FIRE Workshop

Experimental Validation of Cognitive Radio / Cognitive Network Solutions

Chair: Luiz DaSilva, Trinity College Dublin

Future Internet Week
May 9, 2012 – Aalborg, Denmark

Agenda

- **09:00** **Opening: Introduction to the CREW project** (Luiz DaSilva – Trinity College Dublin)
- **09:30** **The CONSERN experimental validation methodology** (Panagis Magdalinos – University of Athens)
- **10:15** **Break**
- **10:30** **The development and evaluation of the COGEU TVWS prototype** (Tim Forde – Trinity College Dublin)
- **11:15** **FARAMIR** (Jad Nasreddine – RWTH Aachen)
- **12:00** **Discussion**
- **12:30** **Lunch**
- **13:30** **IBBT Testbed Tutorial** (Stefan Bouckaert – IBBT)
- **14:15** **The TWIST Testbed** (Mikolaj Chwalisz– TU-Berlin)
- **15:00** **Break**
- **15:15** **The Iris Testbed** (Tim Forde – Trinity College Dublin)
- **16:00** **LOG-a-TEC testbed: Cognitive Radio Networking Experimentation Using the VESNA Platform** (Carolina Fortuna – Institut Josef Stefan)
- **16:45** **Additional discussion and wrap-up**

Introduction to the CREW Project

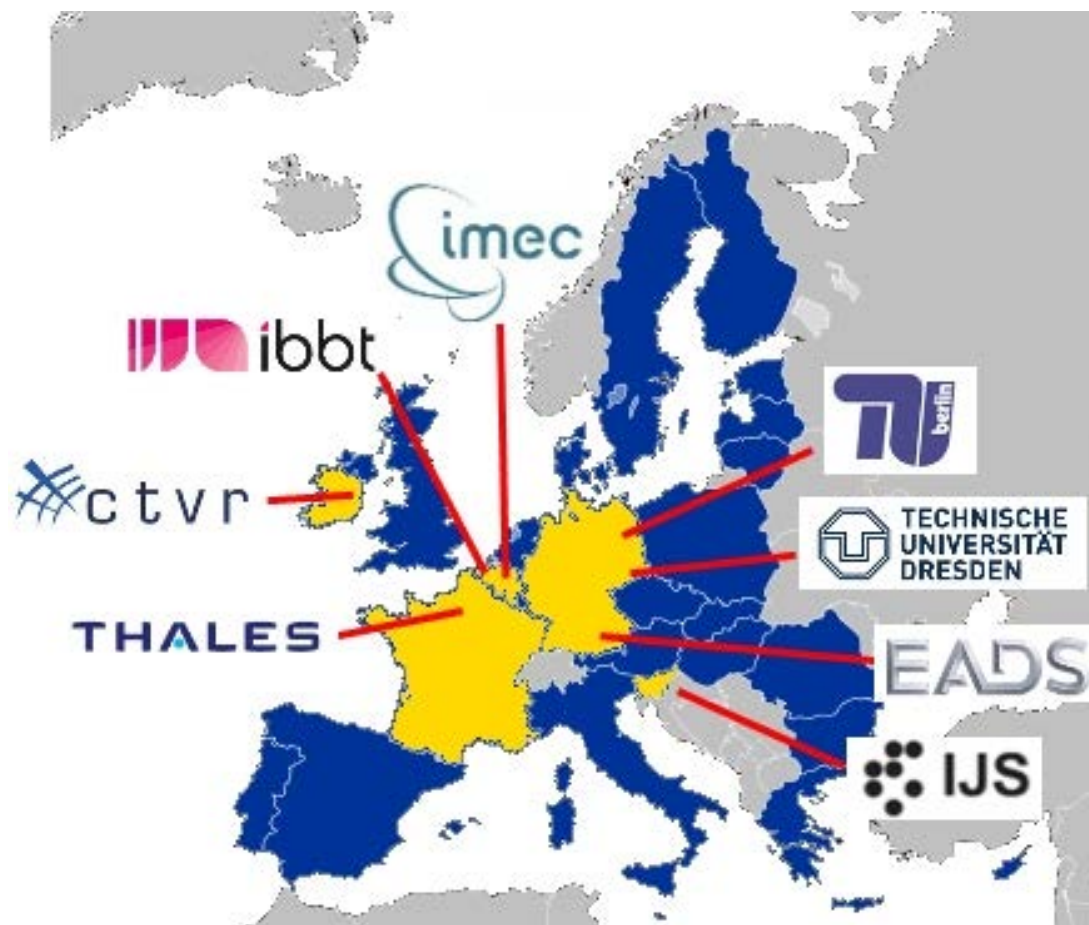**Prof. Luiz DaSilva, Trinity College Dublin**
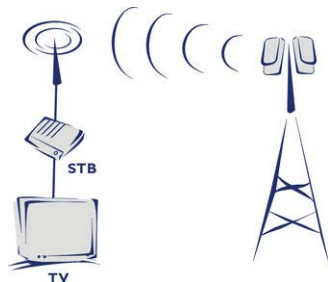
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■ Cognitive Radio Experimentation World

- FP7 call 5
- Project started October 2010
- 8 partners

- **How to evaluate cognitive radio / cognitive networking solutions?**
  - … in a configurable environment
  - … in a repeatable way
  - … allowing fair comparison of results

- **Should/can I build my own testing environment?**

■ **establish an open federated test platform, facilitating experimentally-driven research on**

- advanced spectrum sensing
- cognitive radio
- cognitive networking
- spectrum sharing
  in licensed and unlicensed bands
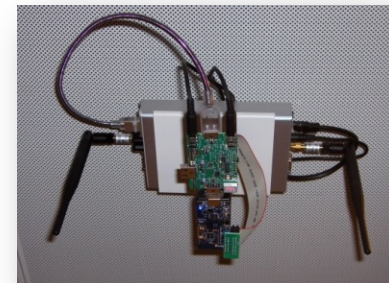
■ **CREW is …**

- Bringing together test facilities for supporting research on spectrum, cognitive radio & cognitive networking
- Augmenting facilities with novel cognitive components
- Bringing together expertise on experimentation
- Facilitating access to heterogeneous test facilities
- Offering better methodologies for experimentation (repeatability, reproducibility, comparability)

■ **CREW is NOT …**

- Doing research on spectrum sensing, cognitive radio & cognitive networking
- Designing new algorithms

CREW platform

- Starting from **5** operational **wireless testbeds**
  - heterogeneous ISM
  - heterogeneous licensed
  - cellular
  - wireless sensor
  - outdoor heterogeneous ISM/TVWS
- augmented with State-of-the-Art cognitive sensing platforms

CREW platform

Ghent
Berlin
Internet
CREW portal
Dublin
Dresden
Ljubljana

Legend:

IEEE 802.11	IRIS GPP-based software radio platform	imec Sensing Agent
IEEE 802.15.1	Comreg spectrum licenses	UHF/VHF TV sensing
IEEE 802.15.4		ISM bands sensing
LTE-advanced	BEE2 FPGA platform	THALES advanced sensing platform
EyesIFX nodes	USRP software radio	WiSpy Spectrum analyzer
CR data base	Versatile Sensor Node on Light pole	Interconnection of portals
		Interconn. between testbed elements

200 + 60 wireless nodes (WiFi/Zigbee/Bluetooth)

cognitive components: USRP, AirMagnet, imec sensing agent

office environment
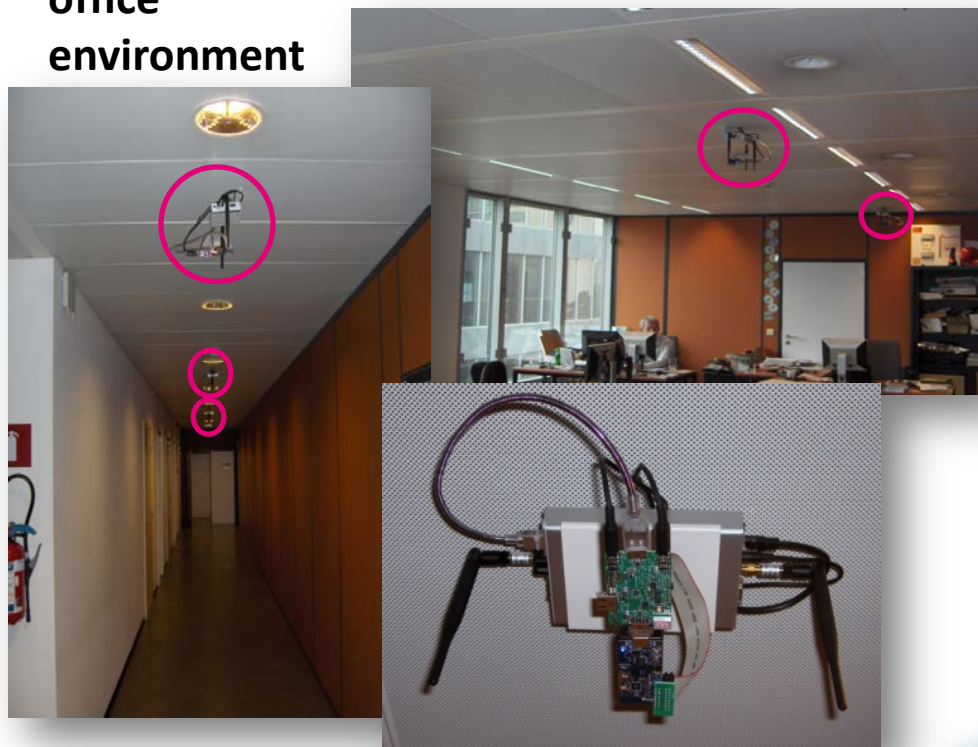
Pseudo-shielded environment

USRP

imec sensing agent

Analog Front-end

Digital Front-end
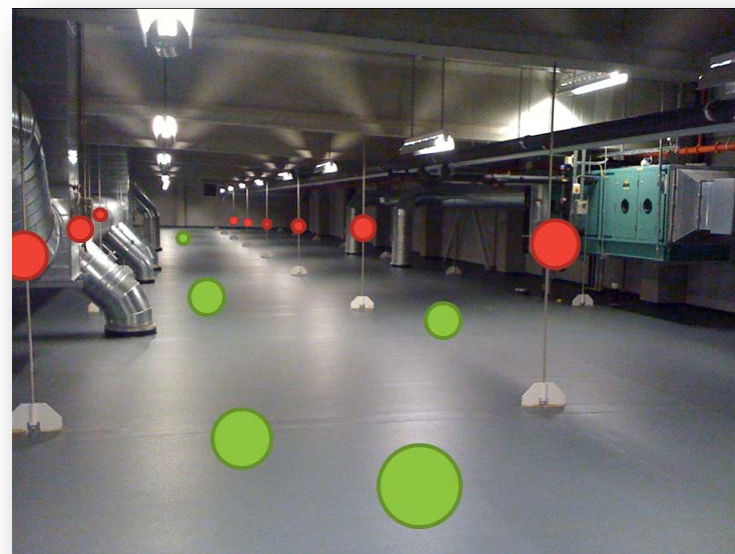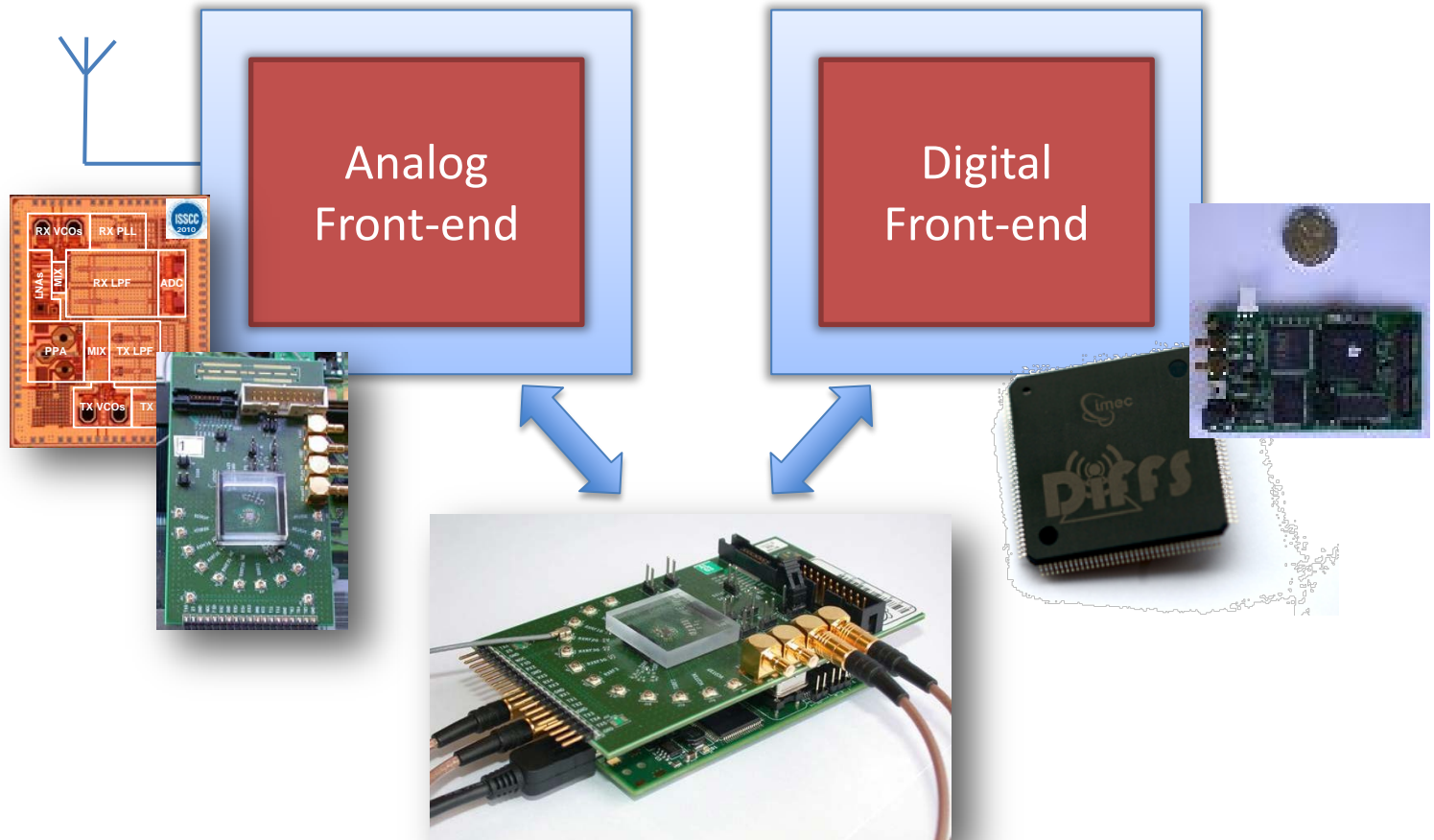
Advanced spectrum sensing

Combination of analog & digital FE in compact device

**204 +16 wireless sensor nodes (Tmote Sky/EyesIFXv2/Shimmer2)
cognitive components: Wi-Spy, BEE 2 FPGA platform**
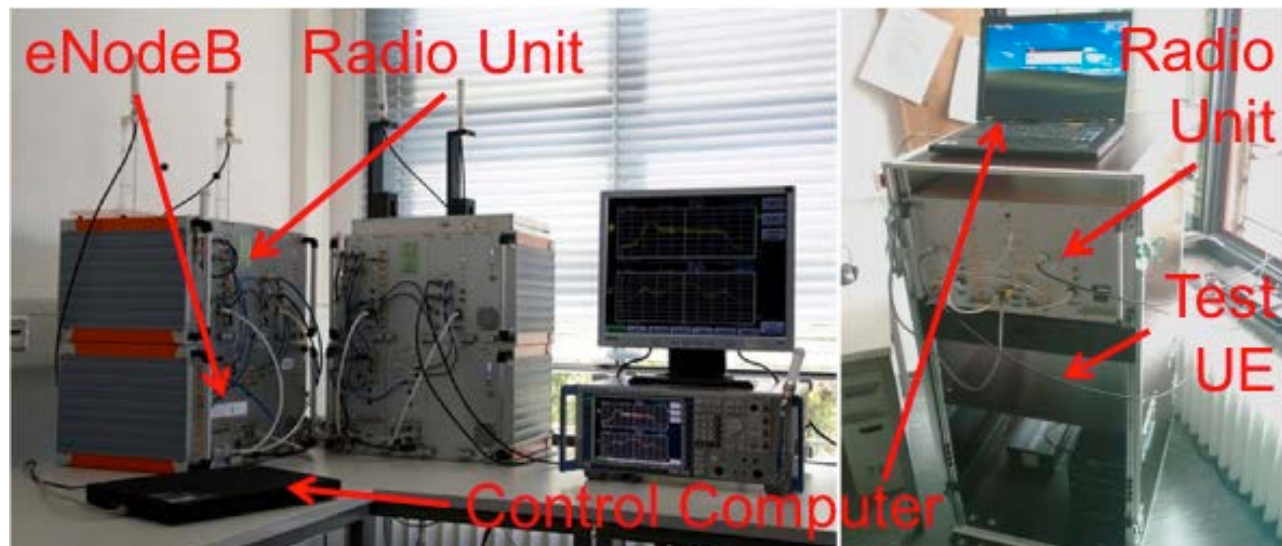
Signalion SORBAS (3 eNodeB + 3 UE)
Signalion HALO 430 SDR equipment
Indoor & outdoor
LTE license

Iris reconfigurable radio software

Remote access to USRP N210 and E100 platforms with Iris

Potential for experimental TV-bands license
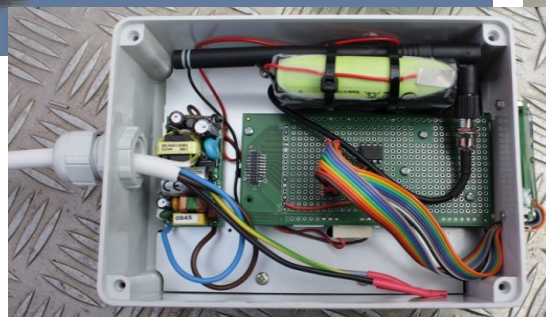
25 outdoor versatile sensor nodes

GRASS RaPlaT open source radio-planning tool
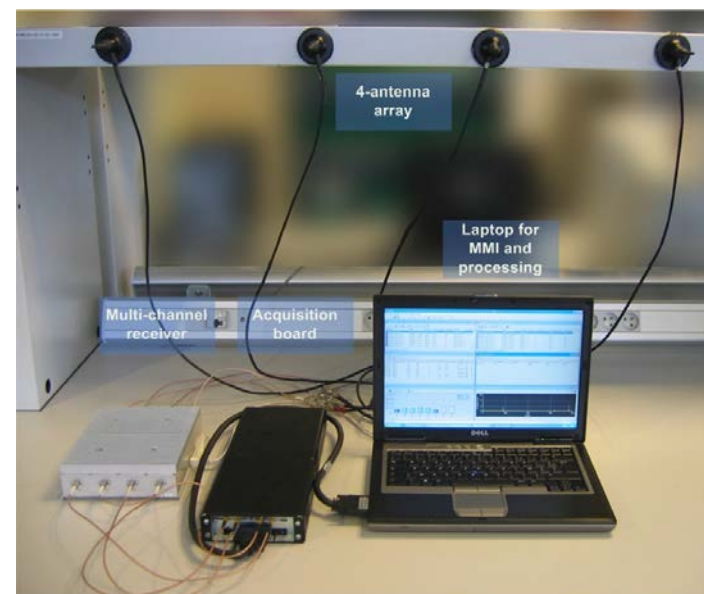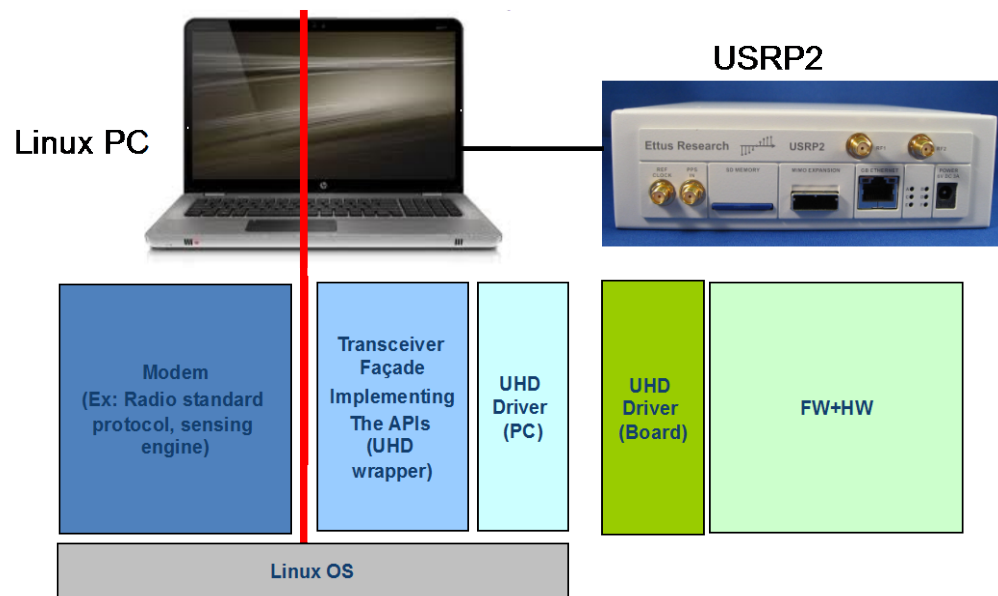
Transceiver API for SDR architecture (compliant to WINNF)

Multi-antenna LTE detection

EADS is a global leader in aerospace, defense and related services and will implement an aeronautics use case.

CREW Federated platform: key aspects

- **common portal**
  - comprehensive **description** of the individual testbeds
  - **guidelines** on how to access and use the federated testbed
- **novel cognitive components**
  - **relocation** of components
  - **linking together** software and hardware **entities** from the different partners
  - **standardized API** for SDR architectures (developed within WINNF)
- **creation of open data sets**

  a **common data structure** enables the emulation of CREW components in other experimental environments or in a simulator
- **benchmarking framework**
  - enabling experiments under controlled and **reproducible test conditions**
  - offering **automated procedures** for experiments and performance evaluation
  - allowing **fair comparison**
- **2 open calls**
  - More info: http://www.crew-project.eu/opencallinfo

■ Tecnalia Research & Innovation (ES)

- to assess the benefits of optimized linear collaborative multiband spectrum sensing in cognitive radio networks with respect to hard-decision based fusion schemes and to its non-optimized counterpart
- TCD Iris platform, THALES transceiver API

■ University of Durham (UK)

- to characterize the performance of sensing engines in the CREW federation in controlled environments and to compare low end COTS, high end COTS such as custom designed units
- Gent & Berlin testbeds, imec sensing agent, TCD Iris platform

■ Ilmenau University of Technology (DE)

- to evaluate contention-based communication protocols such as the CSMA MAC protocol using two cognitive components from the CREW project: the imec sensing engine and the Iris reconfigurable SDR framework
- imec sensing agent (Gent testbed?), TCD Iris platform

- **Official launch**
  - FuNeMS 2012, Berlin, 4-6 July 2012
- **Size of experiments?**
  - Around 100 k€
- **What kind of experiments?**
  - Experiments that make use of the CREW federation to answer open research questions in cognitive radios/cognitive networks
  - Experiments that contribute to the CREW efforts in benchmarking, open data sets, linking together components from the cognitive testbeds in the federation

http://www.crew-project.eu/