

# ISART 2011

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## Cost/benefits in sharing Radar Bands?

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July , 2010

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# DFS Promises....

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Many spectrum bands for many different services are apparently not being used at particular frequencies and locations. Typical band usage = 10 % ?

DFS proposes to use some of these unused frequencies for new services, without interfering with the incumbent licensed users in the frequency band.

Two major benefits:

1. More service in a band.
2. New services without “re-allocating” existing bands.

# No Problems... (Hah!)

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- Motivational problems - Who wants it to work?
- DSA technical problems - Does it actually work? How?
- Regulatory ambiguities. “Opportunistic” or just a Secondary allocation?
- Economic questions. Is DSA a bargain?
- If shared bands count toward 500 MHz “Broadband”, is there a minimum sharing density or only at least one DSA user per band?
- Future of DSA. Trends?

# Motivation

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- DSA looks very different to two groups:
  - “Spectrum Envy” Those without spectrum are envious, and trivialize the difficulties of “borrowing” licensed spectrum.
  - “Spectrum Angst” Those having spectrum fear that their licenses will be “stolen” from them – nibble by nibble.

# “Slippery Slope” of DFS

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Potential DFS concepts include large range of possible DFS rights. Rules might allow spectrum use when:

1. Only if no possibility of interference to incumbent.
  2. Only if minimal possibility of interference to incumbent.
  3. #2, but incumbent must use high-performance receivers.
  4. #3, and incumbent must transmit detectable carrier tone or inform real-time database to protect current use.
  5. #4, and incumbent must allow time for DFS users to move before Xmitting.
- .....etc .....
- N. All users in Queue. Incumbent always moved to top of Q.

Any one of above possibilities might represent state of highest total economic value – but not for incumbent.

# Whose Band?

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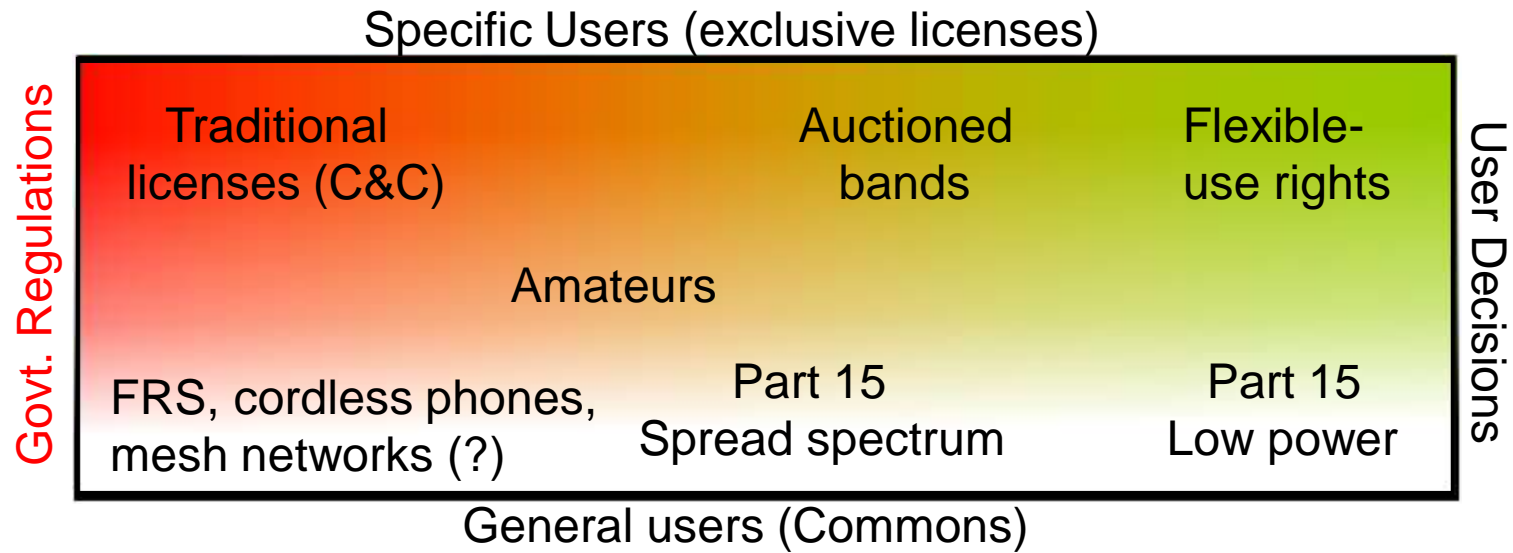
- If DSA services grow to greatly outnumber incumbent services, how will incumbent rights be modified?
- Who will really control the band? Politically?  
Economically?

# Regulatory Ambiguities

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- An ideal DSA device would be able to move into any band, detect incumbent devices, adjust and work around them, and produce any desired services in the “borrowed” spectrum – while all the incumbents continue to do their thing(s).
- However, current U-NII DSA is not particularly “dynamic”, but almost acts like a secondary license, granted to specific users to do their specific jobs in given locations.
- Who enforces rules? Possible future band managers?
- Who “owns” spectrum used by DSA? Auction licenses? Payout to incumbents? What rights for DSA users?

# Types of Spectrum Rights

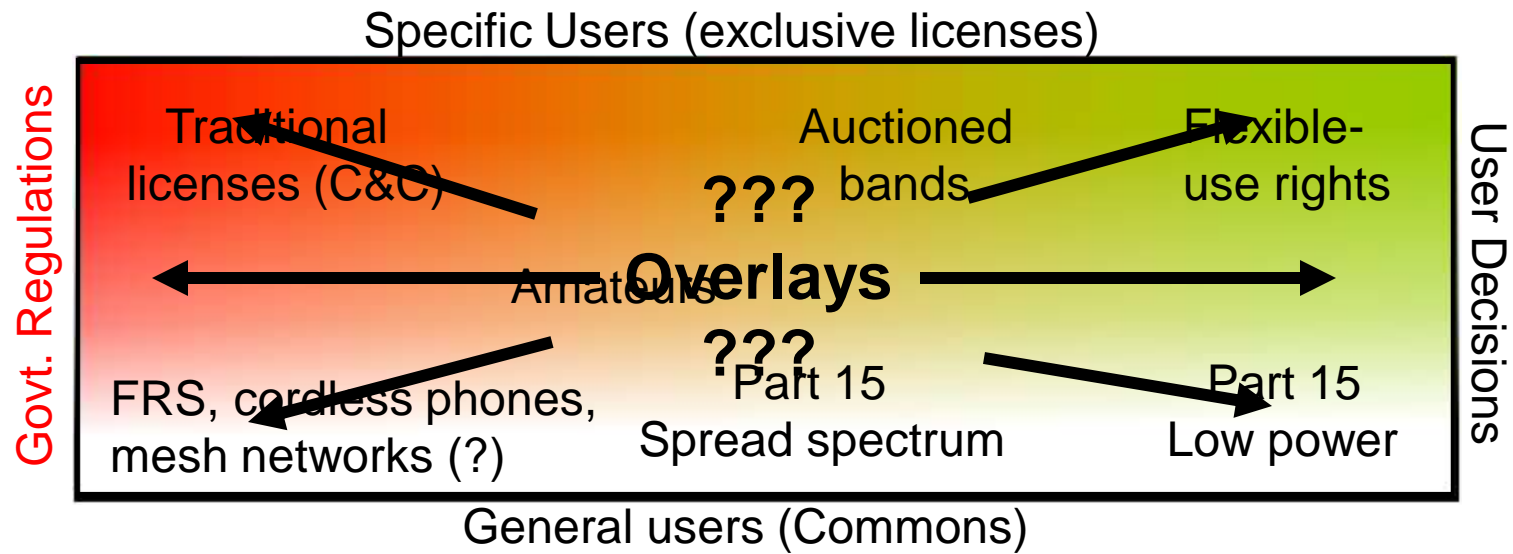


Spectrum management represented on a 2-dimensional continuum.

- Horizontal axis shows decision-making rights, Govt-only to user-only.
- Vertical axis shows how much a frequency is preferentially given to a specific user versus to general users.
- Many areas of model are currently in widespread productive use.



# Types of Spectrum Rights



## Underlays and Overlays.

**Underlays** - Low Power – Part 15 - Transmitted power is low enough that interference to licensed systems is generally not a problem.

**Overlays** - Higher transmitter power. Not permitted at most frequencies, since interference to licensed systems might occur

# Is DSA the best Bargain?

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- Do DSA systems cost more than conventional equipment? Cheap spectrum vs. more complex and tentative system configurations? Complexity vs. mass production?
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- Is DSA a stopgap that delays more efficient band reallocation, or is it a great way to test proposed more permanent sharing approaches?
- Would it be better to squeeze radars into smaller bands and clear remaining spectrum for exclusive Broadband?

# DSA versus Licensed

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Both systems require similar infrastructure and user devices if they provide similar services

- DSA requires greater intelligence and frequency agility to exploit temporary white spaces over wide range of frequencies. Licensed systems have first rights to spectrum in crowded times.
- DSA avoids expensive spectrum licenses (or will they pay rent to borrow frequencies?)
- DSA at 5 GHz opens a new class of “secondary” licenses. Where is business model that gives an advantage to DSA?

# When DSA Is Not Possible...

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Sometimes (emergencies, unusual events, etc) incumbent demand grows to exclusion of any frequencies left for DSA. What then?

Some factors driving increased incumbent demand will also increase demand for DSA services. Therefore. DSA disappears just when it is most needed.

DSA infrastructure may provide more services than incumbent infrastructure. Is there a better way to use DSA infrastructure than turning it off?

# Future of DSA?

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- Does DSA work only when there are lots of extra frequencies available? Or, will future technical advances always find ways to squeeze in? What happens when no frequencies are available?

Consumer radio usage is becoming more nomadic, short-range, and varied. Constant-traffic networks don't match usage, but it is surely useful to have frequencies always available.

When 1000 people suddenly show up at a location coordinated by wireless Facebook messages, how should one adjust? Flexibly and opportunistically?

# Conclusions

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- DSA potentially offers a very useful way to provide new services in an old band without the difficult traditional “clear & reallocate” cycle.
- Many questions concerning the best ways to proceed, including which DSA services can be provided in which allocated bands.
- Good Luck! We can hardly wait to see what happens.

# Questions? Comments?

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July 29, 2011

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