TV White Spaces: The Next Wi-Fi?

Doug Mohney
Editor-in-Chief
VON Magazine
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Who am I? 30 second intro

• Hearing policy wonks talk about 700 MHz, unlicensed spectrum in D.C. for years.
• Day job: Editor-in-Chief, VON Magazine
  – Feb 2007 Interview, Phil Zimmermann
Unlicensed TV White Spaces

• What is “White Spaces”?
• How did the concept get created?
• Technical proposals - History
• Tech Specifics as of July 31, 2006
• Final Word in October
What is White Spaces?

• “Analog”/NTSC TV uses VHF and UHF
  – Today we have TV channels 2-69
  – As of Feb 18, 2009, channels 2-51 will be for TV, and all digital
    • (Assuming no last minute political panic)
• In any given geographic area, one can receive only a handful of stations due to geography, careful licensing
• 51 channels -handful =LOTS of open unused, “white spaces” channels
• Each DTV channel = 6 MHz, 27 Mbps broadcast bandwidth using existing DTV spec
Why is the 700 MHz RF band loved and coveted by all?

- Propagation characteristics
  - Go through walls, obstacles
  - In a licensed use mode, one can cover a city with 1 or 2 base stations vs. lots of cells/transmitters in Wi-Fi and higher frequencies.

- There’s a lot of white spaces space available, the farther away from cities you go.
  - Policy wonks see this as a savior for the “Digital Divide” in Rural America
FYI: There’s a lot of lurking LICENSED 700 MHz space

• First auction
  – Lot of speculators sitting on it
    • Largest Aloha Networks, Vulcan Ventures

• Second auction coming up
  – Speculation cable, Google, others may raise money
  – Lot of political in-fighting on how it should be conducted
    • Google pushing for liberalized auction rules
    • CTIA (the cell guys) like current model
How did White Spaces created?

• Review of spectrum policy by wonks
  – Hey, there’s all this bandwidth…
    • New America Foundation (www.newamerica.net)
• Success of Wi-Fi
• Demand for more unlicensed bandwidth
  – FCC, Congress both recognize needs
• Cognitive/smart radio
  – Enabling technology to “look”
  – DARPA has done work on cognitive radio
The Recent History of White Spaces Maneuvers

• FCC Notice – May 04
• It won’t be Part 15 (WiFi)
• First round of comments
  – “White Spaces” Alliance
  – Motorola
  – Association for Maximum Service Television
• FCC addresses comments July 2007
  – (Not before DEFCON materials deadline 😞)
FCC Notice of Proposed Rulemaking

• Released on May 13, 2004.
  • Written in part by Ed Thomas, FCC, Office of Engineering and Technology

• Statement to open up white spaces channels, solicited comments

• Suggested approaches to avoid interference
  – “Guard signal” to indicate open freqs
  – Geolocation (Where am I? Look at database)
  – Spectrum sensing (Sense before send)
NAB (of course) not happy

- Response by Association for Maximum Television
- Generated worst-case scenarios for white space
  - 154 pages in initial response
- Tried to convince FCC that it would Never Work.
White Spaces Devices won’t be Part 15 (Wi-Fi)

• Part 15
  – Up to 1 watt power
  – Must take interference
  – Not cause interference

• Comments from White Spaces Alliance, Moto indicate Part 15 not workable.

• Typical White Spaces Device
  – Under 1 watt (To avoid interference)
  – Need a cognitive/smart radio
    • “Look before broadcast” and/or geolocation
Cognitive/smart radio

- Smart radio should be able to:
  - Sense environment
  - Avoid broadcasting on channels in use
    - TV most obvious, also some first responders, and licensed wireless microphones.
  - Find the unused bandwidth
  - Adjust power accordingly
  - Sounds like Electronic Warfare, without the War…
  - Can be used for TV white spaces (700 MHz), other bands
“White Spaces” Alliance comments

- Dell, Google, HP, Intel, Microsoft, Philips
  - Contributor – Edmond J. Thomas
- Block off channels 2-20 (and 37)
  - Avoid interference with existing licensed users (LMR)
  - Reserve lower end for potential public safety white spaces use
- Geolocation too cumbersome
- Doesn’t even talk about “guard” channel
- Spectrum sensing “smart” radio only way to go.
- “And here’s a toy Microsoft built…”
The Toy That Microsoft Built
The Toy That Microsoft Built

• “Microsoft TV White Spaces Development Platform Version 1”
• (Ignorant) Press made it sound like a finished consumer device
• Prototyping platform to “explore, develop and evaluate technologies required to create a commercially viable cognitive radio-based communications network product”
Why White Spaces gave FCC the Device

• Enable FCC test division to work with spectrum scanning, gain confidence
  – Test sensitivity of process
  – Turn knobs up (more power) and down (less power)
  – Test interference with existing devices
  – Test waveforms to ID DTV, NTSC, wireless mics
Functions of MS-TV-WS-DP-V1

• Enable developers to:
  – Create spectrum scanning and signal recognition software & hardware used to co-exist and avoid interfering with incumbent (TV) operators
  – Develop & refine transmit power control algorithms
  – Explore & test waveforms & modulation techniques
  – Perform on-air propagation & coverage measurements
    • VERY important in FCC test lab environment
Under the hood of MS...DP-V1

• Two system assemblies
  – Windows-based PC using IE browser as interface
  – Three boxes containing wide-band spectrum scanner and network processor and a tunable UHF half-duplex transceiver controlled by the network processor
MS…DP-V1: How it works

- Spectrum scanner goes through UHF 21-51, does 2048 FFT
- Signature feature templates for DTV and NTSC applied to FFT
- Non-occupied channels are declared potential white space, scanned for narrow-band incumbents such as wireless mics.
- Display scanner control and discovery info using (what else?) MS IE.
Motorola comments

• Much more conservative approach
  – Block off 2-21, also throw in two other channels for public safety use
• Geolocation initially used, with spectrum sensing maybe later
• Spectrum sensing deemed too “immature”
  – Hmm, compared to…?
• No discussion on guard band
• In interview, reluctant to talk about potential demo device/prototype lurking about
New America Comments

• Want all TV white spaces, no technical excuse not to grab ‘em

• Whitespaces Coalition
  – Picked block of 2-20 because they didn’t want big antennas (Mobile device use)

• Motorola
  – Business model geared to fixed broadband, so geolocation works better; i.e. dealer installed Canopy-type devices
FCC addresses comments in July 2007

- Not announced as of July 6, 2007
- This slide to be updated for DEFCON presentation
What is expected to be finalized

- Technical specifications
- Final Report and Order Issued in October 2007
Real World Implementation by ???

• Consumer electronics vendors hot to go
• Intel, Philips always needs to sell more chips, devices
• Google wants Yet Another Way Around The Man (In this case, Telcos & Cable)
• Software is relatively straight-forward
  – After all, Microsoft did it with one engineer and IE…
  – Maybe by late 2008 or early 2008, if we don’t get into “standards”
    • 802.11n still isn’t finalized