Dynamic Spectrum Access - A Solution for the growing need for Spectrum

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ANCOM Conference “Riding the (Radio) waves of change, September 26th, 2016

Overview

- Motivation for DSA
- DSA Methods
- The TV Whitespace Concept as an (good?) example
- International View: Who is already acting?
- Summary and Future Outlook

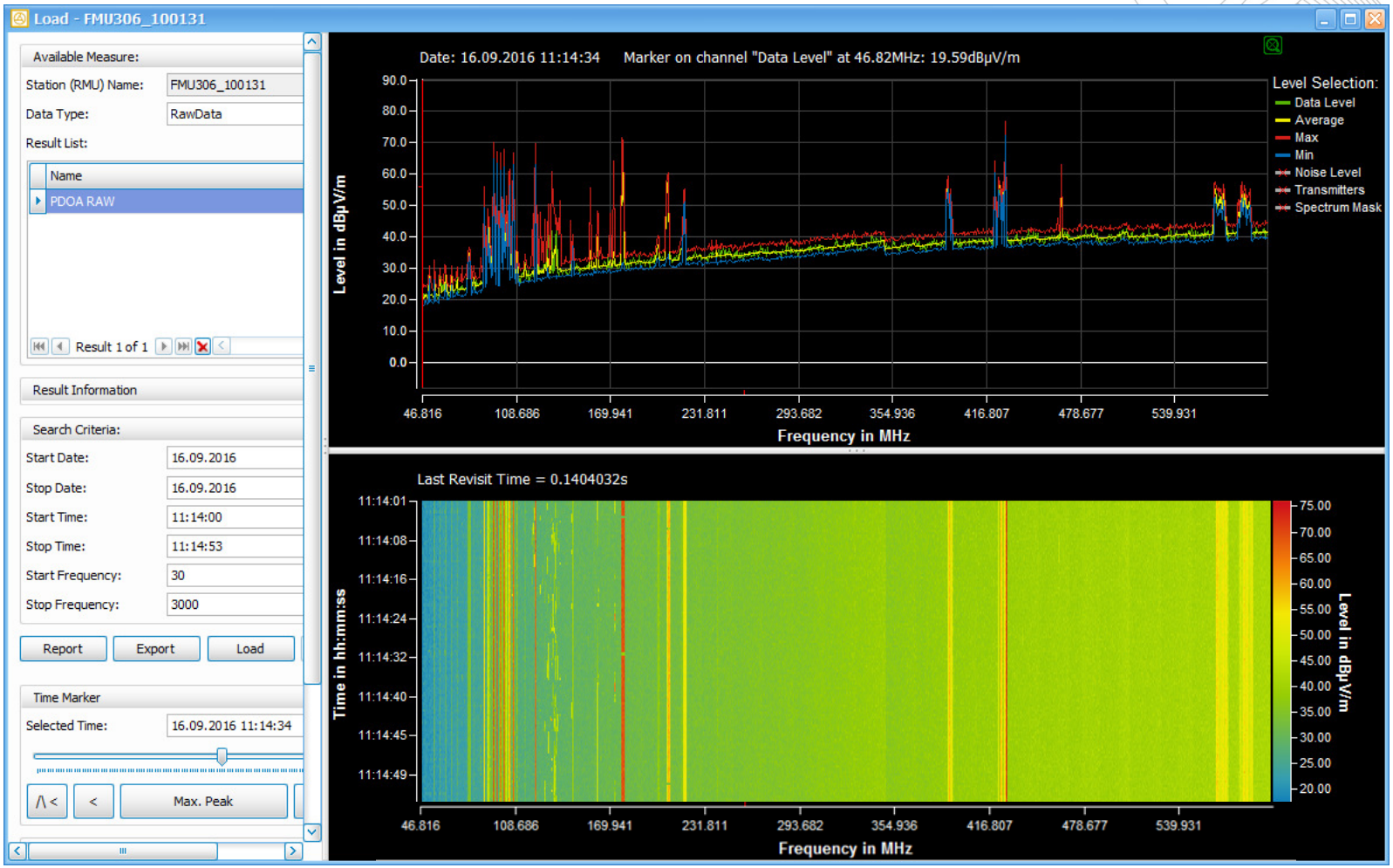
Dynamic Spectrum Access: Motivation

- Better usage of “residual” Spectrum
- Easy reclaim and re-farming of Spectrum
- Instant reaction possibility on emergency incidents
- Making Spectrum available which cannot be freed otherwise like military bands

		One Service	Multiple Services
Identical Hierarchy	One Operator	??	?
	More Operators	√	√√
Multiple Hierarchy levels		√√	√√√

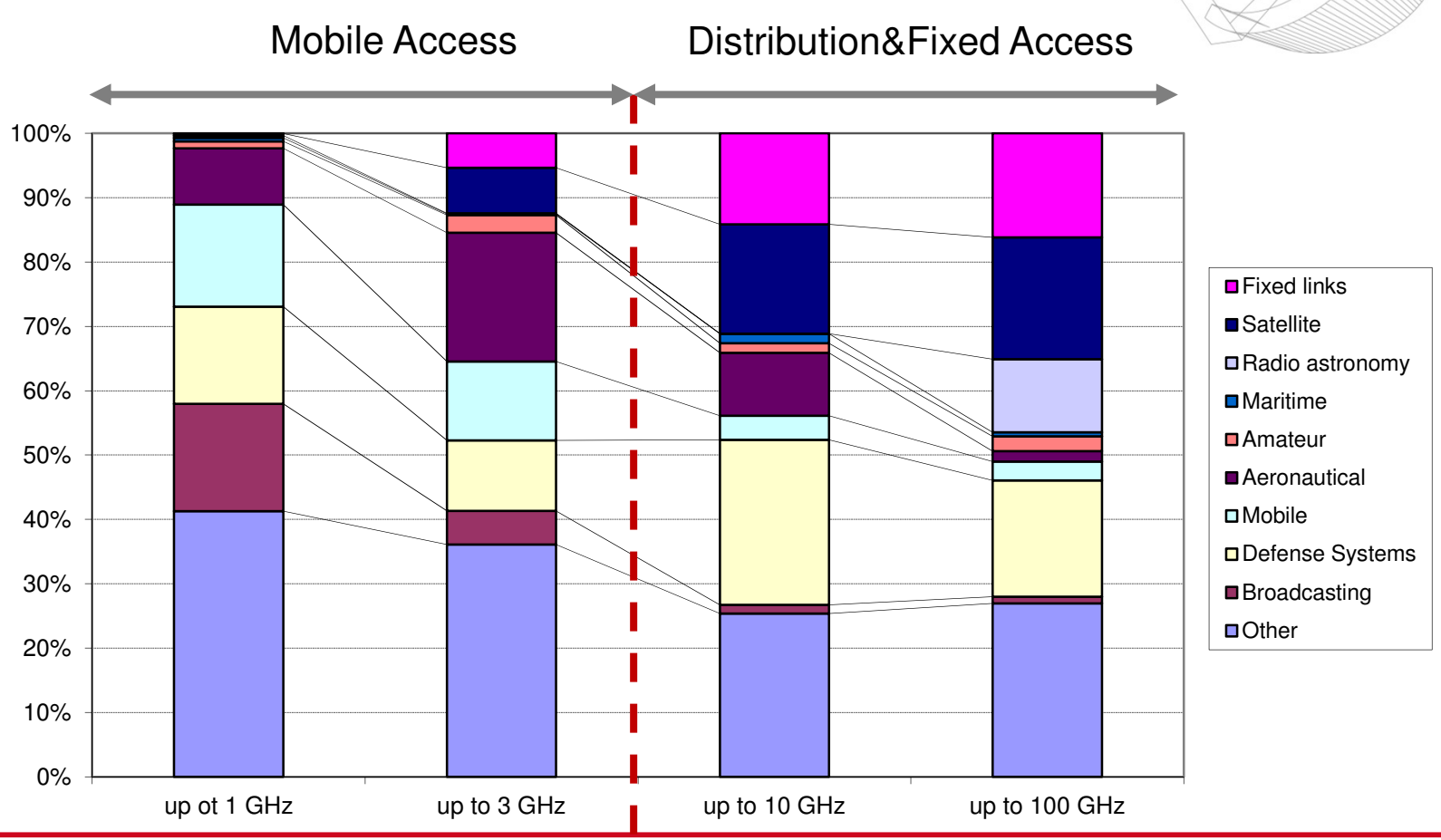
Many entities would be open for band sharing if they could definitely reclaim their frequencies within one hour

Motivation: The physical situation



The temptation: Even in Central Europe a widely empty band

Motivation ? The available band fractions



The fact: Possible gain of 100-200% for a specific service, but not powers of 10!

Reducing the cell diameter has much higher impact on available capacity

Motivation: Still there is something to gain!

Seattle

High dense urban
1 channel

Anchorage, Alaska

Dense urban
10 channels

Toccoa, Georgia

Rural
16 channels

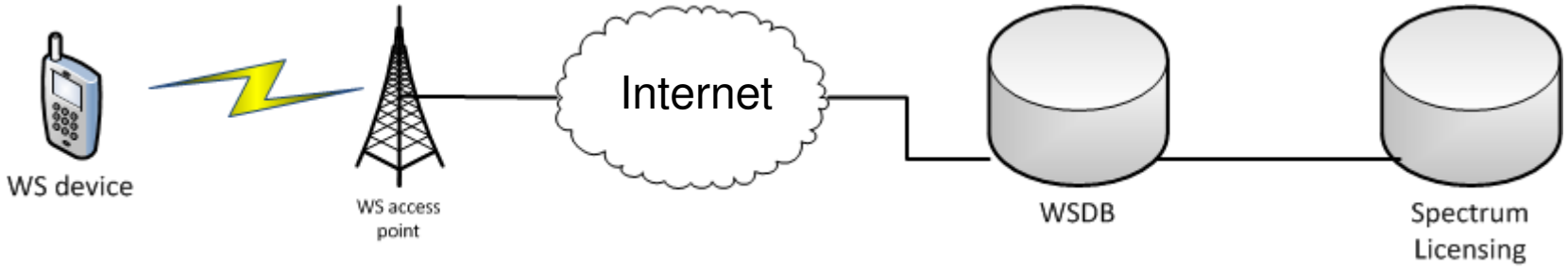
But: There are many places, where more bandwidth would be welcomed!

Dynamic Spectrum Access: Methods

- **Self negotiating devices (listen before talk, negotiation channels…)**
  - **Works fine in equally privileged scenarios of lesser importance like WiFi , Amateur Radio or CB**
  - **Problem of interference to others in systems with non equal link balance. Therefore not appropriate for systems with safety of live or high availability /high quality of service requirements**
- **Locally controlled networks**
  - **Typical example: GSM/3G: BSC assigns channel and timeslot or code for a mobile.**
- **Geo-location databases**
  - **All systems report to one central node**

DSA Methods: The infrastructure

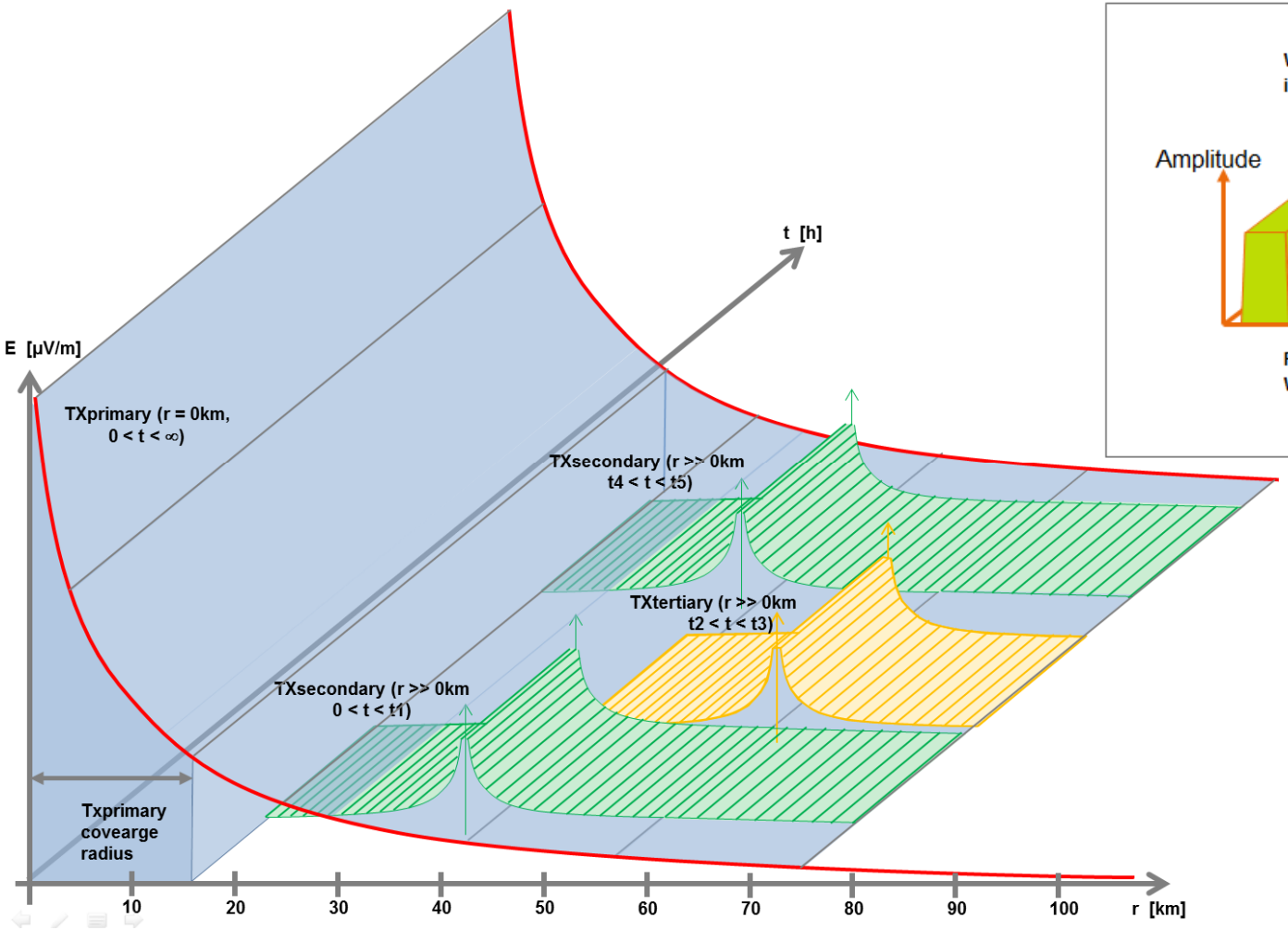
Use a Database to manage spectrum allocation

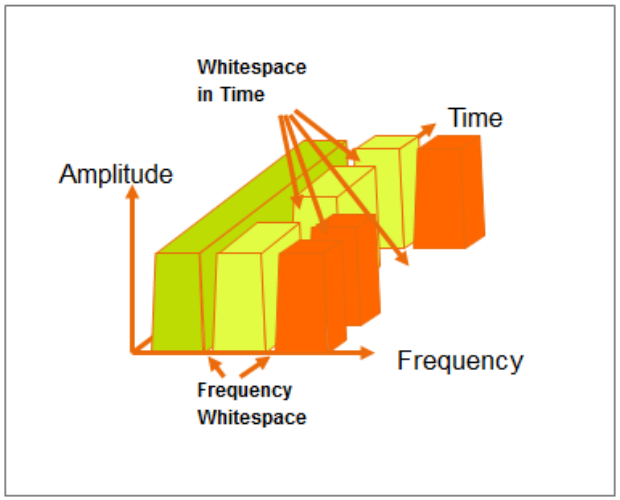


User access	Infrastructure	Interconnectivity	DSA database	Spectrum Licensing data
Consumer access device	Consumer access point Network provider infrastructure	Network transport mechanism probably internet based	Whitespaces spectrum assignment, registration, authorisation	Incumbent users, temporary protected users and regulatory controls
Large number of devices	Large number of access nodes	Multiple paths	One database OR multiple administrators	One source of prime data

Sensing is an additional option and not a solution to managing whitespaces

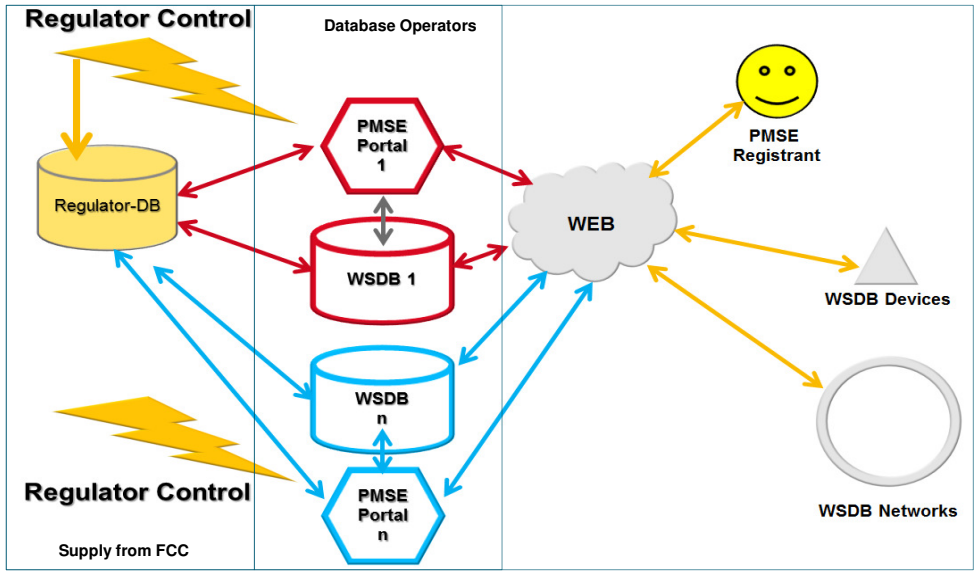
TV Whitespace Concept





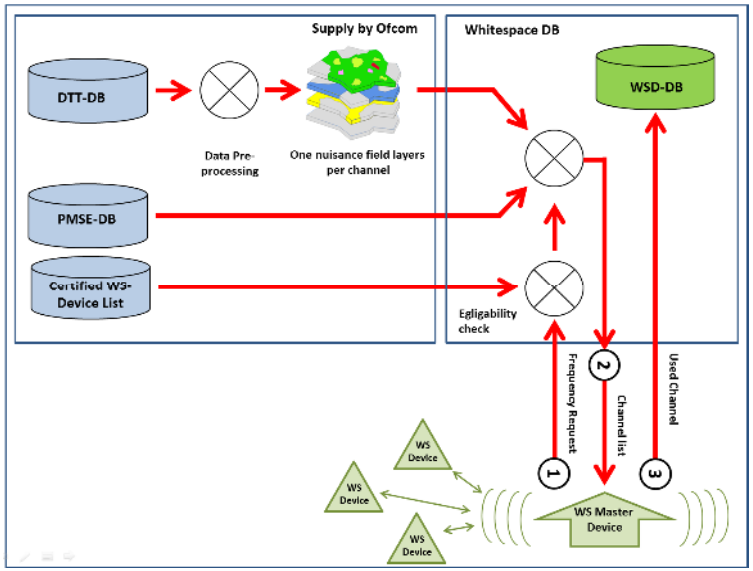
DSA (Whitespace) Mechanics: FCC vs. Ofcom

FCC: is easier to implement



- Multiple database operators
- More could join or leave at anytime
- Calculates available TVWS on the fly
- Must register protected LP-Aux
- Must share data between databases

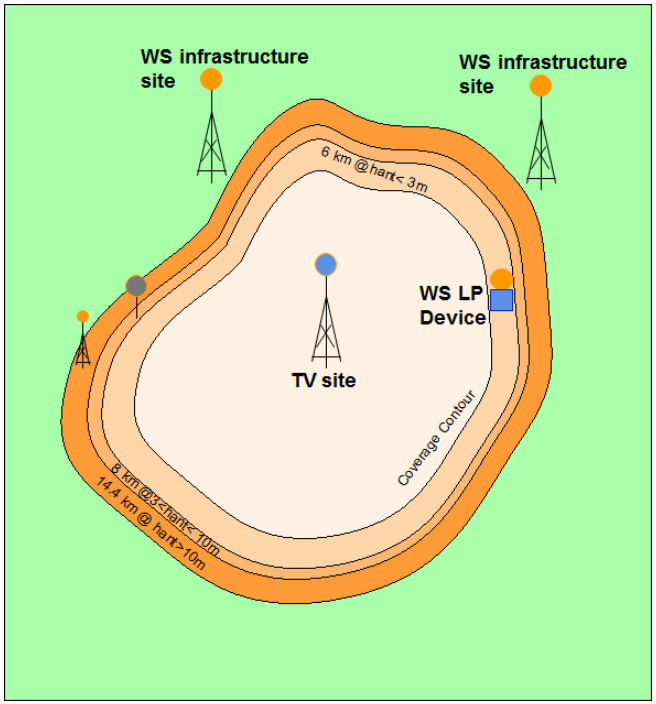
OFCOM: more controlled and risk averse



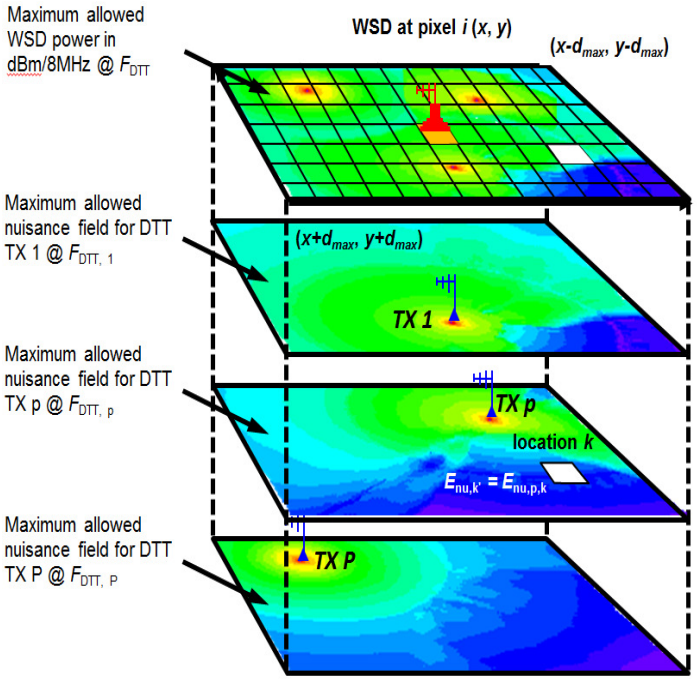
- Multiple database operators
- Can only join at specific approved times
- Calculation is a logic engine of data
- Must provide a specific enforcement portal

DSA (Whitespace) Physics:FCC vs. Ofcom

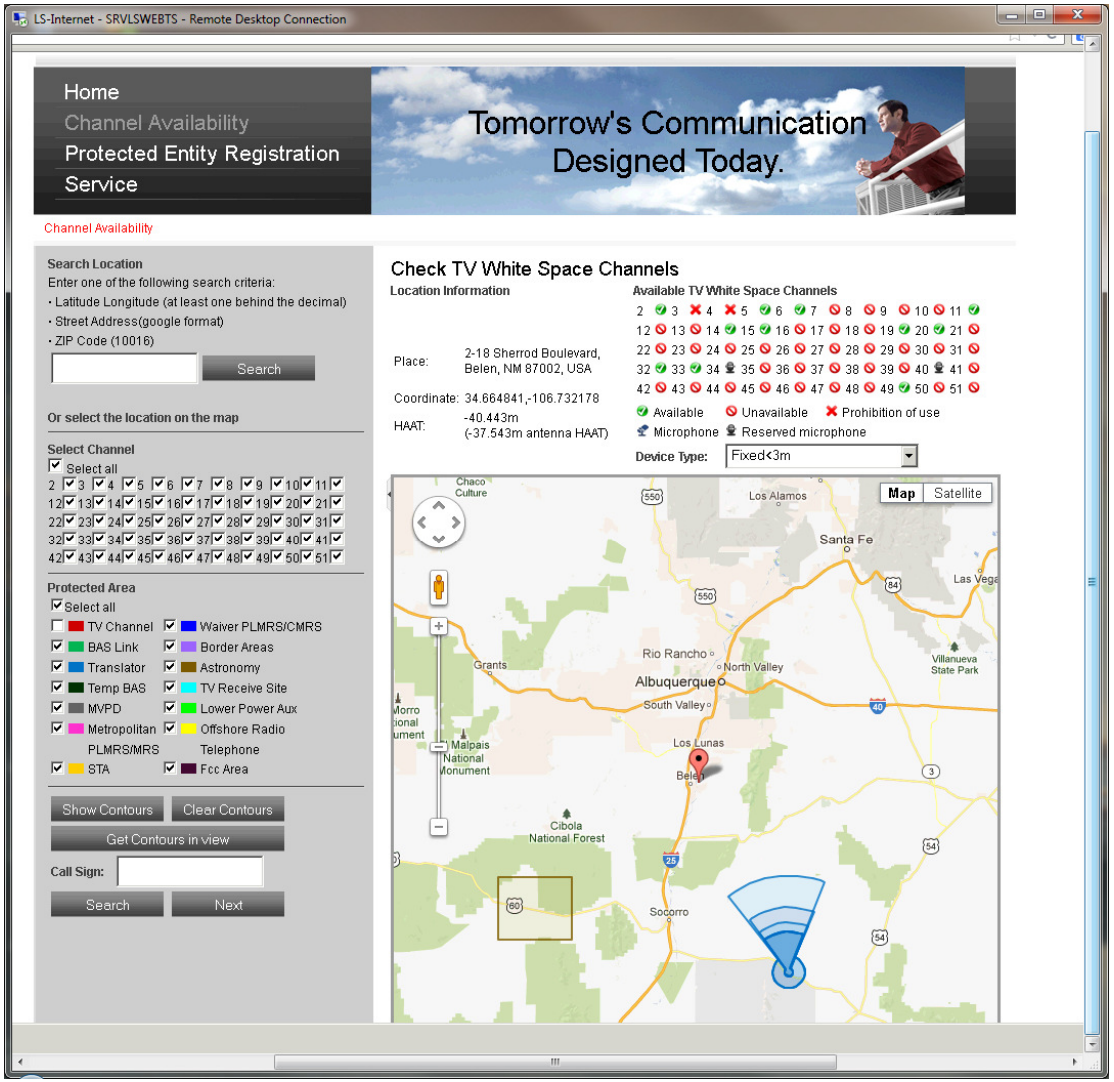
FCC: is easier to implement



OFCOM: more controlled and risk averse



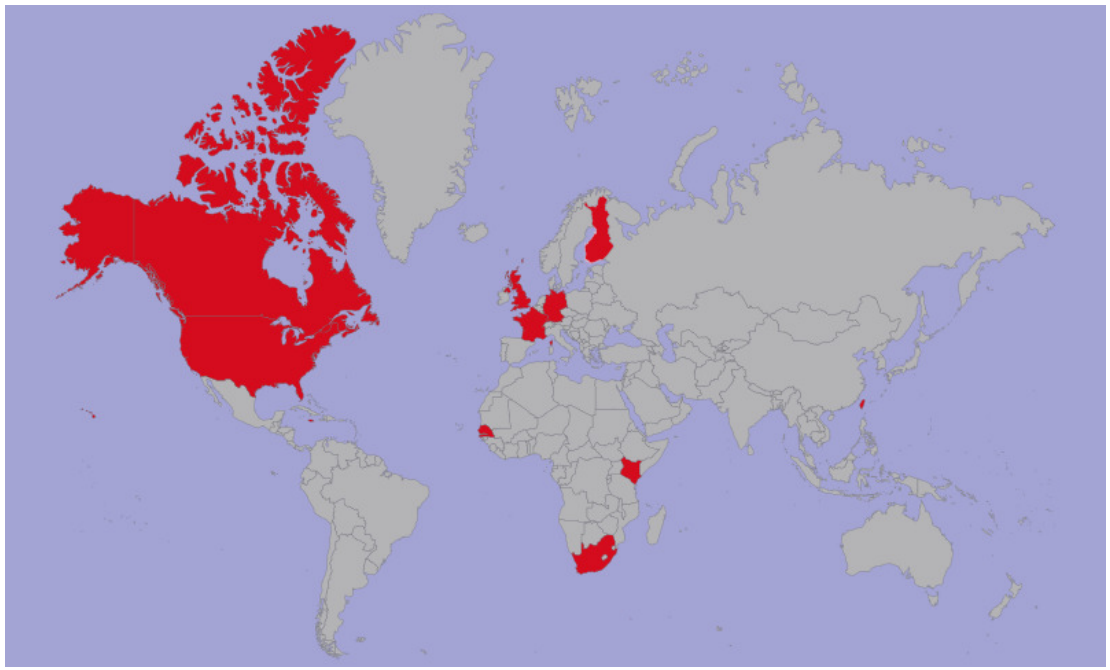
Whitespace Databases: An example



www.whitespaceforus.com

International footprint

- Operational DSA policy and operations (trial or commercial)
  - **USA, Canada, Jamaica**
  - **UK, Finland, Germany, France**
  - **Singapore, Taiwan**
  - **Malawi, South Africa, Senegal,**
  - **Kenya**



- Mainly TVWS although several countries are now moving to release of other bands (primarily Military spectrum)
  - Netherlands, France, USA

DSA Outlook

- No “killer” application has yet been found…..
- Applications to date are mainly about rural and similar internet access
  - Limited hardware supplier base
  - Limited application benefit
- USA has about 400 TVWS nodes mainly for rural access or trial technologies like mobile TV for sport events, or TV extension inside shopping Malls.
- UK applications are; rural internet access, flood warning, IoT type applications.

Commercial viability is doubtful

BUT……

DSA Outlook

- The release of spectrum adjacent to used, or densely demanded spectrum opens up more opportunity… especially if this is co-ordinated worldwide.
- Trials of LTE in DSA allocations have taken place
- Chipset manufacturers get interested if there are viably large demands of co-ordinated releases
- The next wave will involve mobile broadband, probably using a version of LTE or in the roll out of 5G type capabilities.
- Huawei demonstrated this two years ago. Other commercial operators are frequently involved in discussions.

Thank you for your attention!

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