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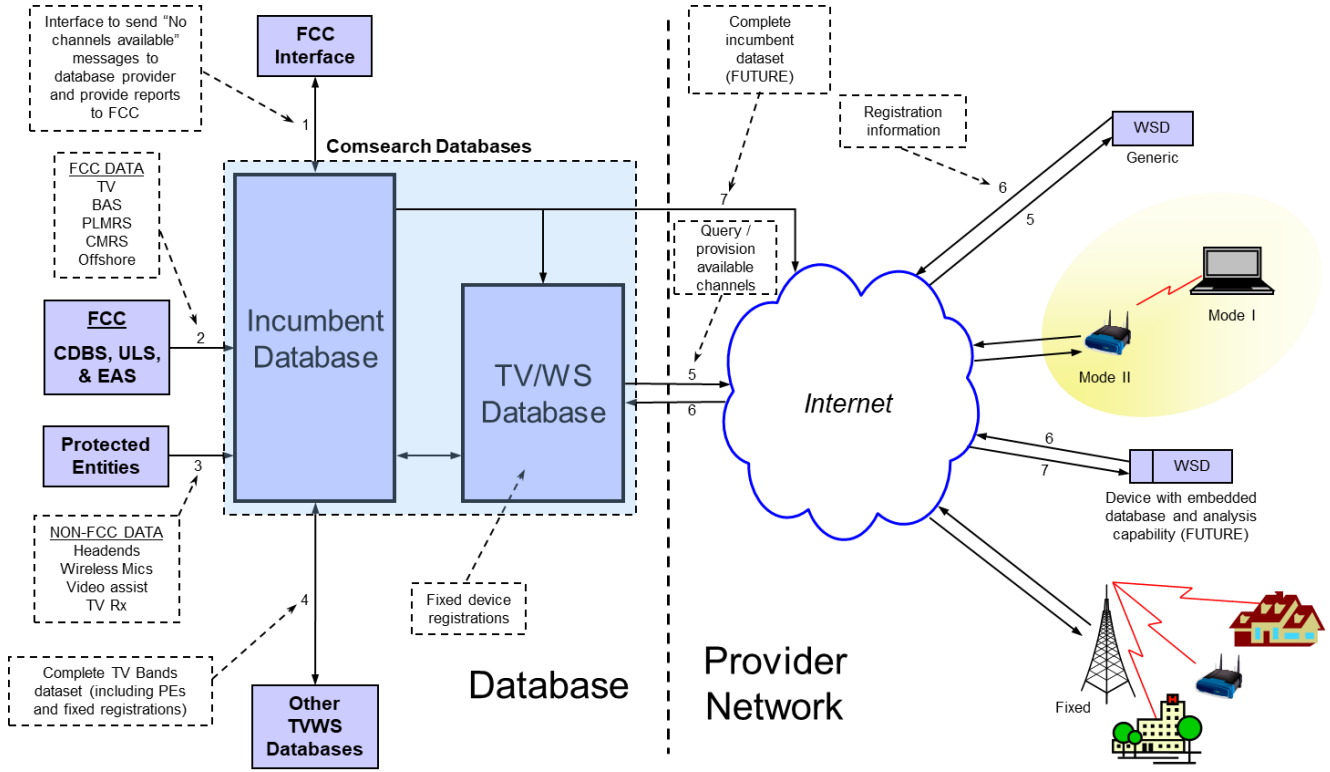
Industry Spectrum Sharing Lessons learned

International Symposium on Advanced Radio Technologies

June 13, 2022

TV White Space

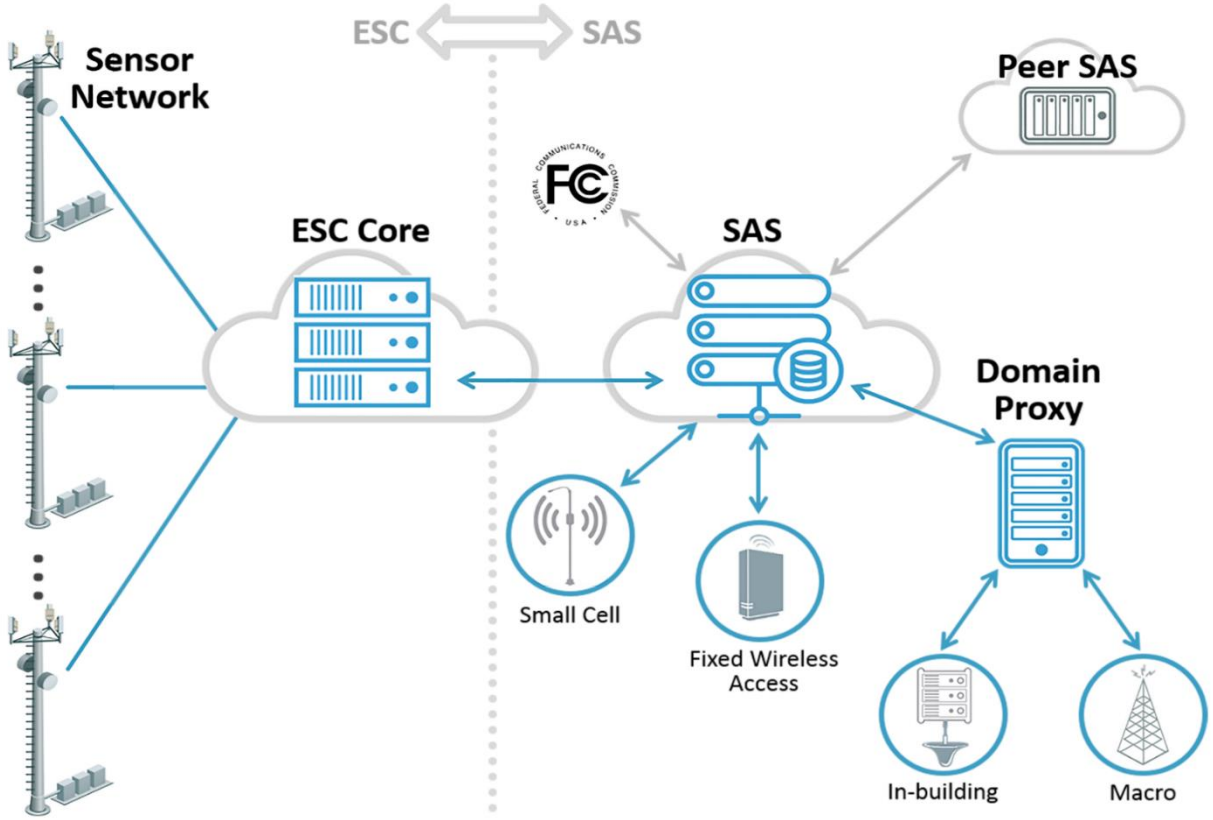
- Background
  - Established by FCC in 2004
  - Commercial TVWS database administrators built and operated databases that allow unlicensed devices to share unused TV channels at specific locations
  - FCC selected ten TVWS database administrators
  - Upper portion of the TV band in the U.S. reallocated to mobile, severely limiting remaining TV White Space and market
  - TVWS database testing done serially by FCC took several months
  - Microsoft using TVWS for Airband
  - RED took over all database operations
  - Fewer than 300 TVWS deployments
  - Several international TVWS applications
  - Three years between FCC PN inviting TVWS proposals and PN granting full certification
- Lessons Learned
  - Band plagued by regulatory uncertainty
  - FCC database testing delayed rollout
  - Never really addressed Enforcement



From Comsearch TVWS DBA Proposal

Citizens Broadband Radio Service (CBRS) Spectrum Access System (SAS)

- Background
  - Established by FCC in 2015
  - FCC selected ten SAS administrators and four ESC providers (who are also SAS admins)
  - SASs have been in commercial operation since Jan 27, 2020
  - SASs allow CBRS devices (CBSDs) to share spectrum with other CBRS users and incumbents
  - ESC providers have built coastal sensor networks to protect Navy radar operations
  - Numerous engagements with DoD required
  - NTIA now considering IIC
  - SAS's role in Enforcement still TBD
  - Over four years between FCC PN inviting SAS proposals and PN granting full certification
  - Two higher powered serviced now bookend CBRS
- Lessons Learned
  - Issues with regulatory uncertainty
  - Certification process was long and complicated
  - Concerns about role of SASs in Enforcement
  - Future sharing needs to be more forward-thinking considering imminent replacement of ESC with IIC

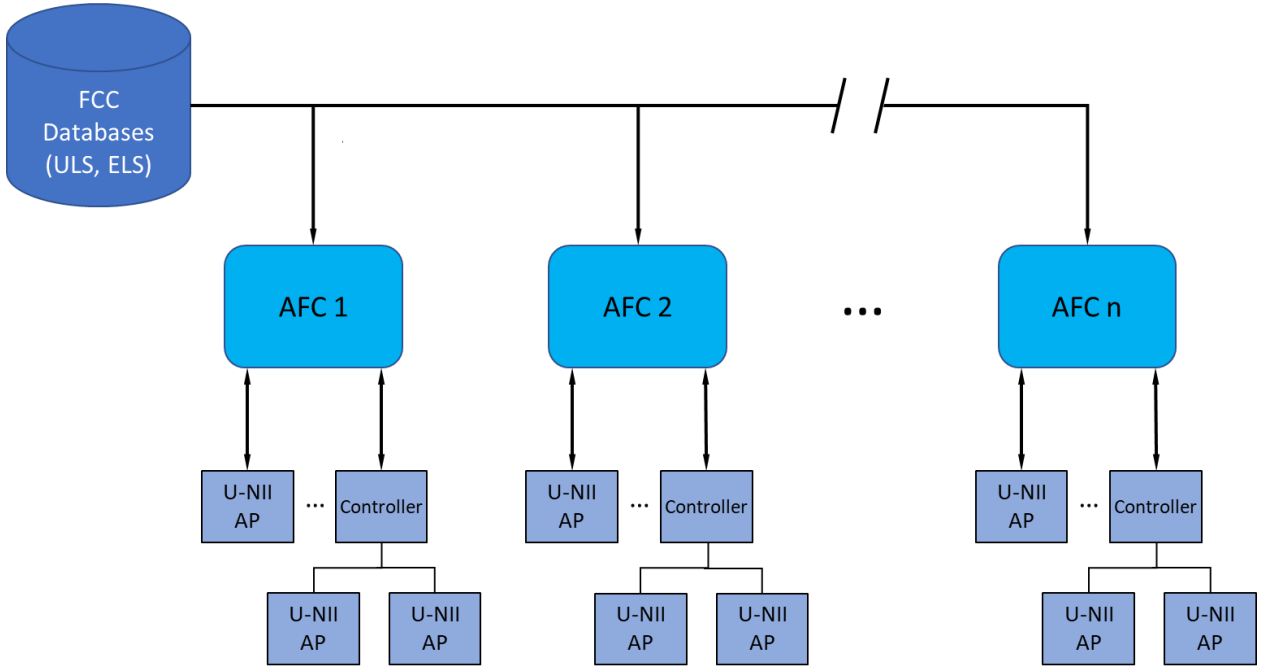


CommScope SAS Architecture

Automatic Frequency Coordination (AFC) for 6 GHz

- Background
  - Established by FCC in 2020
  - Used to allow for standard power unlicensed devices to operate in portions of the 6 GHz band and not cause harmful interference into incumbents using the AFC
  - WInnForum & Wi-Fi Alliance have been working on specifications and recommendations
  - FCC directed formation of a Multi-stakeholder Group (MSG) to address issues specific to technical and operational aspects of the AFC
  - Several open issues: testing, certification, enforcement, etc.

- Lessons Learned (so far)
  - MSG interaction been difficult
  - Need clarity on testing/certification/public trials/demonstration projects
  - Need to better address Enforcement



AFC Functional Architecture

Advanced Wireless Services (AWS)

AWS-1

- 1710-1755/2110-2155 MHz
- Sharing with feds in 1.7 GHz: fixed MW, airborne telemetry, precision-guided munitions, video surveillance, mobile
- Sharing with commercial: fixed MW & BRS in 2.1 GHz
- Both federal and commercial systems were relocated
- Deployment predicated on traditional frequency coordination described in FCC public notice (allowed operation before relocation completed)
- DoD ultimately created a portal to facilitate data exchange
- NTIA helped manage federal interactions: transition plans and costs
- Creation of Commercial Spectrum Enhancement Act (CSEA)
- Lessons Learned:
  - Lack of clarity on commercial funding of early federal relocation
  - Portal was afterthought
  - No additional funding for NTIA efforts
  - Need better way for commercial/federal interactions

AWS-3

- 1755-1780/2155-2180 MHz
- Sharing with feds in 1.7 GHz: ACTS, AMT, UAS, Sat, TRR, fixed MW
- Sharing with commercial: fixed MW & BRS in 2.1 GHz
- CSMAC used to facilitate commercial/federal interaction and interference study: 5 WGs
- Initial sharing studies used incorrect mobile system parameters, CSMAC process also used to refine
- Developed “trusted agent” concept to facilitate discussion and analysis of sensitive (AMT)
- DoD data exchange portal created at outset
- NTIA helped manage federal interactions: transition plans and costs
- Lessons Learned:
  - CSMAC process worked well, but concerns with ”openness”
  - No additional funding for NTIA efforts
  - Need to confirm operating parameters early

3 GHz Bands

3.45 GHz

- 3450-3550 MHz
- Sharing with DoD: airborne & ground-based radar
- Sharing approach with DoD developed by America's Mid-Band Initiative Team (AMBIT)
- AMBIT established Cooperative Planning Areas (CPAs) and Periodic Use Areas (PUAs)
- Sharing study shifted to National Defense Industrial Association (NDIA)
- Deployment predicated on traditional frequency coordination described in FCC public notice (allowed operation before relocation completed)
- DoD created a new portal to facilitate data exchange
- NTIA helped manage federal interactions: transition plans and costs
- Lessons Learned:
  - AMBIT was opaque
  - NDIA was more open, but data exchange and study was difficult
  - No additional funding for NTIA efforts

3.1 GHz

- 3100-3450 MHz
- Sharing with DoD: airborne, ground-based & shipborne radar
- NTIA will likely help manage federal interactions: transition plans and costs
- Sharing approach and study being worked under National Spectrum Consortium (NSC) task group: Partnering on Advancing Trusted and Holistic Spectrum Solutions
- NSC sponsored CLASSIFIED security clearances for industry representatives
- Lessons Learned (so far)
  - PATHSS process is next generation for commercial/federal interaction
  - Ability to permit CLASSIFIED discussions and data discovery is helpful
  - Maybe provide funding to NTIA

Lessons Learned Summary

- Each new sharing endeavor is generally treated as new – need more “official” lessons learned discussions that can feed into future decisions.
- NSC PATHSS process for commercial/federal engagement, discovery and analysis seems like a workable model that can be applied to future shared band study.
- NTIA should be funded to support commercial/federal sharing and relocation efforts.
- Longer-term spectrum allocation planning is needed.
- Need to study Enforcement in the realm of commercial dynamic spectrum management systems.

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Thank you!