



## Cognitive Radio Experimentation World



### Project Deliverable D8.8.5 Promotion & dissemination report of WINGS experiment

<b>Contractual date of delivery:</b>	31-03-2014
<b>Actual date of delivery:</b>	18-04-2014
<b>Beneficiaries:</b>	WINGS
<b>Lead beneficiary:</b>	WINGS
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<b>Workpackage:</b>	WP8 – Promotion and Sustainability
<b>Estimated person months:</b>	1
<b>Nature:</b>	R
<b>Dissemination level:</b>	PU
<b>Version</b>	1.2

**Abstract:** This deliverable compiles all the promotion and dissemination activities accomplished within the scope of WP8 by WINGS. These activities include scientific presentations, general presentations and demonstrations.

**Keywords:** dissemination, presentations, publications, demonstrations, network testbeds, federation, wireless networks, cognitive radio, cognitive network, benchmarking

## REVISION HISTORY

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Description</b>
1.0	17/03/2014	WINGS	1 <sup>st</sup> version of the document
1.1	23/03/2014	WINGS	Revised version
1.2	30/03/2014	WINGS	Revised version

## **Executive Summary**

This document provides an overview of the WINGS dissemination activities during the duration of the experiment which ran for one year as planned. The document collects all the publications and dissemination activities that were achieved by WINGS, which joined the CREW Consortium as an open call partner (as a result from Open Call 2). This deliverable includes scientific publications, participation and demonstrations in international conferences, standardization or regulation events...

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## **1 Introduction**

The experiments of WINGS are focused on the evaluation of signalling load associated with the creation of D2D (device-to-device) networking constructs and the performance of the D2D network following the creation. These networks may be needed at a specific location for a limited amount of time, so as to provide coverage or capacity extension to the infrastructure. In order to proceed to the decision making for the creation of a D2D network, contextual information needs to be collected through the usage of specified data structures, which are being exchanged through control messages. Control messages are transmitted between devices by utilizing JADE software agents. For the establishment of the D2D network, the protocol 802.11s (related to mesh networking) is utilized. As soon as the network is established, its performance can be assessed by using various applications such as ping application, video streaming and file transferring.

In this context of these experiments, WINGS has participated in various demonstration activities and proceeded to the publication of results in scientific journals. Moreover, the promotion of the CREW project has taken place during the ITU meeting in November 2013 in Geneva.

## 2 Scientific publications

- 1 Dimitrios Karvounas, Andreas Georgakopoulos, Vera Stavroulaki, Kostas Tsagkaris, Panagiotis Demestichas, "Evaluation of signalling load in control channels for the cognitive management of opportunistic networks", Transactions on Emerging Telecommunications Technologies, to appear, 2014, Wiley.

### Journal publication

**Abstract:** This paper proposes the data structures needed for the cognitive management of operator-governed opportunistic networks (ONs) which are coordinated extensions of the infrastructure and are created dynamically and temporarily through operator policies when they are needed. The data structures are divided in 5 categories: profiles, context, decision, knowledge and policy. Profile information provides information on the capabilities of devices and infrastructure-elements, the characteristics of applications, and the requirements and preferences of users. Contextual information comprises information regarding the current status of the terminal and the infrastructure devices as well as their environment, while decisions include information about the creation and (re-)configuration of ONs, as well as information for the (re-)configuration of infrastructure and terminals. Knowledge information focuses on the storage of the decisions made for each occurred context, while the policies provide rules for context handling, in terms of objectives to be achieved, strategies to be used for the optimization, and constraints to be respected. The data structures are evaluated through the capacity extension scenario where network elements exchange messages based on the IEEE 802.21 standard in order to relieve a congested base station through the ON creation that will offload a proportion of terminals to alternative base stations. For a small network, the evaluation proves that the signaling load is around 60KB, while for a large network the load is around 260KB.

- 2 Dimitrios Karvounas, Andreas Georgakopoulos, Kostas Tsagkaris, Vera Stavroulaki, Panagiotis Demestichas, "Smart Management of D2D Constructs: An Experiment-based Approach", IEEE Communications Magazine, Special Issue on "Smart Device-to-Smart Device Communications", to appear, 2014, IEEE.

### Journal publication

**Abstract:** This paper considers the concept of device-to-device (D2D) communications for the resolutions of persistent issues of mobile networks. Specifically, two scenarios will be described, the opportunistic coverage expansion of the infrastructure, where an Access Point (AP) transits to offline mode and hence its terminals shall exploit the presence of neighboring devices in order to reroute their traffic to alternative APs, as well as the opportunistic capacity expansion scenario where an AP faces congestion issues due to the excessive traffic of its terminals or the use of an obsolete RAT with low capacity. In the same manner, part of the traffic shall be offloaded to alternative APs through the creation of D2D links with neighboring devices. In order to realize the proposed solutions, the network elements will exchange information regarding their capabilities and their status so as to identify the best path from all the potential ones. Therefore, Control Channels for Cognitive Radio Systems will be utilized since the information that is conveyed through them comprise information from all the layers of the protocol stack. Furthermore, the paper will focus on the coverage expansion scenario, which is implemented at the w.iLab-t testbed. In order to realize the D2D constructs, the devices of the testbed will be configured to communicate through the Wi-Fi technology, and specifically the 802.11s standard for wireless mesh networks in order to enable multi-hop communication. To this respect the D2D constructs that will be created will be mesh networks that comprise the problematic terminals, their neighboring terminals that offload their traffic and the APs that receive the traffic. In order to evaluate the proposed solution, the signaling load of the conveyed messages will be measured, as well as the performance of the mesh network that is created after the solution enforcement through the use of a ping, a file transfer and a video streaming application.

### 3 Contributions to standardization fora

- 3 CREW/ WINGS presentation at ITU WP5A Seminar on “Cognitive Radio Systems and the use of White Spaces”, Geneva, Switzerland, 18 November 2013. Title: “A Cognitive Radio Experimentation on the Validation of Control Channels for the Management of D2D Constructs”. Presenter: Andreas Georgakopoulos, WINGS.

#### Presentation

### 4 Demonstrations & posters

The “scientific publication” section of this document already indicated that several demonstrations were given as a result of the acceptance of a peer-reviewed publication. In this section, additional CREW posters and demonstrations –those that are not attached to peer-reviewed publications– are listed:

- 4 “Experiment-based Validation of Control Channels for Cognitive Radio Systems (EVOLVE)” *Hands-on-FIRE! Demo session* organized at the *Future Internet Assembly (FIA)* in Dublin, Ireland, May 2013.

#### ½ poster

- 5 “Experiment-based Validation of Control Channels for Cognitive Radio Systems (EVOLVE)”, *Future Network & Mobile Summit 2013*, Lisbon, Portugal, July 2013.

#### Demonstration & poster

**Video:** <http://www.youtube.com/watch?v=WwALwYOnq8A>

- 6 “Experiment-based Validation of Control Channels for Cognitive Radio Systems (EVOLVE)”, *ICT 2013*, Vilnius, Lithuania, Nov. 2013.

#### Demonstration & poster

- 7 “Experiment-based Validation of Control Channels for Cognitive Radio Systems (EVOLVE)”, *Future Internet Assembly (FIA) 2014*, Athens, Greece, Mar. 2014.

#### Demonstration & poster

### 5 Workshops & Tutorials

- 8 Kostas Tsagkaris, Dimitrios Karvounas, Andreas Georgakopoulos, “Experiences from experimenting with a FIRE facility: Smart management of D2D constructs on the CREW testbed”, *Future Internet Assembly (FIA) 2014*, Athens, Greece, Mar. 2014.

#### Presentation

## **6 Conclusion**

From the list of events and publications above, it can be seen that WINGS proceeded to numerous dissemination activities during the duration of the experiment which ran from Mar. 2013 to Mar. 2014, including scientific publications, participation and demonstration in international conferences and contributions in various workshops, evidencing the benefits of CREW for experimental validation of novel wireless concepts.