Urban Planning for RadioCommunications (*URC*) and Cognitive Radio:

A Solution to the Spectrum Management Challenge

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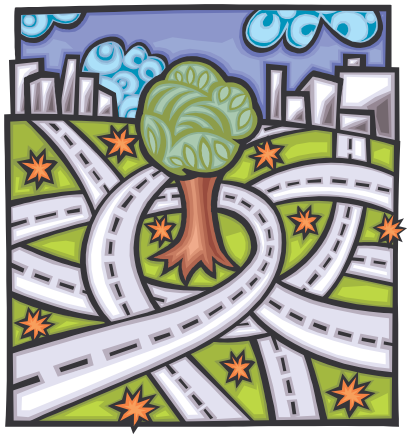
General Objectives



- Facts
  - Spectrum is a limited resource
  - and spectrum demand is increasing
  - Megalopolis like Paris is likely to be saturated soon
  - Dynamic spectrum management is a solution but need to be under control
- URC challenges
  - Should provide solutions for opportunistic use of the spectrum but controlled: optimized and secured
  - Promote advanced concepts for Regional Development in the communication area, also taking into account Urban Landscape constraints
  - Provide Spectrum Management tools for Local Authorities

Scientific and Technical Objectives

- Research new cognitive-based radio access schemes based upon new sensing techniques enabling the opportunistic use of spectrum while mitigating interference
- Address Dynamic Spectrum Allocation and Dynamic Spectrum Access schemes
- Develop a software demonstrator (mockup) of a dynamic spectrum management tool
- Constitute a data base of signals acquired in the Paris region and make it available to the partners
- File patents

Dissemination Objectives

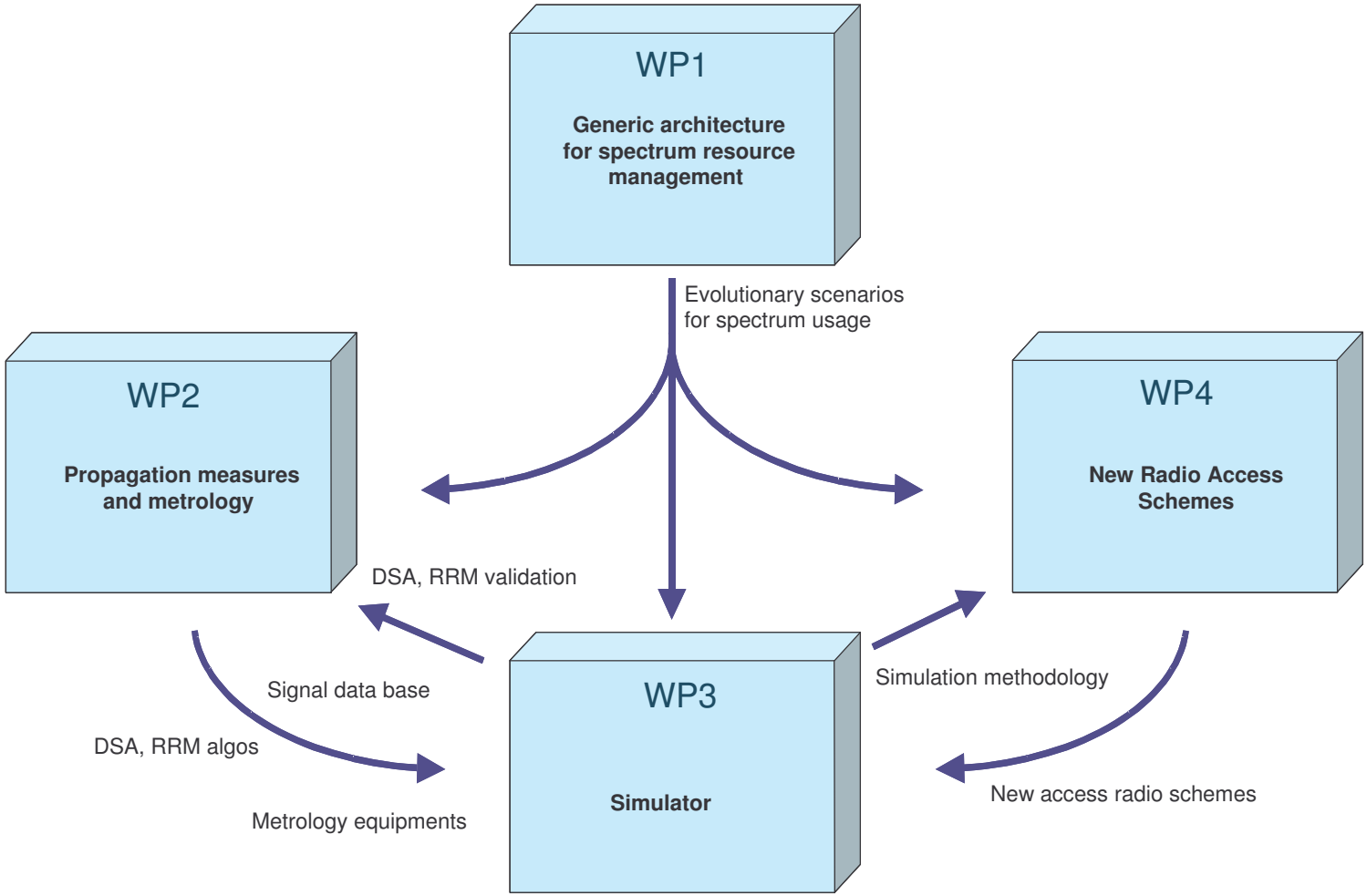
- Propose new dynamic spectrum management schemes to regulatory bodies (ITU)
- Contribute to standardization (ITU, P1900.4 …)
- Promote dynamic spectrum management schemes where public authorities play a key role in regional development
- Promote Cognitive Radio concept as a mean to enable optimization of the spectrum usage and promote disseminated sensing approach
- Reinforce worldwide visibility of l'Île-de-France Region and actors, and its leadership on the Spectrum Management market

At a Glance

- Funding (14M€ total budget)
- French Regulator
- Telecom, transport, broadcasting operators
- Industries, Equipment
- Technological SMEs
- Academic

Started October 2006, duration 3 years

Workpackage Breakdown

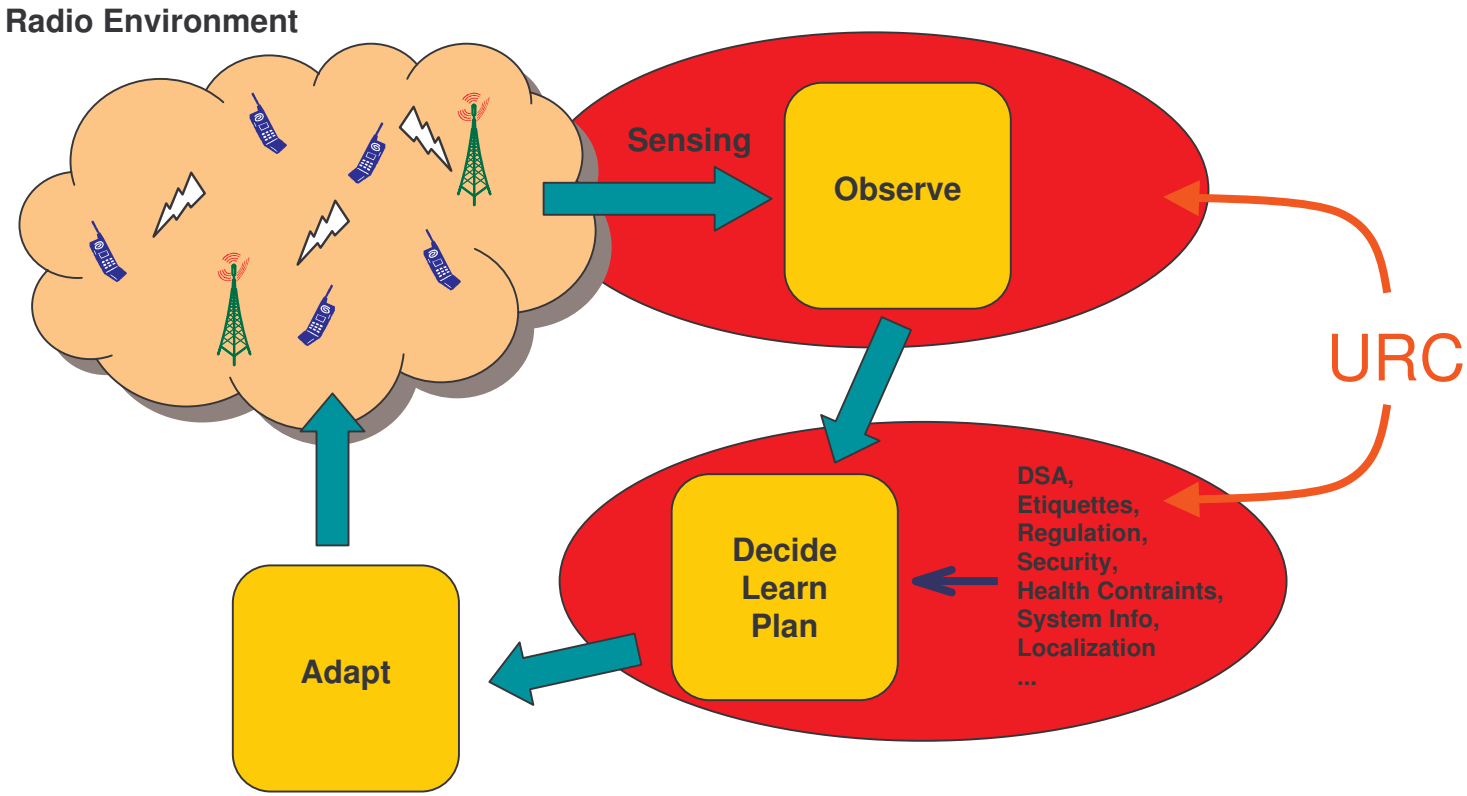


3 years in 3 steps: Definition, Development/Simulation, Validation/Exploitation

Technical Approach

- Cognitive radio
- Disseminated sensing
- Simulator

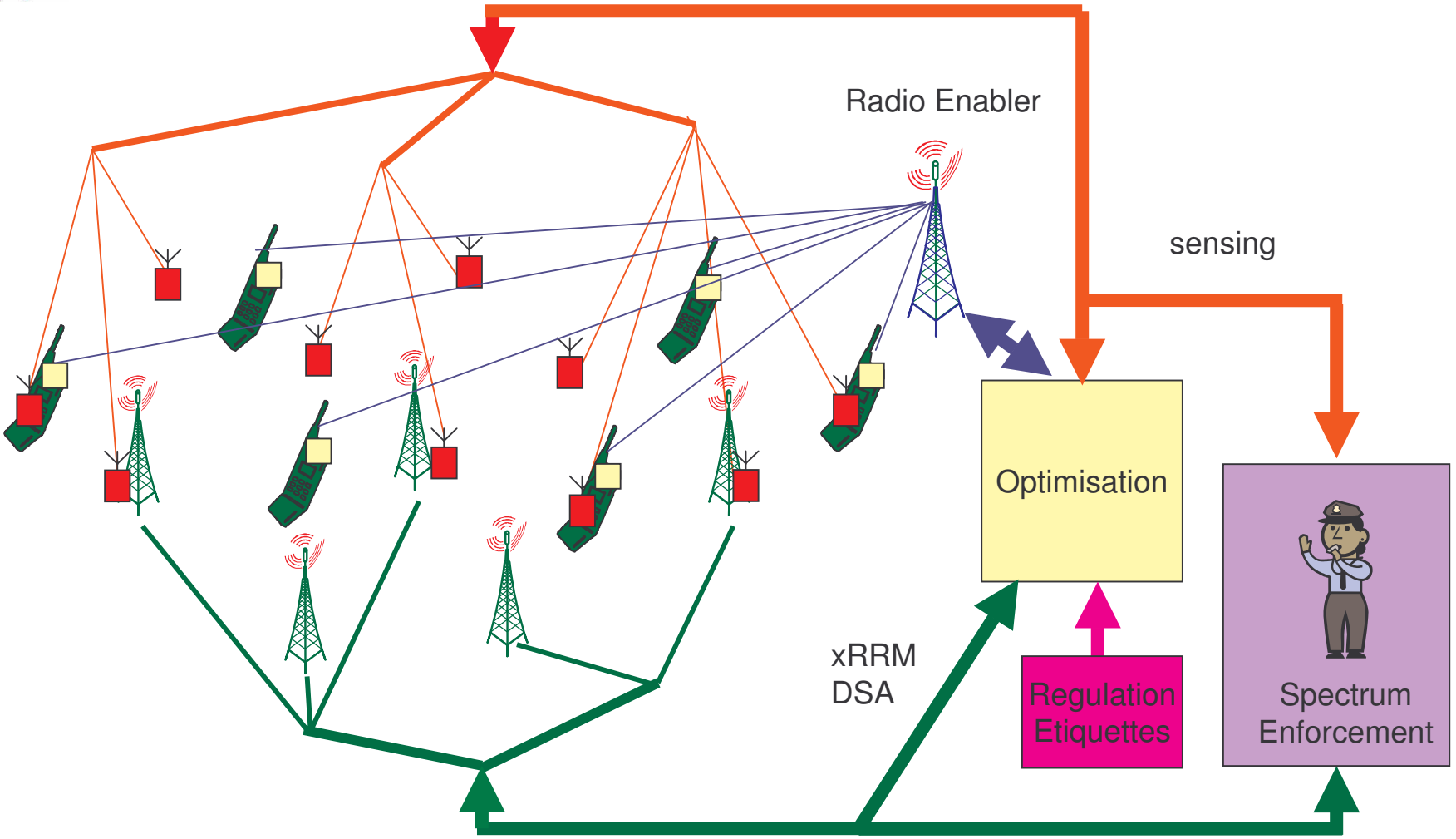
Application of Cognitive Radio Paradigm to Dynamic Spectral Resource Management



Disseminated Sensing

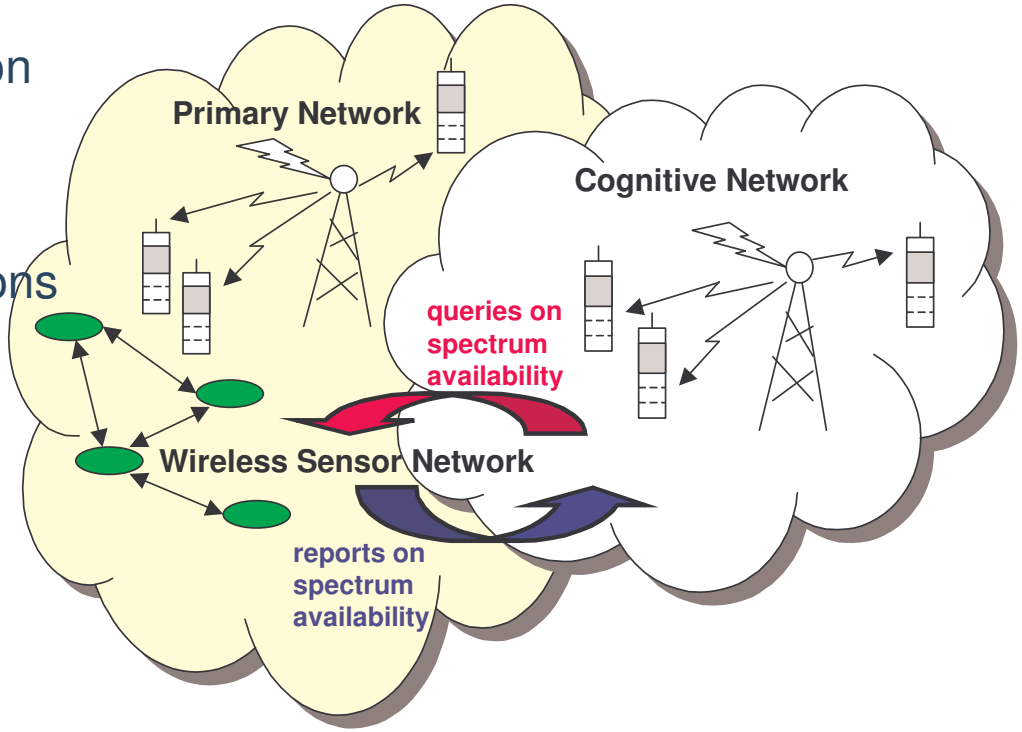
- Concept
  - Distribute sensors
    - Within infrastructures (BST, ad hoc network, …)
    - Within handsets
- Two functions
  - 1/ Spectrum Management
    - Regulation enforcement, interference measurements, …
  - 2/ Cognitive Radio
    - Sensing of the Mitola's cognitive cycle -> adaptation
    - New funtionalities to existing ongoing standards (P1900, 802.22, …)

Disseminated Sensing



SENDORA project

- "Sensor Network aided Cognitive Radio" concept study and demonstration
- Key topics addressed:
  - Wireless Sensor Networks (WSN) for spectrum sensing
  - Cognitive radio
  - Dynamic spectrum allocation
- Enabling techniques:
  - Spectrum sensing
  - Collaborative communications
  - End-to-end protocol stack
  - Cognitive actuation
- T0 = 1st January 2008
- Duration: 3 years



SENDORA main objectives

- Identify and analyze operational scenarios of the Wireless Sensor Network aided Cognitive Radio technology
- Define and simulate WSN aided opportunistic access and dynamic resources allocation strategies for cognitive radios
- Design a flexible and reconfigurable architecture, and demonstrate through a proof-of-concept the WSN aided Cognitive Radio technology

URC Simulator

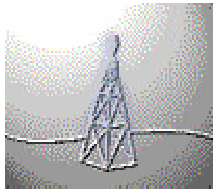
3D data map : 47 km²

Large scale models (trafic, mobility, propag., …)

Geographic area, Scenarios

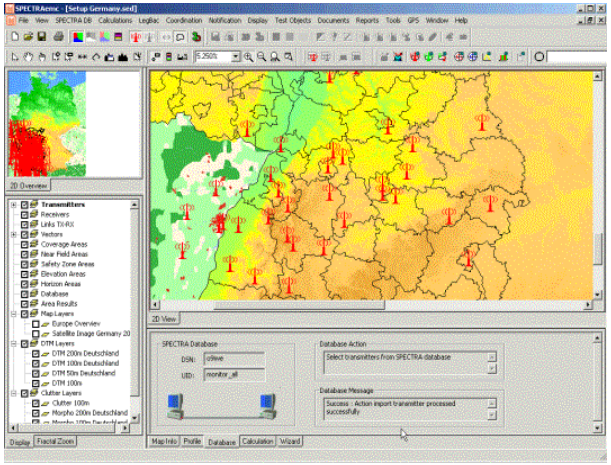
Small scale models (propagation, terminal, radio access, interference, …)

Objective performance (QoS, revenues, …)



Dynamic access and Cognitive Radio schemes

Assessment of performance enhancement



Performance assessment:
✓radio (spectral efficiency, power, coverage, interference, …)
✓Network (blocking rate, delay, nb of users, …)
✓Application (QoS)

Follow-up: Toward a Spectrum Management Tool for Local Authorities

Objectives / Constraints

QoS,
Security,
Economic Development,
Revenues,
Regulation,
Urban landscape…

Network setting parameters

Network measurements

Adjust the spectrum usage to Local Authorities needs

Thank you!

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