Towards an EU policy for Cognitive Radio?

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What is the RSPG and what is it doing on CR?

Radio Spectrum Policy Group
• Advisory body to the European Commission on Radio Spectrum Policy Issues
• Representatives of the Member States and of the Commission

Workprogramme 2009
• 7 - Cognitive Technologies
• Expected result: Introduction of the issue to the European agenda
Objective of the work

**Strategic RSPG report**

*Is there a need for regulatory action to enable spectrum access for cognitive radio?*

- Defines and explains the terminology
- Overview of various components of cognitive technologies
- A brief overview of the experiences and lessons in Europe and elsewhere with (pre) cognitive technologies;
- Insight in the way cognitive technologies could operate in the various models for spectrum management;
- Comparison with the US framework;
- Identifies the challenging issues which require further attention.
Spectrum management: What is the problem?

Unused “white” spots

Deliberately left unused for Radio Astronomy

Need for more dynamic access to spectrum
How to use these white spots?
Problems with Dynamic Spectrum Access

• Sensing the opportunity:
  • How to detect when channels are free?

• Quality of Service for opportunistic user:
  • How long channels are going to be free?

• Interference to incumbent user:
  • How to avoid potential interference?

• Medium Access Control:
  • How to coordinate multi-channel communication?

• Policies in channel access:
  • How to regulate spectrum access?
The hidden node problem

Diagram:
- Node A transmits to Node C.
- Node A is a cognitive transmitter.
- Node B is a transmitter to Node C.
- An obstacle interferes with the transmission from A to C.
- Node A cannot detect the transmission from B.
- Transmission from A interferes with the reception of C.
Mastering the hidden node problem

Need for cooperation

• Sharing of spectrum sensing information among CRs

• Cognitive Pilot Channel

• Database with local spectrum usage

Unsolved issues:

• Availability and reliability of information
• Standardized access to the information
Regulatory framework

Collective Use of Spectrum
Smart radios are used with a build in techniques and rules (etiquettes) to reduce interference
Everybody can use the spectrum as long as the etiquettes are followed.

Market based access
Well defined exclusive rights
Maximum right of flexibility as to the type of services that can be provided
A market type mechanism such as an auction for an initial allocation of spectrum rights
Secondary market in which these rights can be sold or leased
Two types of sharing

Vertical sharing

Horizontal sharing
Access models

**Collective Use of Spectrum**
- Vertical sharing
  - OSA
  - Licensee
- Cognitive radio
- Horizontal sharing
  - CR
  - CR

**Market based access**
- Vertical sharing
  - Licensee
- Cognitive radio
- Horizontal sharing
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What are the spectrum policy implications?
### CR under a CUS model

<table>
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<tr>
<th>Vertical sharing</th>
<th>Horizontal sharing</th>
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<td>- Designate the band for opportunistic spectrum access;</td>
<td>- Designate the band to allow usage on a cognitive basis which does not interfere with existing users;</td>
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<td>- Define the appropriate technical conditions for the cognitive devices.</td>
<td>- Define technical conditions for the block of spectrum.</td>
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- CRs will need to adapt to future developments of other use(rs) of the band
- Sharing between CRs can be set outside the scope of the regulator
- Ensure equitable and non discriminatory access
CR under a market based access model

Vertical sharing

- Define the framework for (sub)leasing;
- Assess the results of negotiations on spectrum access.

Horizontal sharing

- Define the framework for trading and leasing;
- Provide a dispute resolution mechanism in case of interference.

- Provide flexibility in the use of spectrum
- Identification of opportunities for CR lies within the remit of the licensed holders.
What needs to be done?

- More flexibility in the use of frequencies
- More flexibility in the assignment of frequencies and trading thereof
- Conditions for opportunistic spectrum access
  - Spectrum sensing limit
  - Transmitter parameters
- Additional means for information gathering on spectrum usage
  - Pilot channel
  - Database
- Viable business models
What is already be done?
European activities

More flexibility in the use of spectrum
• RSPG Opinion on WAPECS RSPG05-102
Increasing use of market mechanism
• RSPG Opinion on Secondary Trading RSPG04-54

Preliminary CEPT Study on opportunistic use of CR in the TV bands
• Uncertainty on availability of white spaces
  – Tight broadcast planning and use
  – TV band also used for Program Making and Special Event services

• ECC/SE is investigating technical and operational requirements for use of the broadcasting band for CRS

• ECC/FM works on identification of possible candidate bands for CRS
International regulations - Agenda WRC 2011

1.19 to consider regulatory measures and their relevance, in order to enable the introduction of software-defined radio and cognitive radio systems, based on the results of ITU-R studies, in accordance with Resolution 956 (WRC-07);

1.2 taking into account the ITU-R studies carried out in accordance with Resolution 951 (Rev.WRC-07), to take appropriate action with a view to enhancing the international regulatory framework;
Concluding remarks

CR have potentials for increased spectrum efficiency
Many aspects still unclear

Careful introduction on a case-by-case basis

Do not focus only on uncoordinated Opportunistic Spectrum Access

Need for cooperation between regulators, industry and research
Questions