Cognitive Radio Experimentation World

Project Deliverable D8.8.2
Promotion and dissemination of TUIL experiment

Contractual date of delivery:	31-03-13
Actual date of delivery:	25-03-13
Beneficiaries:	Technische Universität Ilmenau (TUIL)
Lead beneficiary:	10
Authors:	Andre Puschmann and Mohamed A. Kalil
Reviewers:	IMEC and TCD
Workpackage:	WP8
Estimated person months:	1.00
Nature:	R
Dissemination level:	PU
Version	1.0

Abstract:

This deliverable describes all promotion and dissemination activity accomplished within TUIL's experiment entitled "Experimental-driven Optimization of Timing Parameters of Contention-based MAC Protocols". The main goal of the experiment is evaluating the performance of CSMA based MAC protocol based on integration of the Iris framework and the IMEC sensing engine.

Keywords: dissemination; presentations; publications; demonstrations; CSMA/CA; Iris reconfigurable SDR framework; IMEC sensing engine

Executive Summary

In this report, we present an overview about promotion and dissemination activity accomplished within TUIL's experiment entitled "Experimental-driven Optimization of Timing Parameters of Contention-based MAC Protocols". The main goal of the experiment is evaluating the performance of CSMA based MAC protocol based on integration of the Iris framework and the IMEC sensing engine.

List of Acronyms and Abbreviations

CCA:	Clear Channel Assessment
CR:	Cognitive Radio
CREW:	Cognitive Radio Experimentation World
CSMA:	Carrier Sense Multiple Access
GPIO:	General Purpose Input/Output
MAC:	Medium Access Control
SDR:	Software Defined Radio

Table of contents

1 Publications

1. M. A. Kalil, A. Puschmann, A. Mitschele-Thiel, P. Van Wesemael, S.Pollin and M. Desmet, "Improving the Performance of MAC Protocols in Cognitive Radio Networks through Sensing Accuracy Enhancement," FIRE engineering workshop, Ghent, Belgium, 6-7 November 2012.
   Extended abstract & presentation
   Abstract: In this paper, the first results of TUIL's experiment have been presented. The paper presents a technique for enhancing the sensing capabilities of a software implementation of a CSMA based MAC protocol by using a dedicated spectrum sensing engine provided by IMEC.

2 Planned Dissemination Activities

2.1 Planned publication

1. A. Puschmann and M. A. Kalil, "Enhancing the Sensing Capabilities of a Software CSMA Protocol through a Dedicated Sensing Engine," 2nd International Workshop on Measurement-based Experimental Research, Methodology and Tools (MERMAT2013), May 7th, 2013 - Dublin, Ireland.
   Abstract: SDR has created new opportunities for designing and implementing future wireless communication systems. However, it is widely known that SDRs impose significant research and engineering challenges, especially for ISO/OSI layer two and above, due to increased processing delay. In this paper, software and hardware coupling between Iris reconfigurable SDR and the IMEC sensing engine is proposed. Different scenarios are used to evaluate the impact of this coupling on the performance of the MAC protocol. The experiment results indicate that the sensing engine has a positive impact in reducing the packet error rate compared to software- based implementations.

2. A. Puschmann, P. Di Francesco, M. A. Kalil, L. A. DaSilva and A. Mitschele-Thiel "Enhancing the Performance of Random Access MAC Protocols for low-cost SDRs," Second Workshop of Software Radio Implementation Forum (SRIF 2013), ACM SIGCOMM 2013, Hong Kong, China
   Abstract: SDR is a technology which facilitates experimentation and the practical realization of CR principles. Especially low-cost SDRs, however, experience high communication delays due to the slow connection between the radio hardware and the host computer. This delay hinders the implementation of MAC protocols. In CSMA based protocols, especially the CCA as well as the subsequent channel access phase are subject to strict temporal constraints that need to be met. In this paper, we present two strategies that address both issues and aim to enhance the performance and efficiency of CSMA protocols implemented on low-cost SDRs. The first approach employs a dedicated spectrum sensing engine as a CCA agent for the SDR. The second strategy is named premodulation. It optimizes the packet transmission path inside the SDR. Experimental results indicate that both strategies have a positive impact on reducing the slot time parameter of the CSMA MAC:

2.2 Planned Demonstration

In the next FIRE Pre-FIA workshop 2013 Dublin, Ireland, we will have a showcase for our experiment. The experimental setup consists of two nodes. Both are sending a continuous data stream (bi-directional) between each other. This is typically the case in video-conferencing applications when two users are transmitting video and audio data at the same time. The objective of this showcase can be listed as follows:

- Showing the impact of employing a dedicated spectrum sensing engine (i.e. the IMEC sensing engine [1]) as a CCA agent on the performance of the CSMA based MAC protocol. A hardware coupling between the SE and Iris [2] will be shown. Hardware coupling refers to connecting the SE to the host PC through a GPIO-pin.
- Showing the impact of a new technique called premodulation on the performance of the CSMA based MAC protocol. The main idea of this concept is to move the packet to be sent as close as possible to the RF part of the radio while at the same time allowing software to precisely control the actual transmission**.**

References:

[1] S. Pollin, L. Hollevoet, P. Van Wesemael, M. Desmet, A. Bourdoux, E. Lopez, F. Naessens, P. Raghavan, V.Derudder, S. Dupont, and A. Dejonghe "An integrated reconfigurable engine for multi-purpose sensing up to 6 GHz," In Proceedings of 2011 IEEE Symposium on New Frontiers in Dynamic Spectrum Access Networks (DySPAN), 2011

[2] P.D. Sutton et al., "Iris: an architecture for cognitive radio networking testbeds," IEEE Communications Magazine, vol. 48, no. 9, pp. 114-122, September 2010.