

# White Spaces and Spectrum Sharing for Wireless Broadband

Office of Engineering and Technology  
Wireless Telecommunications Bureau

FCC Open Agenda Meeting  
July 19, 2012



# Overview

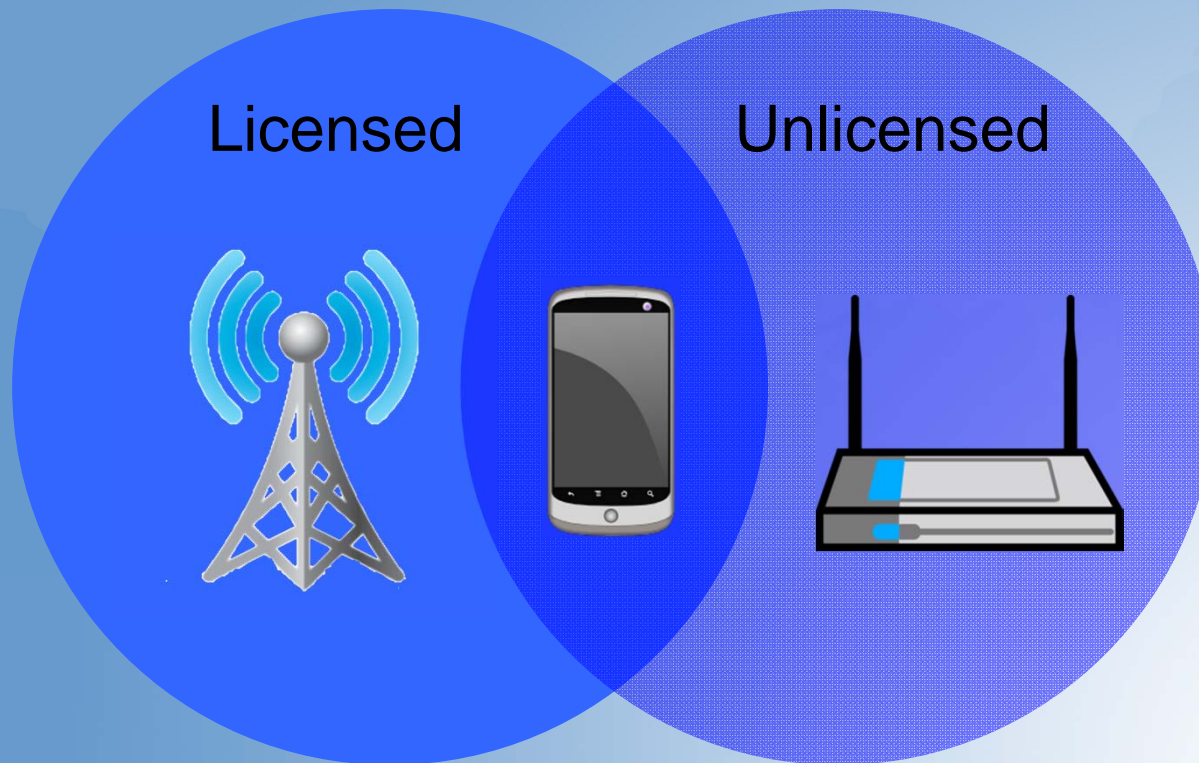
1. Spectrum Use Today: Licensed and Unlicensed
2. Emerging Spectrum Sharing Approaches
3. White Spaces: Progress to date and future directions



# 1. Spectrum Use Today



# Wireless Broadband Ecosystem: Convergence



## Unlicensed Spectrum

- Diversity of Uses: broadband, sensors, RF ID, baby monitors; cordless phones, vehicular radars, etc.
- Carries 30-40% of Internet traffic, expected to increase
- Enormous economic value
- Inherently shared spectrum
- Authorized in most bands, higher power in some



## Licensed Spectrum

- Approximately 2 million FCC licenses
- Diversity of uses: broadband, broadcast, point-to-point, satellite, etc.
- \$150 billion wireless industry
- Flexible use policy





# Spectrum Management Today



Spectrum Allocations  
Are Silos



Silos Can Lead to  
Inefficiency



\* USA \*

## 2. Spectrum Sharing Approaches





## Multiple “Layers” of Sharing

Services

- Multiple users share same service, potentially multiple user types

Network

- Multiple service providers share network infrastructure, different spectrum

Spectrum

- Different radio systems share electromagnetic spectrum



## Improving Efficiency: Sharing

- Much of the Spectrum Is Shared
- Several Ways to Share
  - Frequency
  - Space
  - Time
  - Accept Interference
  - Share Infrastructure
- Most Sharing is Static
  - Opportunity to share more



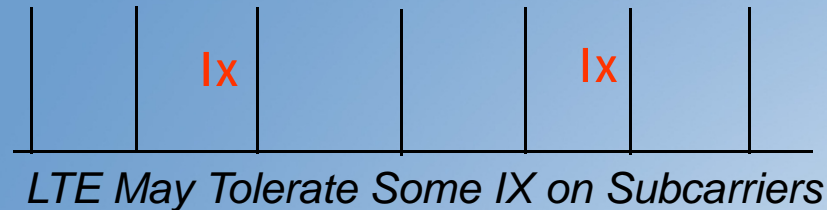
## Basic Sharing Techniques

- Frequency (hopping, spread spectrum, coexistence)
- Geographical (exclusion zones, area licenses)
- Temporal (priority / scheduled access)

*Modern sharing technologies (e.g., White Spaces) use these basic techniques, but more dynamically*



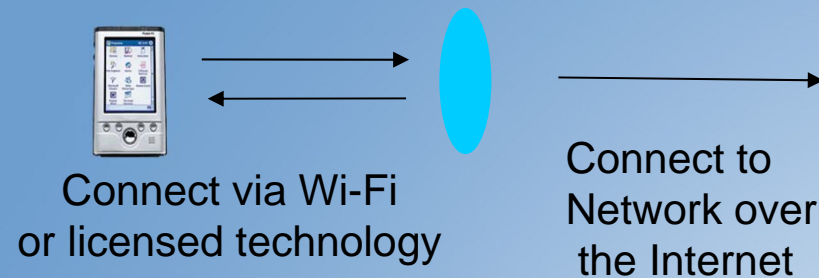
## Example 1: Coexistence Overlay



- Frequency coexistence using licensed spectrum
- LTE: designed to tolerate some interference
- Exploring this approach with federal @ 1755-1850 MHz
- Testing planned



## Example 2: Small Cells



- Example of geographic sharing
- Licensed or unlicensed spectrum
- Dense networks = higher capacity
- Side benefit: short range = precise area targeting
- Stand-alone or combined with cognitive radio

# Example 3: Dynamic Frequency Selection

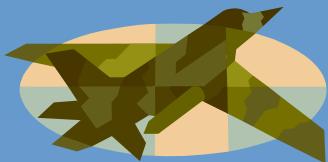


Radar operates only at certain Locations or intermittently

DFS Enables Access to 5 GHz Spectrum for Unlicensed Devices



Device detects radar and moves to unoccupied channel



Medical Body Area Network detects and avoids flight testing and other signals



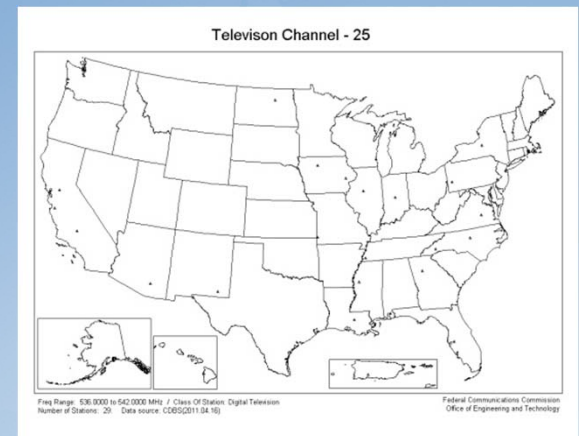


# 3. White Spaces: Update



# White Spaces Paradigm

- Basic Concept:
  - Identify spectrum “White Space”
  - Device/Network adapts to use it – Dynamic Spectrum Access (DSA)
  - Technical standards protect services
- First Implementation: TV bands
  - Rules finalized September 2010
  - Slight modifications April 2012



*Example: TV Ch. 25  
Assignments /  
White Space*



# Sharing White Space in the TV Band

- Several TV channels are vacant at any given location
- Accessing the White Space
  - Device determines its location
  - Communicates with data base of protected services
  - Data base replies with permissible frequencies at that location
  - Device automatically adjusts to operate on permissible frequencies
- Services protected in the data base:
  - Digital TV, analog Class A, and low power TV, translator & booster stations
  - Wireless Microphones
  - Cable head-ends
  - Land mobile systems



# U.S. Leads the World in White Space Technology

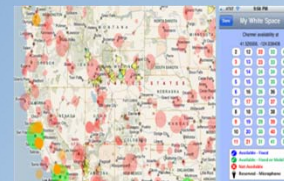
- Adopted final rules
- Approved the first devices
- Approved first databases
- Approved initial tests
- Approved first deployments
- Testing microphone registration



KTS



Adaptrum



Spectrum  
Bridge



Telcordia



Wireless Cameras Cover  
Park in Wilmington NC



## Spectrum Sharing: Beyond the TV Band

- Spectrum Innovation NOI: asked how dynamic access can provide more intensive and efficient use of spectrum
- Middle Class Tax Relief Act of 2012: Roadmap for exploring expansion of 5 GHz Wi-Fi
- President's Council of Advisors on Science and Technology (PCAST): working on a report that will likely encourage shared spectrum model in federal government spectrum bands
- Potential Bands: 1.7 GHz, 3.5 GHz, 5 GHz – likely will require different approaches

