Spectrum Management With SAS

Srikathyayani Srikanteswara
Intel Corporation
1/14/2013
SAS Architecture Assumptions

- Incumbent decides which spectrum to share and for how long
- Licensed and unlicensed spectrum have different spectrum management and monitoring needs

PA Priority Users (Licensed)
GAA (Un-Licensed)

Physical band separation Phase 1

SAS
Spectrum Database
Spectrum Management

REM Database
Radio Environment Maps
FCC
Incumbent Users
Spectrum Management: Spectrum Use Determination

• Incumbent has a-priori knowledge of spectrum use
• Spectrum sensing: susceptible to shadowing and other issues
  – For better accuracy sensing needs*
    • Complex algorithms beyond energy detection
    • Distributed sensing with cooperation
    • High density of sensing nodes
• Radio Environment Maps (REM) databases, Spectrum Cartography †
  – Cloud based database that collects interference and spectrum use information, performs analytics
  – Can provide channel recommendations for GAA users
  – May or may not be integrated with the SAS

* Please see references (1),(2)  † Please see references (3),(4),(5)
Interference and Misuse Detection

- Interference thresholds based on incumbent usage and FCC
- Allow all end user equipment to detect and report interference and misuse
- Incumbent
  - Interference and misuse detection in incumbent devices
- Cloud based REM databases
  - Collect data from various end users to generate interference/heat maps
- SAS
  - Combine information from incumbent, REM databases to locate source of interference
Interference Rule Compliance and Enforcement

• Different techniques needed for interference management for licensed and un-licensed users

• Licensed Spectrum
  – SAS sends message to coordinating entity or operator’s OA&M to locate and shut down interfering device

• Unlicensed Spectrum
  – SAS stops allowing spectrum use to all users in the area affected by interference until issue is resolved
References

1) Spectrum Sensing fundamental limits and practical challenges, Anant Sahai, Danijela Cabric, Robert W. Brodersen, Niels Hoven, Shridhar Mubaraq Mishra, Rahul Tandra, Dyspan Tutorial 2005

2) Capacity limits introduced by data fusion on cooperative spectrum sensing under correlated environments, Pratas, N.; Marchetti, N.; Rodrigues, A.; Prasad, R., IEEE 8th International Conference on Communications (COMM), 2010 Digital Object Identifier: 10.1109/ICCOMM.2010.5509025, Page(s): 497 – 502

3) Reduced-effort generation of indoor radio maps using crowdsourcing and manifold alignment, Sorour, S.; Lostanlen, Y.; Valae, S., Sixth International Symposium on Telecommunications (IST), 2012, Digital Object Identifier: 10.1109/ISTEL.2012.6483011, Page(s): 354 – 358

4) Improved performance of spectrum cartography based on compressive sensing in cognitive radio networks, Jayawickrama, B.A.; Dutkiewicz, E.; Oppermann, I.; Fang, G.; Ding, J., 2013 IEEE International Conference on Communications (ICC), Digital Object Identifier: 10.1109/ICC.2013.6655495, Page(s): 5657 - 5661