Cognitive Radio

SDR: a collection of hardware and software technologies that enable reconfigurable system architectures for wireless networks and user terminals (SDR Forum)

Cognitive radio (CR) – a radio that is aware of and can sense its environment, and can make decisions about its operating behavior based on that information and pre-defined objectives (IEEE 1900.1)

A cognitive radio is aware of:

- The RF environment
- Its own capabilities
- The policies it needs to follow
- Local and Global objectives
- Network conditions
- Other user's priorities and authorizations

A cognitive radio can adapt

- Control of transmit power
- Selecting its dynamic waveform
- Accessing dynamic spectrum
- Routing
- Negotiating waveforms and protocols

SW/RF front end separation

Front end deals with frequency, filtering, and power

Software handles waveforms and protocols

CR applications

- DSA
- Dynamic Medium Access and cooperative communications
- Opportunistic switching among available wireless networks
- Adaptive selection of available radio resources
- Increased interoperability of different systems

Overlay Opportunistic use of fallow spectrum

Underlay Non-Interfering use

Knobs (adjustables)

- Frequency of operation
- power
- waveform

Meters

- Occupied bands
- Signal Strength
- Neighbor list

FemtoCells

Small cellular base stations for residential/business installation, sharing 2g/3g/4g access

ease of deployment and low price point are major issues as femtocells are a mass market device

Self-organising networks

Can automatically extend change configure and optimise their topology, coverage, channel allocation and other operating parameters

- excellent scalability

Cross layer issues

- Spectrum Management requires information regarding QoS requirements, transport, routing, scheduling and sensing
- Spectrum sharing requires cooperative techniques for interference mitigation considering current channel capacity.
- Spectrum handoff where application, transport and network layers may be made aware of spectrum mobility
- Channel aware topology and routing

Acronyms

- SDR: Software Defined Radio
- CR: Cognitive Radio
- RF: Radio Frequency
- DSA: Dynamic Spectrum Access