Expanding Our Options
For Context Awareness

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500 MHz and Beyond

- National Broadband Plan and Presidential Memorandum promise
  - 300 MHz within 5 years
  - 500 MHz within 10 years
- and the spectrum pipeline takes many years

- Will spectrum scarcity be over in 10 years?
- We have a big challenge.

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- Will spectrum scarcity be over in 10 years?
- We have a big ~~challenge~~ opportunity
  - We must think creatively

How Do Devices Learn Context?

- Much of recent debate
  - sensing to detect opportunity to transmit
  - sensing versus geolocation
- Many other models are possible*
  - Primary-secondary sharing can be based on cooperation or coexistence
    - If opportunistic, based on static or dynamic info
  - Primaries can cooperate or coexist
  - Secondary can cooperate or coexist

*e.g. see taxonomy, J Peha, "Sharing Spectrum through Spectrum Policy Reform and Cognitive Radio," *Proc. of IEEE, Apr. 2009*

An Unconventional Example*

- Secondary devices share with cellular system
    - Spectrum need not be "unused" to allow sharing
    - Secondaries transmit when primary signal is strong, not weak

- Context awareness from
    - Dynamic info: a sensor network gives secondaries info about observed spectrum usage.   (third party?)
    - Static info: a priori knowledge of cellular technology
    - Implications for policy and business arrangements

* Saruthirathanaworakun & Peha, Crowncom 2010

Technology, Policy, and Business Issues are Intertwined

- Considering other models forces us to consider policy and business context
  - Is cooperation possible between given parties? Is it to be required? Who will enforce?
  - Is it reasonable to assume trust between systems?
  - Can violators be detected? penalized?
- There are cases where we must trade off efficiency and enforceability.
  - BOTH are important.

What is Context?

- Cognitive radios reconfigure based on context
- Not just about spectrum utilization
- Reconfigure based things user/device knows
  – Application: tolerance to BER, throughout, ...
  – Urgency/importance to user
  – Mobility: physical and logical

Conclusions

- The time for creative forms of spectrum sharing has arrived.

  – Great potential to help meet our challenges.

- To address long-term needs, we should broaden our thinking about sharing models, including context awareness.

  – Range of cooperative and coexistent models.

  – There is probably no "best" model. Different approaches for different types of systems.

- We should broaden our ideas of context.

  – Include things like application, and user intentions