

# Self-optimization and Cognitive Radio in Commercial Wireless Infrastructure

SDR 2010, Washington DC

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## Founded in 1990

- First coverage was commercial applications of wireless semiconductors used by the military
- Coverage gradually expanded beyond semis to end-equipment markets and services

## Global firm; Boutique support

- Analysts located in all major regions: Americas, Europe and Asia
- Sales and client support in localized markets

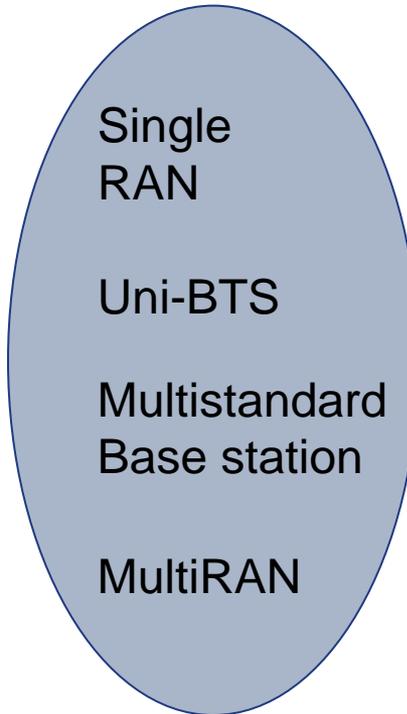
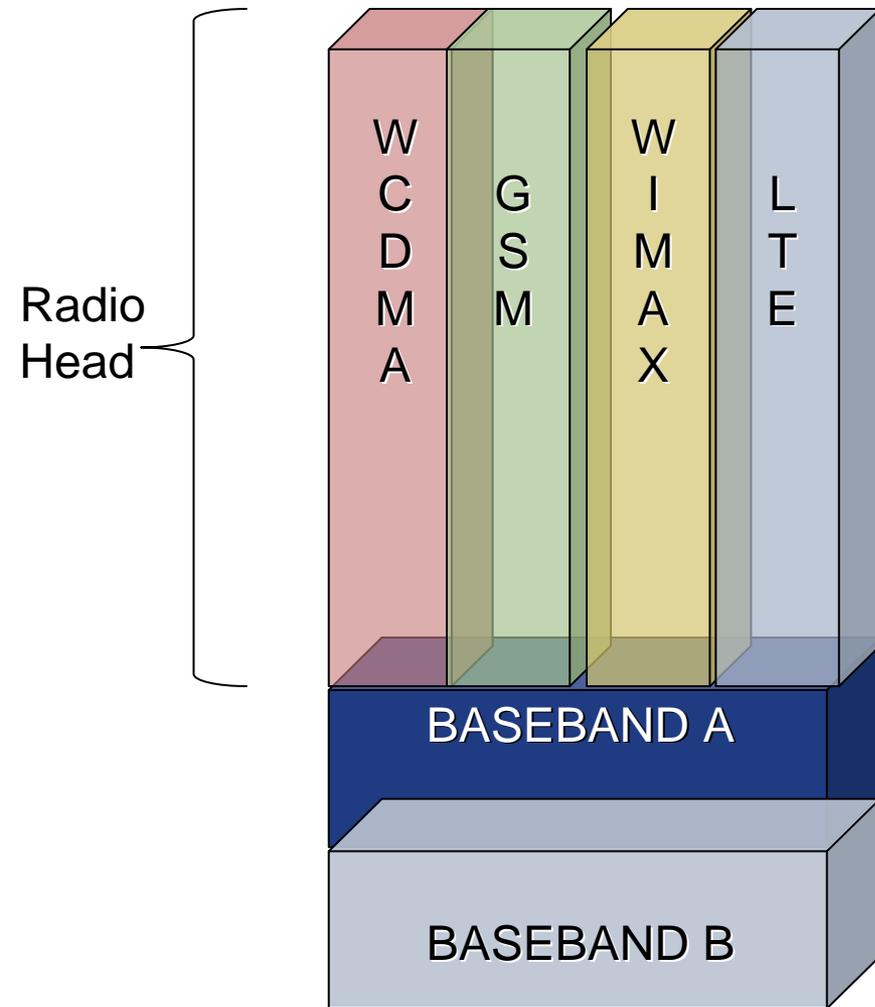
## Focused on the identifying emerging technology trends first

- Early beachheads provide strong relationships in nascent markets
- Relationships continue as markets mature

## Proven research methodology

- Key analyst relationships provide supply-side intelligence
- Enterprise and consumer surveys provide demand-side intelligence

- **Multistandard Base Stations & SDR**
- **Self-optimization in Wireless Infrastructure**
- **Cognitive Radio in Wireless Infrastructure**
- **Conclusions**



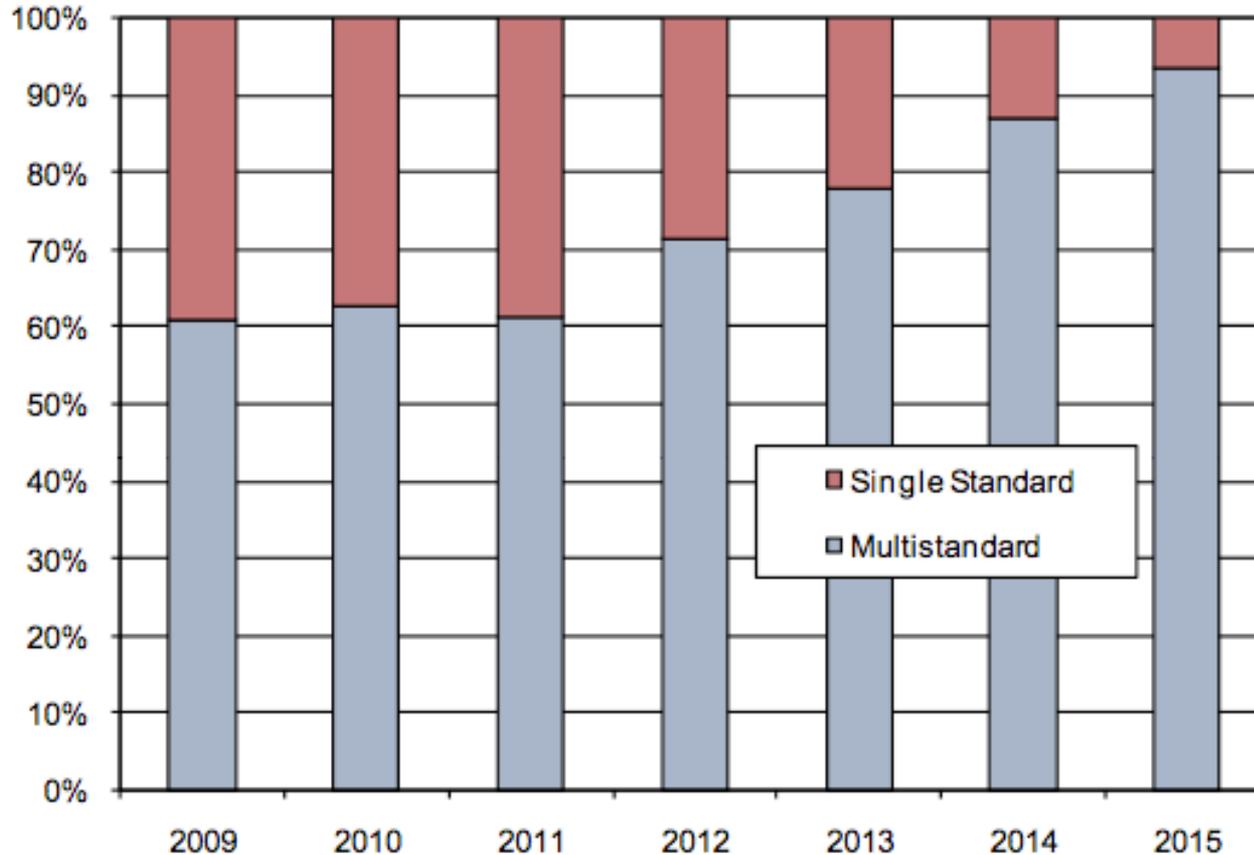
**MS Base station can support more than one technology generation**

**Using SDR definition all MS base stations whether cabinet-based or common-platform are SDR**

**Most vendors shy away from using the term SDR**

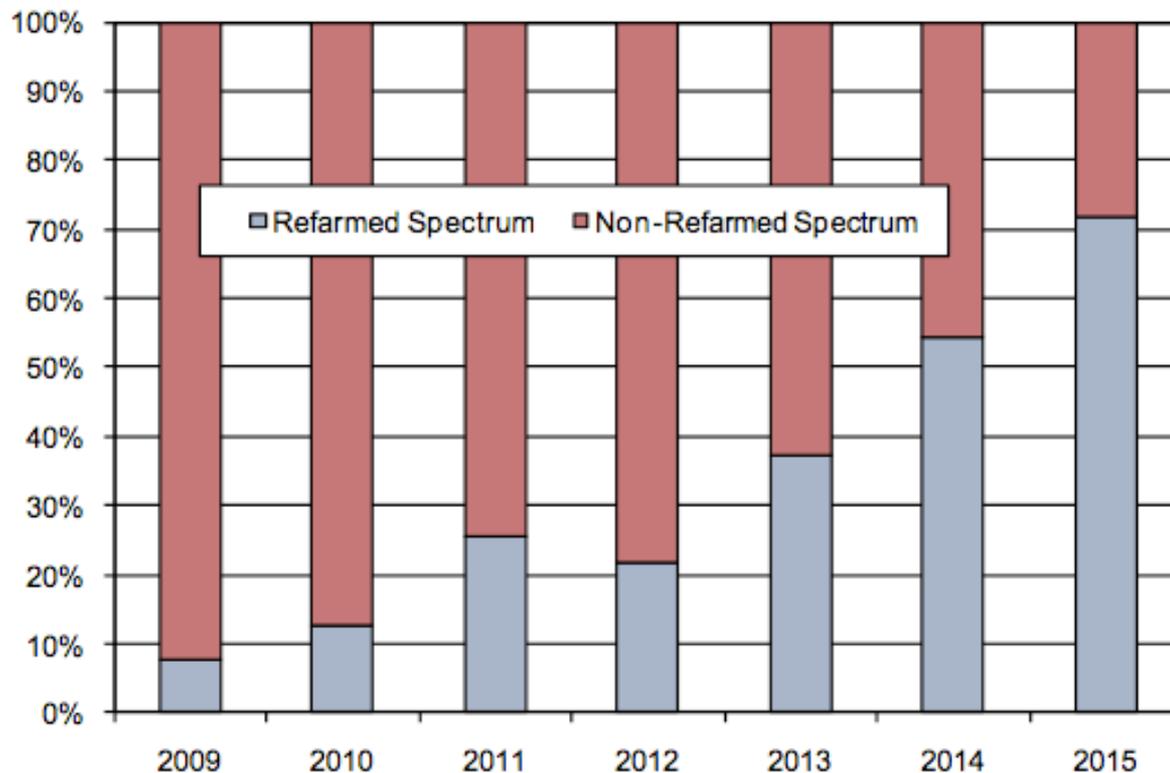
**SDR for most vendors is all about the RF**

**Spectrum refarming going to provide the push needed for true multimode RF capable SDR**



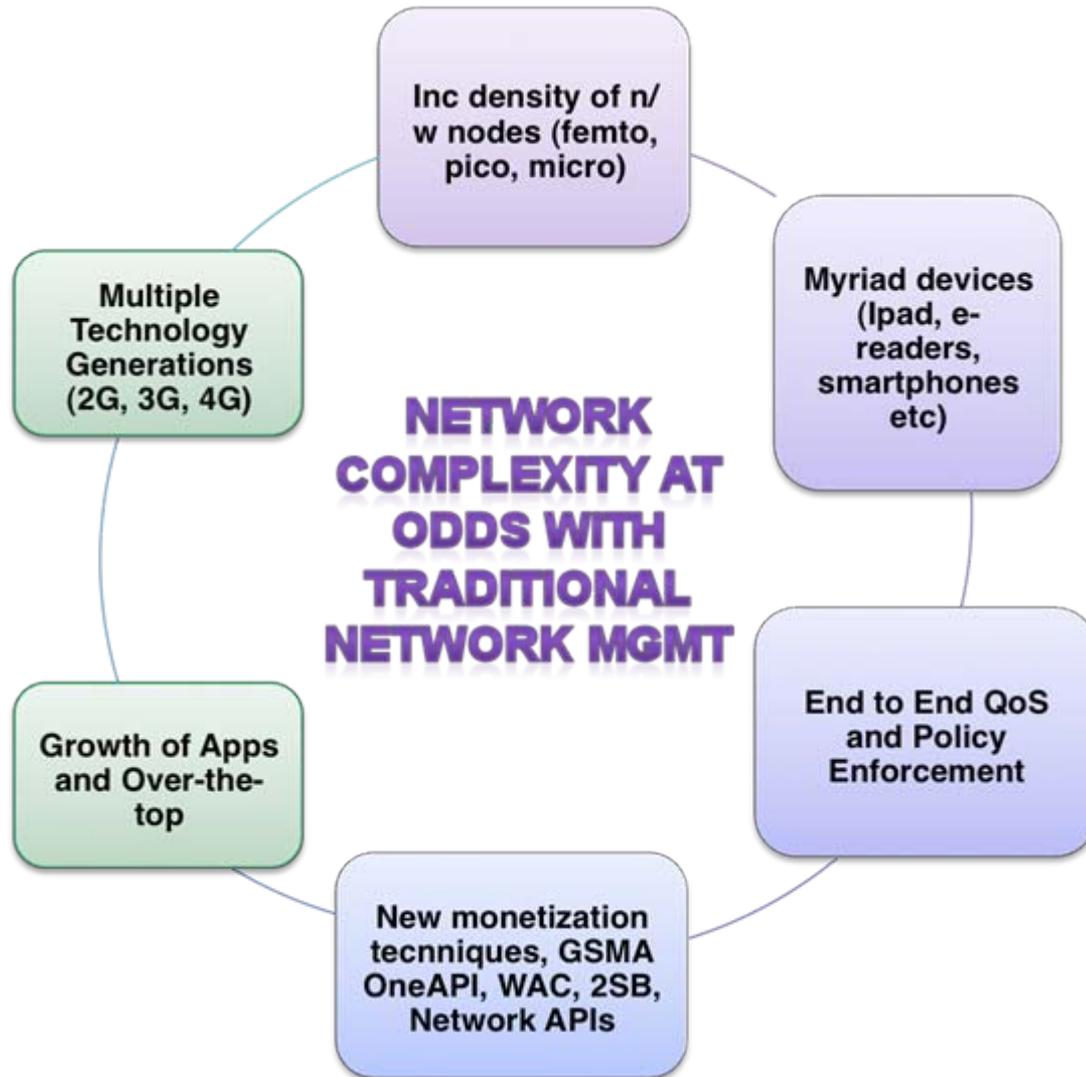
(Source: ABI Research)

Multistandard Base Stations will make up more than 90% of shipments in 2015



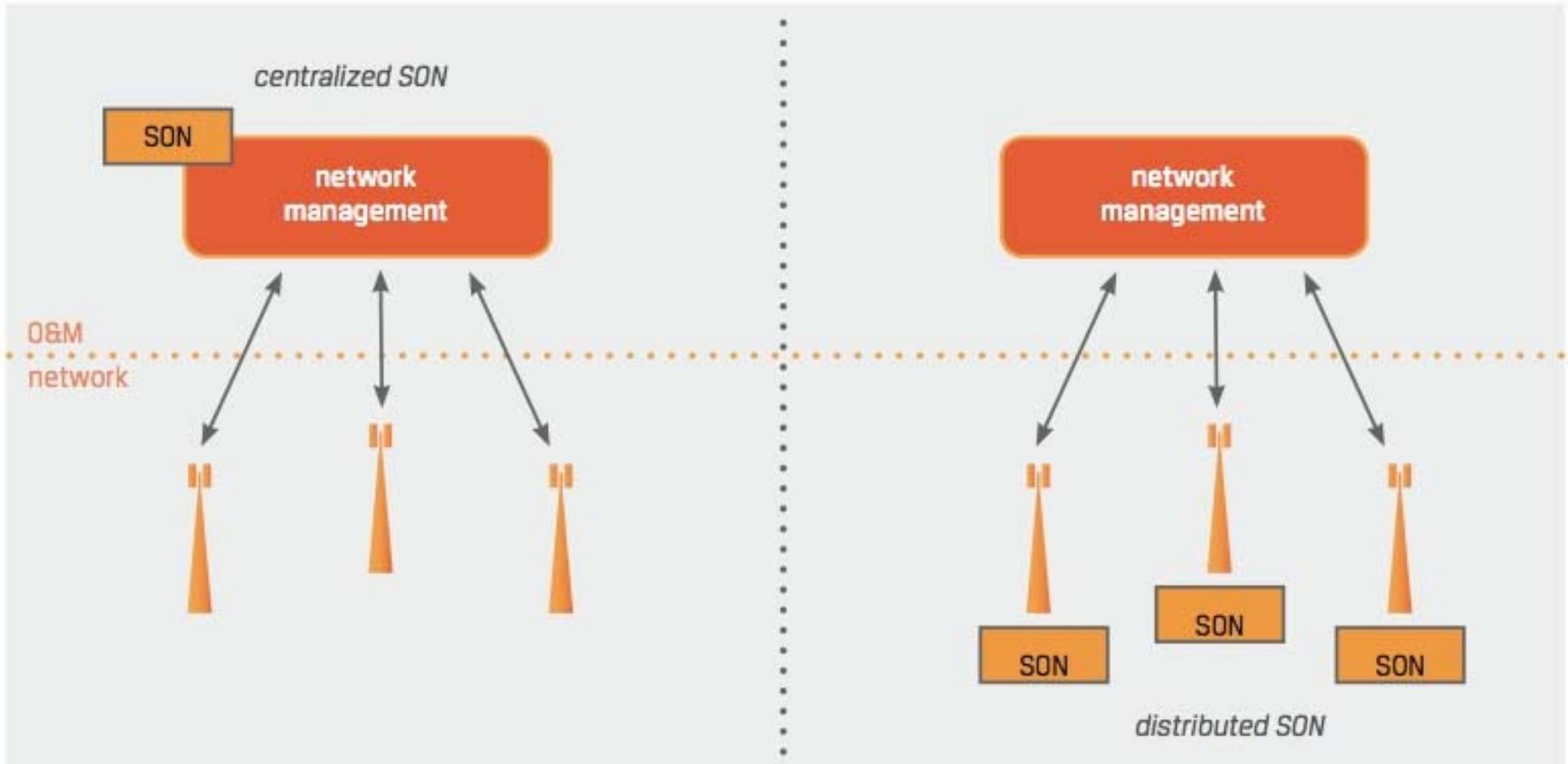
(Source: ABI Research)

More than 70% of the MS base stations shipped in 2015 will be in reformed spectrum. 900 MHz UMTS driving most reformed spectrum shipments currently. Other bands include 1800 MHz, 800 MHz, AWS (1700/2100), 850 MHz, and 2600 MHz.



- **Minimize manual radio planning and optimization. Eliminate drive tests and performance measurements**
- **SON refers to multiple network features**
  - **Self-configuring**
  - **Self-optimizing**
  - **Self-operating**
  - **Self-healing**
- **Self-optimization is sometimes referred to as SON**
- **SON is a focus area in 3GPP mainly for LTE and LTE-Advanced**
  - **Automatic Neighbor Relation (ANR) Detection**
  - **RF Power**
  - **Antenna Tilt**
  - **Load balancing**
  - **Interference avoidance**

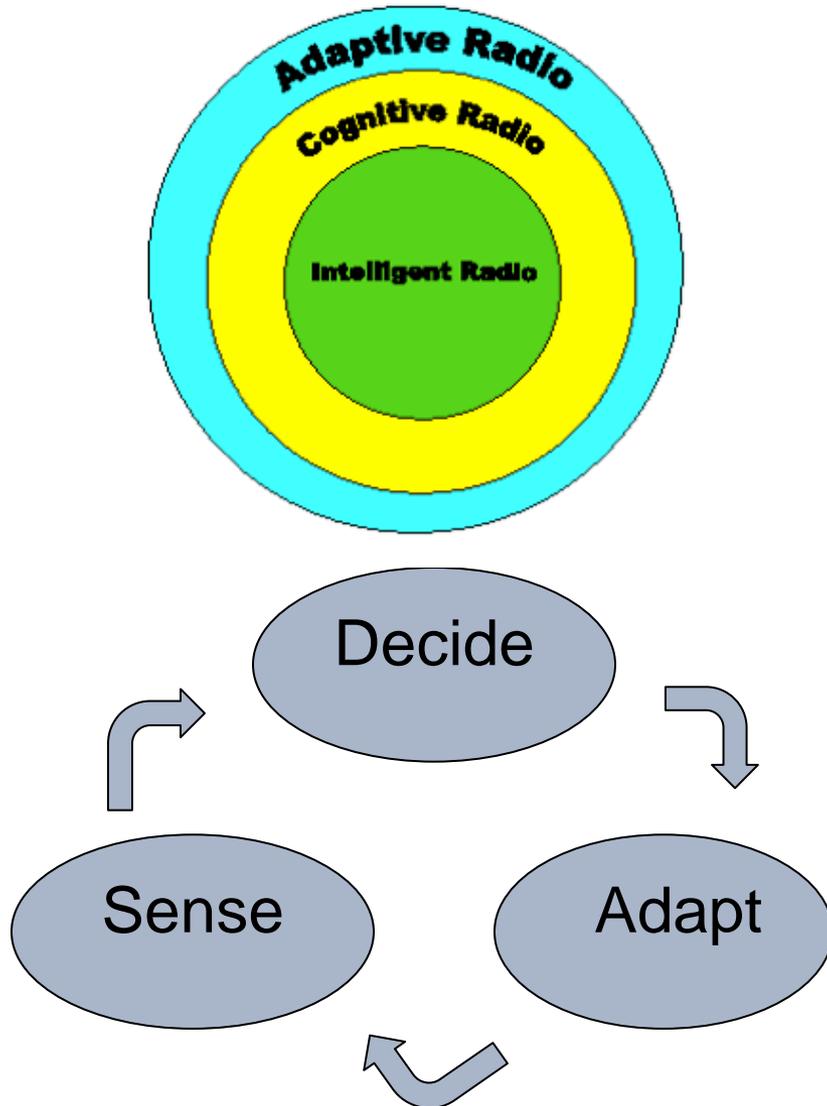
- **SON has to be integrated across various network domains, technology generations and vendor equipments**
- **Examples of conflict**
  - **Layer 2/3 packet compression due to SON could render DPI useless**
  - **Layer 1 optimization can cause oscillations of power levels at cell sites**
- **SON has to be interoperable across vendors – Vendor independent definition of SON is required**
- **Major OEMs and Third-Party optimization vendors integrating– how realistic is it?**



Source: Comarch

Going from a distributed to a more centralized SON

- **Barcelona 2010 saw some SON announcements – expect more in 2011**
- **Vendors driving SON in LTE (Actix, NEC, ALU, Ericsson, Huawei)**
- **Radio engineers not fully convinced about the ‘self’ in SON**
- **Operators ideally need multi-technology SON (e.g. Optimi)**
- **Enterprise femtocells likely to see one of the first commercial deployments of SON (auto-configuration, peer to peer handover, continuous sensing, load balancing, group provisioning)**

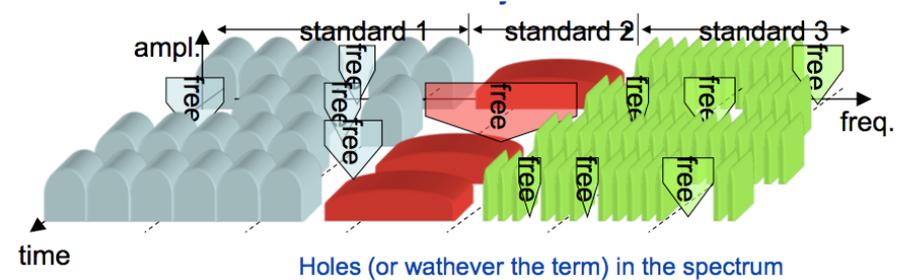


Moving from a centralized predictive, static view of the network towards a more local, real-time dynamic view

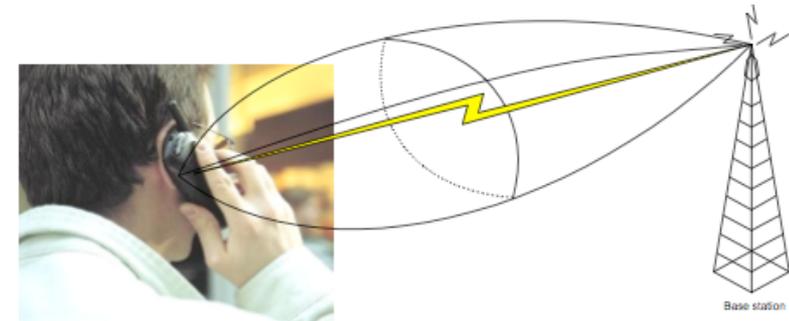
Primarily dealing with sensing of Spectrum environment and adjusting using Adaptive Radio and SDR techniques to achieve a pre-defined set of objectives

Intelligent Radio is an extension of cognitive radio which incorporates machine learning

- **First use case of Cognitive Radio will be in the unlicensed/semi-licensed bands rather than licensed bands (ISM, UNI)**



- **Cognitive Radios have been proposed for health/electromagnetic radio emission control<sup>1</sup>**
- **Femtocells have some sort of cognitive radio functionality (channel reuse, interference mgmt)**



<sup>1</sup>. J.Palicot, «Cognitive Radio: An Enabling Technology for the Green Radio Communications Concept», IWCMC, Leipzig, Germany June 2009

- **White spaces direct beneficiary of CR in commercial wireless**
- **White spaces slowed by regulation, lawsuits**
- **FCC finalizes its whitespace spectrum policy – WiFi was last unlicensed spectrum release**
- **FCC abandons mandatory spectrum sensing – goes for geolocation database check**
- **Ofcom UK released White Spaces consultation in Nov 2010**
  - **Prefers database approach, open to sensing**
  - **Not in favor of cognitive pilot channel**
  - **Commercially viable by 2014**
  - **Rural, Urban, Boost Home WiFi, Hospitals**

- **Spectrum refarming will drive SDR success in multistandard base stations**
- **By 2015 expect more than 70% of base stations shipped to be in refarmed spectrum**
- **While SON is a necessity with growing network complexity, integrated holistic, interoperable solutions are the need of the day**
- **Operators like SON but there is hesitation on how much of the network should be 'self-controlled'**
- **Cognitive radio commercial use case primarily driven by the spectrum crunch and 'holes' in existing bands i.e white spaces**
- **Femtocells could be seen as the pre-cursor to first adoption of cognitive radio in commercial wireless infrastructure**

# Thank You

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