sensing for mobile devices: cost, performance and hardware prototypes"

"This paper discusses the trade-off between cost and performance of spectrum sensing solutions, and the viability of using these techniques for every mobile device. Next, hardware prototypes are

discussed, specifically the imec sensing engine which is a unique hardware prototype in terms of performance and cost since it is the first integrated digital CMOS solution for scanning the spectrum".

5 Open Calls

5.1 Networking at events and presentations

To attract the maximum number of experimenters to the CREW open call, promoting the call is frequently done when attending various events, also when CREW is not the main reason to attend a specific event.

In addition to these ad-hoc promotion opportunities, members of the CREW project attended and organized multiple sessions that were specifically targeted at promoting the open call. These specific events are listed below.

- First FIRE open call information day (February 9, 2011, Brussels, Belgium)

At this event, a general introduction to the CREW project was presented. The presentation included a first version of the specific open call information for CREW.

- Future Network and Mobile Summit 2011 (June 16, 2011, Warsaw, Poland)

In Poland, a dedicated session to the CREW project was organized. The session took place in meeting room “GrandBallroom A”, on the conference floor of the Marriott Warsaw, and lasted for about an hour. About 10 people attended the session, meeting our expectations; although this was not a huge crowd, several of the attendants expressed serious interest to participate to the CREW open call after the session.

- Second FIRE open call information day (September 14, 2011, Brussels, Belgium)

At this event, organized by FIRESTATION, details on the CREW open call were be shared. In the morning, a plenary session together with other FIRE projects is scheduled. In the afternoon, there was a dedicated CREW session. Details on the different infrastructures that are available for the open call were shared, and participants had the opportunity to discuss possible experiments.

5.2 Additional ways of promoting the open call

- **CREW website:** the open call is clearly mentioned, and highlighted through banners.
- **CREW mailing list:** at events, people interested in the open call/interested in the project, people are encouraged to subscribe to the CREW mailing list. The open call events are promoted via the mailing list.
- **Advertisements:** advertisements, formatted according to the rules set by the European Commission, were published in the following journal, and newspapers:
    - **Journal:** IEEE Communications Magazine, August 2011
    - **Newspaper 1:** De Tijd / L’Echo (Belgium): Saturday August 27, 2011
    - **Newspaper 2:** Tagesspiegel (Germany): Sunday September 4, 2011
    - **Newspaper 3:** The Irish times (Ireland): Wednesday September 12, 2011
    - **"le Ministère de l'Economie, des Finances et de l'Industrie" and " Ministère du Commerce Extérieur" french mailinglists :** These distribution lists address virtually every economic actor. This means, institutions, academia, companies, SMEs etc.

Figure 3: advertisement, as used for publication in IEEE Communications Magazine

- **ACROPOLIS Newsletter:** In the newsletter of the Network of Excellence on cognitive radio and cognitive networking ACROPOLIS the CREW project is presented and the first open call is highlighted.

6 Standardization activities

The CREW project is considered as key enabler for the publishing of a new version of the Transceiver Facility Specification and as such it is being taken into account by the Transceiver Subsystem Interfaces Task Group (TSI-TG) from the Wireless Innovation Forum. The goals and presentation of this working group is provided below:

The TSI-TG aims to elaborate on an agreed interface specification of a Software Defined Radio (SDR) Transceiver Subsystem.

Unlike existing specifications such as OBSAI RP3, CPRI, Vita 49 or DigRF, which focus on interoperability between hardware subsystems, and which do not sufficiently address control and configuration mechanisms, this specification provides a software abstraction that decouples waveform software from the specifics of the transceiver subsystem implementation, while not preventing use of any of the aforementioned standards.

The Transceiver Subsystem is the part of a radio chain that transposes - for transmission - baseband signal into radio signal, and - for reception - radio signal into baseband signal.

The CREW project was presented within the Wireless Innovation Forum in the European Workshop Meeting 2010 (Mainz, Germany, June 2010). The goals of CREW in general and more specifically the Cognitive Radio extensions to the Transceiver Facility Specification were exposed.

Following the common data formats harmonization efforts inputs from IEEE 1900.6 are being considered. It is likely that CREW will try to contribute to the standardization body during the coming year as the common data formats definition gets more mature.

7 Conclusion

This document sums up the most important promotion and dissemination activities of the CREW project that took place during the first twelve months of the project. Ten general presentations about the project, its partners and its goals have been given at events and conferences all over Europe, in the United States and in Brazil. Four demonstrations showing parts of the CREW facilities in live operation have been given, as well as eleven scientific publications published in journals or presented at conferences in Europe and the United States. The first open call of the project has been announced at three dedicated networking events, as well as via the project website, its mailing list, newspaper advertisements and mailing lists of other projects. With its activities in the Wireless Innovation Forum, CREW is also involved in the standardization of cognitive radio.

With this broad set of promotion and dissemination activities, the project CREW should have achieved broad visibility within the cognitive radio community all across Europe and even beyond. With its great number of scientific publications, CREW also delivers new concepts, ideas and thought-provoking impulses in the cognitive radio community.

The dissemination activities related to the first open call should result in a sufficiently great number of submissions from external experimenters, so that an interesting and gainful set of experiments can be selected to be performed on the federated testbed.