

Self-optimization and Cognitive Radio in Commercial Wireless Infrastructure

SDR 2010, Washington DC

Aditya Kaul

Practice Director,
Mobile Networks

kaul@abiresearch.com

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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

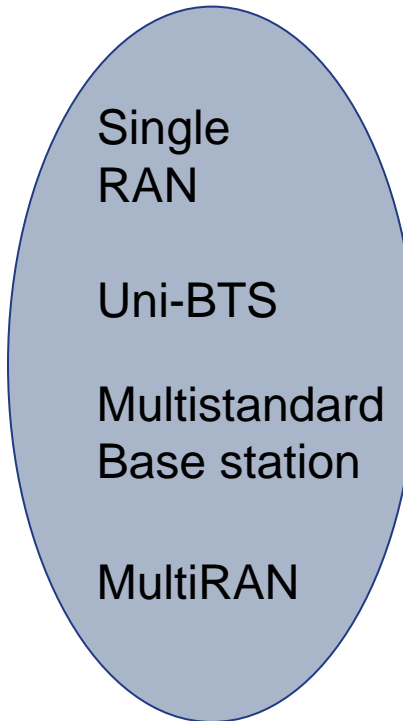
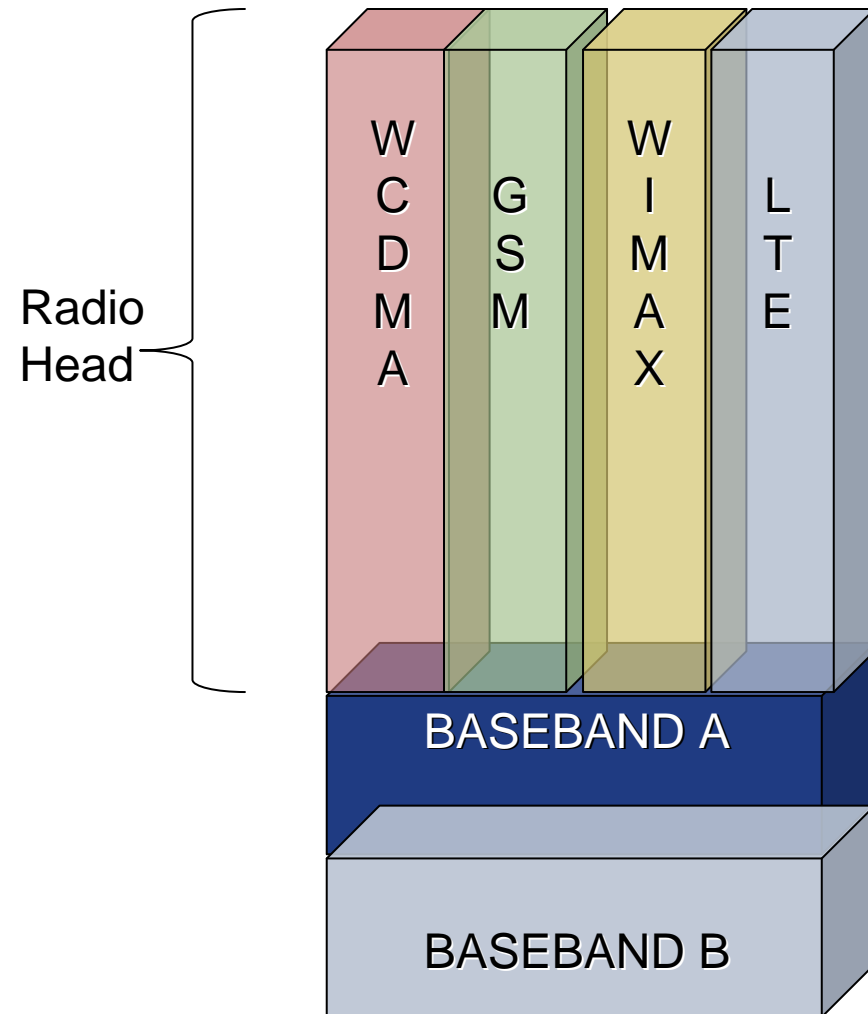
Focused on the identifying emerging technology trends first

- 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**



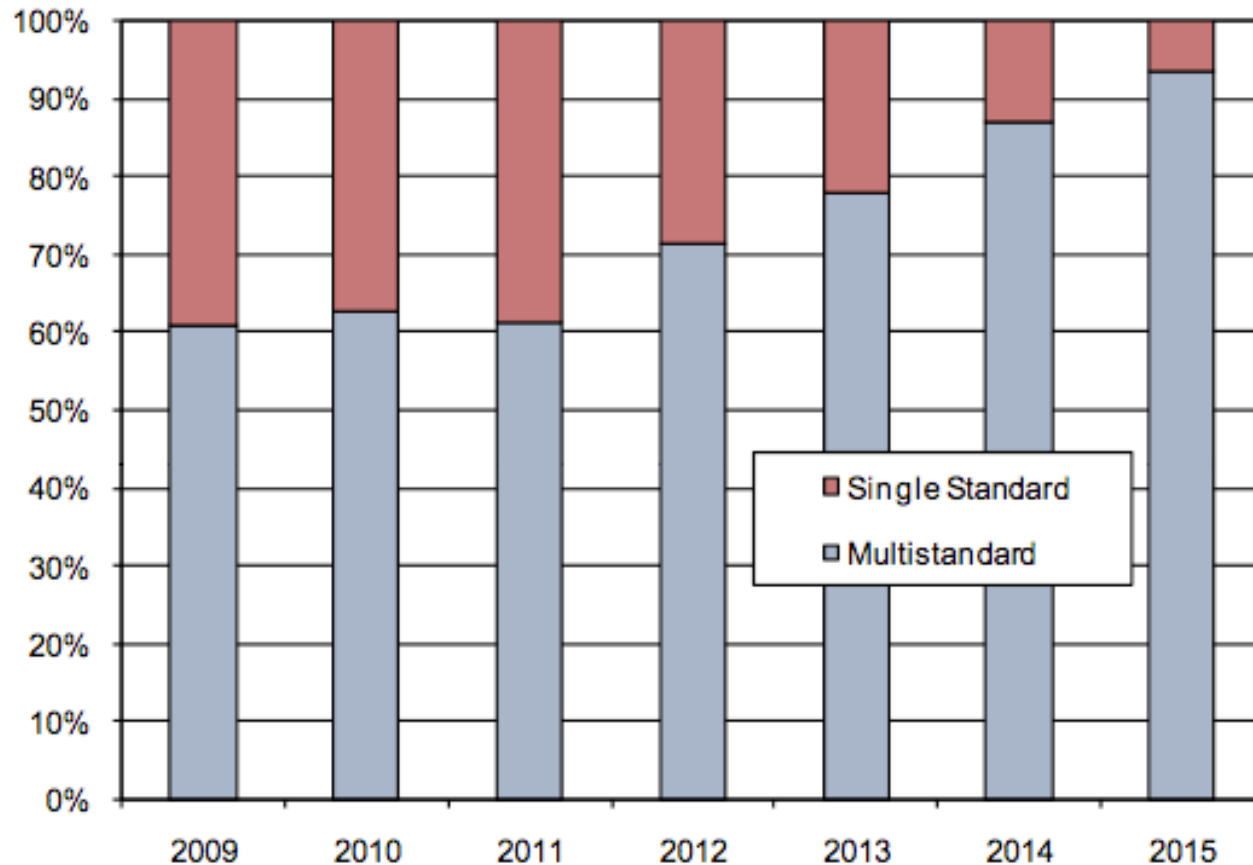
MS Base station can support more than one technology generation

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

Most vendors shy away from using the term SDR

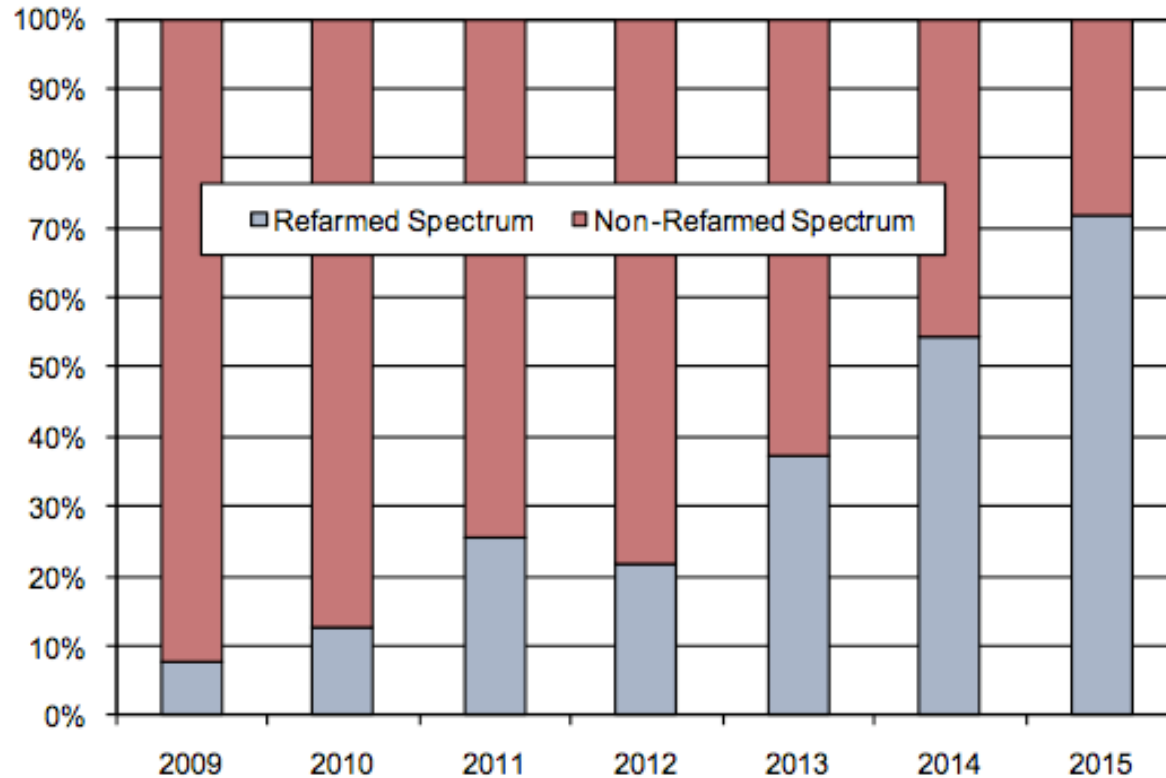
SDR for most vendors is all about the RF

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



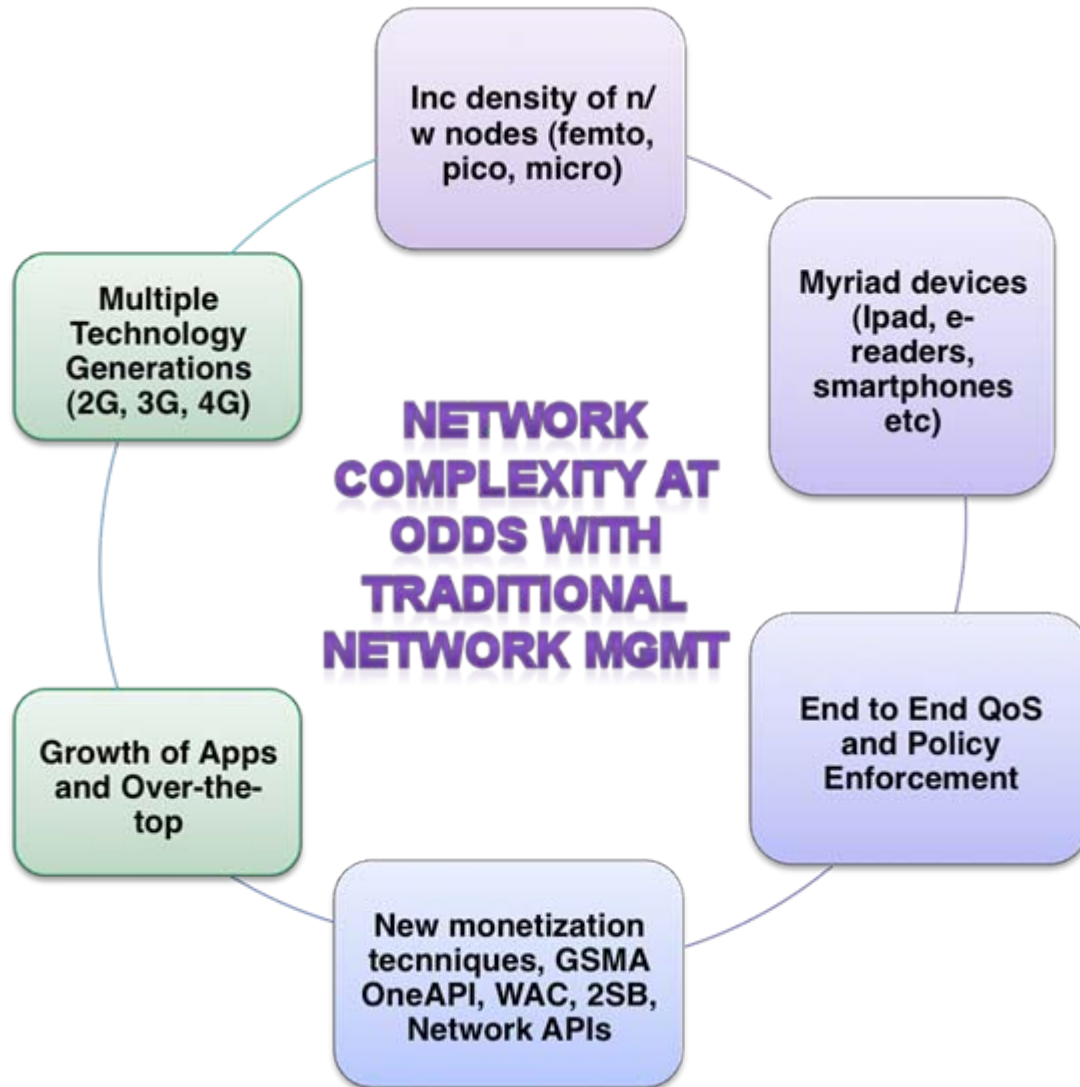
(Source: ABI Research)

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



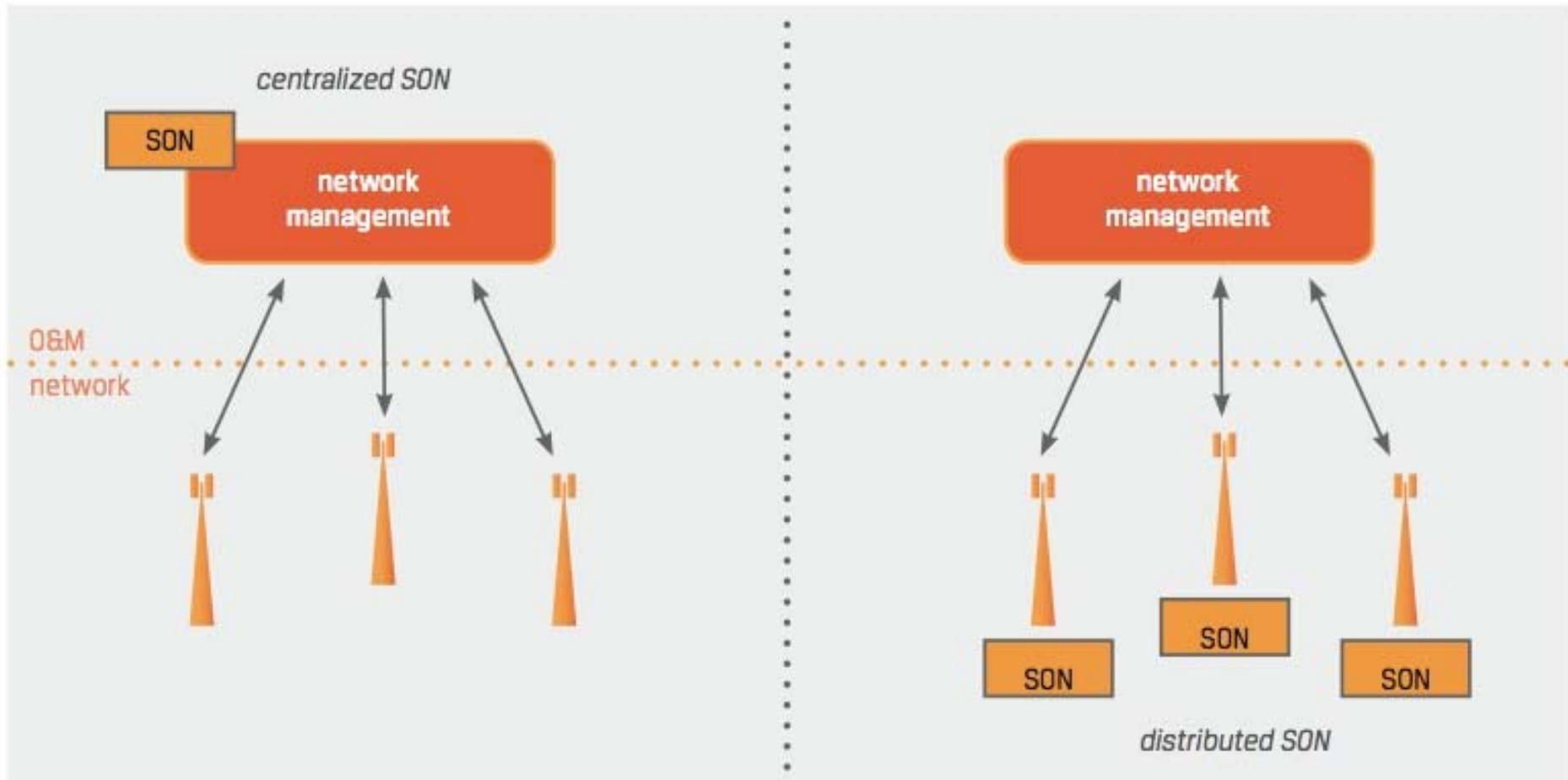
(Source: ABI Research)

More than 70% of the MS base stations shipped in 2015 will be in refarmed spectrum. 900 MHz UMTS driving most refarmed 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**

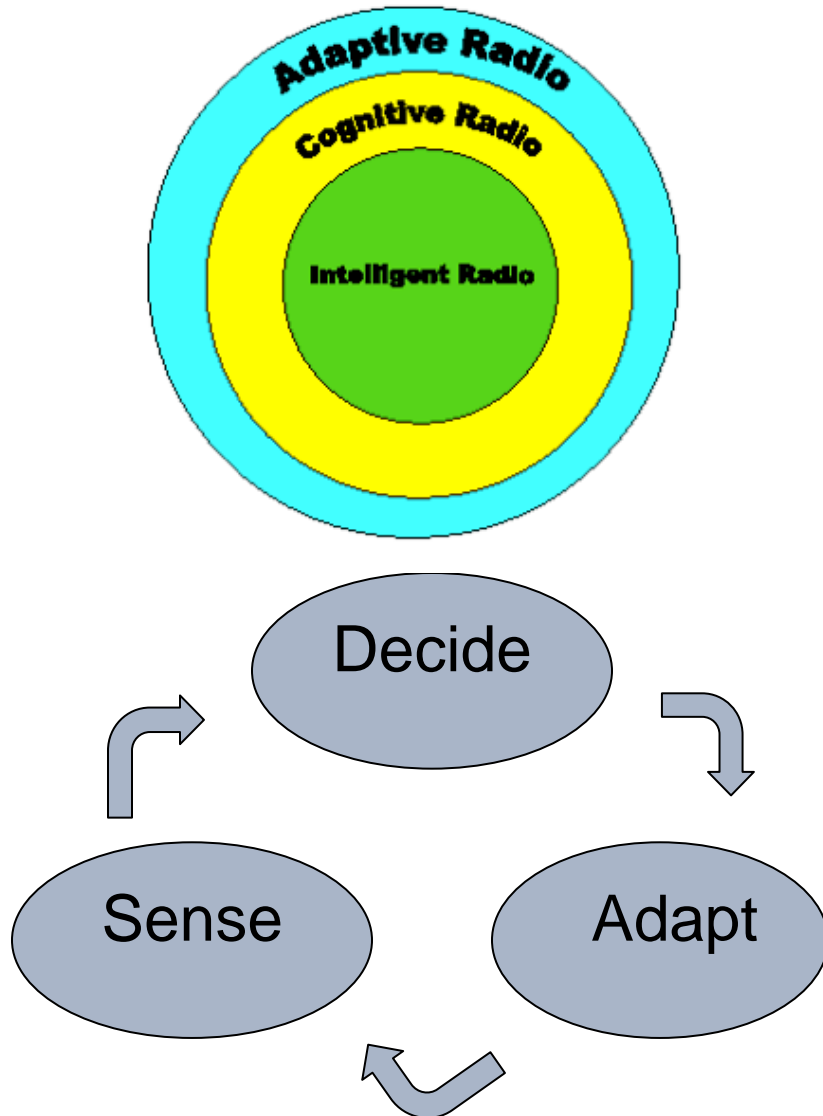
- **SON has to be integrated across various network domains, technology generations and vendor equipments**
- **Examples of conflict**
 - **Layer 2/3 packet compression due to SON could render DPI useless**
 - **Layer 1 optimization can cause oscillations of power levels at cell sites**
- **SON has to 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)**

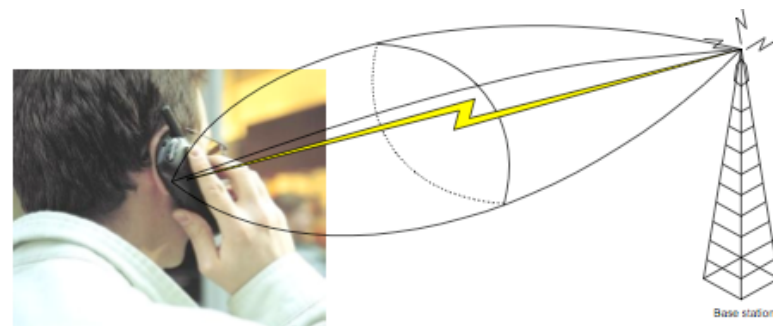
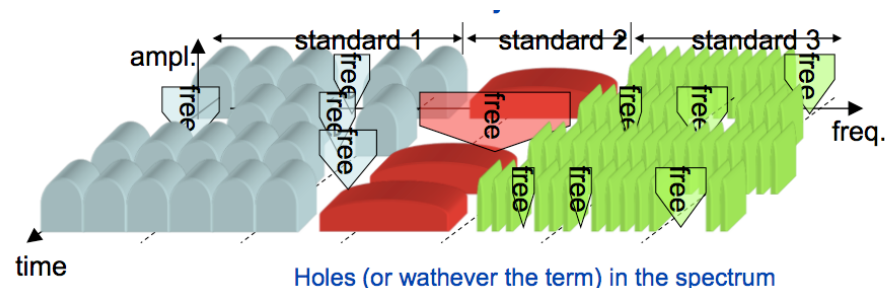


Moving from a centralized predictive, static view of the network towards a more local, real-time dynamic view

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 control¹**
- **Femtocells have some sort of cognitive radio functionality (channel reuse, interference mgmt)**



¹. 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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