Citizen's Broadband Radio Service Overview
And the Industrial IoT Usecase

Alan Ewing
CBRS Alliance, Executive Director

Overview

- History of CBRS and spectrum sharing the 3.5GHz in the US

- Industry Associations involved with CBRS

- How is the CBRS spectrum allocated?

- SAS's and how they work

- Architecture of spectrum sharing

- Equipment approvals

- Example use cases

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A Brief History of CBRS

- The National Telecommunications and Information Administration (NTIA) identified the 3.5GHz spectrum in 2010 for possible shared use

- The FCC proposed the Citizen's Broadband Radio Service (CBRS) in December 2012, and finalized the proposal in April of 2014

- The CBRS Alliance was formed in mid 2016 to further the shared use of the 3.5GHz spectrum for 3GPP based deployments

- Spectrum sharing is codified under FCC "Part 96" (Code of Federal Regulation, Title 47, Chapter 1, Volume 5, Part 96)

- Wireless Innovation Forum (WInnForum) and CBRS Alliance work cooperatively to develop testing and certification schemes to support CBRS Band deployments

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Industry Organizations with a Primary Focus on CBRS
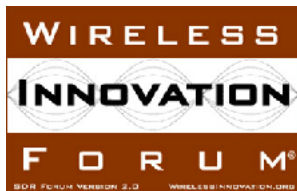
- Standards Development Organization
- Radio technology neutral
- Functionality and architecture for SAS and ESC
- Requirements, processes, and methods for protection of incumbent users
- Interoperability requirements and protocol definition
- Common framework for FCC testing and certification

- Industry Alliance
- Evangelize LTE-based CBRS technology, use cases and business opportunities
- Develop technical requirements for CBRS use cases
- Establish an effective product certification program for LTE equipment in the 3.5 GHz band ensuring multi-vendor interoperability

CBRS 3-tiered spectrum sharing in the US

Opens up 150 MHz spectrum for new commercial use without impacting incumbents

Tier 1
Incumbents

Military radar: ship-based | ground based

FSS RX

WISP
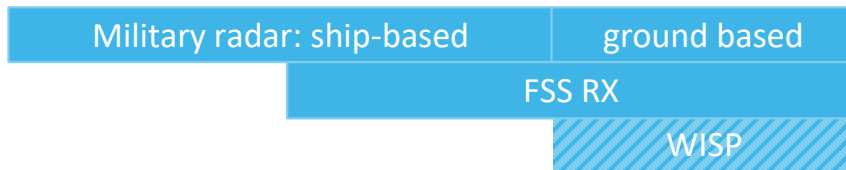
Incumbents are protected from interference from PAL and GAA

Tier 2
Priority Access Licenses (PAL)

PAL

PAL has priority over GAA, licensed via auction, 10 MHz blocks, up to 7 licenses

Tier 3
General Authorized Access (GAA)

GAA
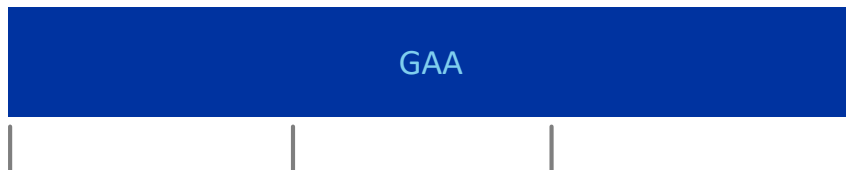
GAA can use any spectrum not used, yields to PAL and incumbents
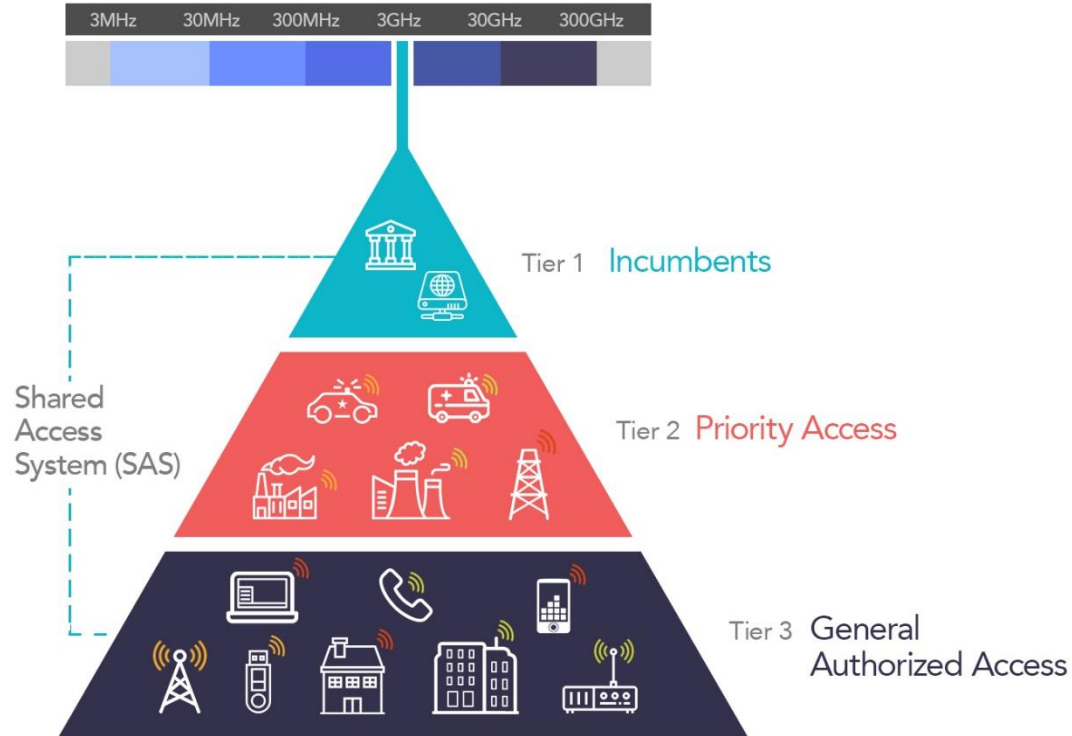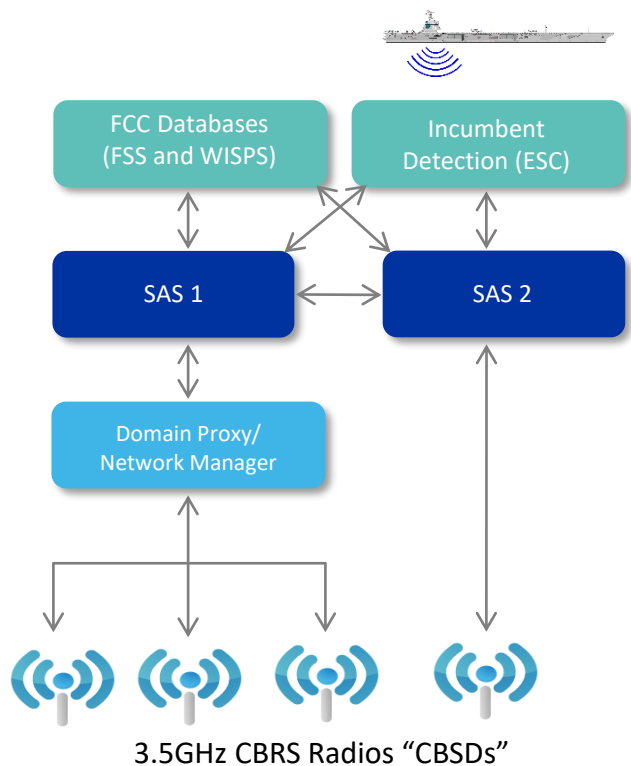
3550   3600   3650   3700 MHz

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Spectrum Access System

Figure 1. The Three-Tiered Spectrum Access System (SAS)

CBRS Functional Components

3.5GHz CBRS Radios "CBSDs"

- **Spectrum Access System (SAS)**
  - Centrally coordinates access to the shared spectrum, enforcing priorities and modeling the RF environment
- **Environmental Sensing Capability (ESC)**
  - Detects incumbent activity and informs SAS so that channels can be cleared of lower priority use
- **Domain Proxy**
  - CBSD aggregation and proxy function for large networks, can be integrated with an EMS / NMS or be standalone
- **CBRS Device (CBSD)**
  - Radio nodes operating in the CBRS band, must be centrally coordinated by a SAS in order to transmit

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Unprecedented Government/Industry Collaboration

*"Replacing static exclusion zones with Dynamic Protection Areas will maximize the commercial potential of this band while not losing the assurance that incumbent military radar systems will be protected. **This is truly a win-win."***
– David Redl, NTIA Administrator, July 24, 2018 speaking about CBRS

*"We're right now in the middle of the 5G wars where the U.S., China and other folks are trying to battle for leadership." "That being said, I think a lot of these spectrum auctions are going to start slowing down. I don't think there's any more low-hanging fruit. **As the airwaves continue to get more and more crowded, more spectrum-sharing is going to be the new normal**."*
– Frederick Moorefield Jr., Acting Principal Director, DoD CIO's Office, September 24, 2018

*"**Collaboration among all of the stakeholders is excellent.**"*
- FCC Report to Congress, November 2, 2018

Equipment Approvals

FCC Equipment Authorization and WInnForum

- The CBRS Band equipment authorizations are governed by FCC Part 96 rules

- WInnForum has developed technology agnostic tests against the requirements of Part 96

- The FCC has deemed that successful completion of these tests provides sufficient evidence of Part 96 compliance for CBSD to SAS interaction

- The FCC, thereby, provides equipment authorization to CBSDs via TCBs and testing performed by WInnForum authorized laboratories

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OnGo Certification

- CBRS Alliance licenses the WInnForum Test Specification and Test Code to allow CBRS Alliance to facilitate approval of test labs supporting its members to run the WInnForum testing.

- CBRS Alliance has taken the test code and developed a user friendly version of the Test Harness with GUI and extensible architecture

- Test labs approved by the CBRS Alliance will be reported to WInnForum to include on the master list.

- CBRS Alliance will require additional testing beyond what is required in Part 96 to be recognized as OnGo Certified.

What about User Equipment, SASs, etc.?

- Other network entities are not currently part of the OnGo™ Certification Program. These entities are not considered out of scope, but managed by other processes outside of CBRS Alliance

- SAS and ESC Certification is handled directly by the FCC

- UEs are tested for FCC Part 96 compliance and authorized accordingly. There is no OnGo™ Certification <u>currently</u> available for User Equipment

Use Cases

OnGo: a Range of Use Cases

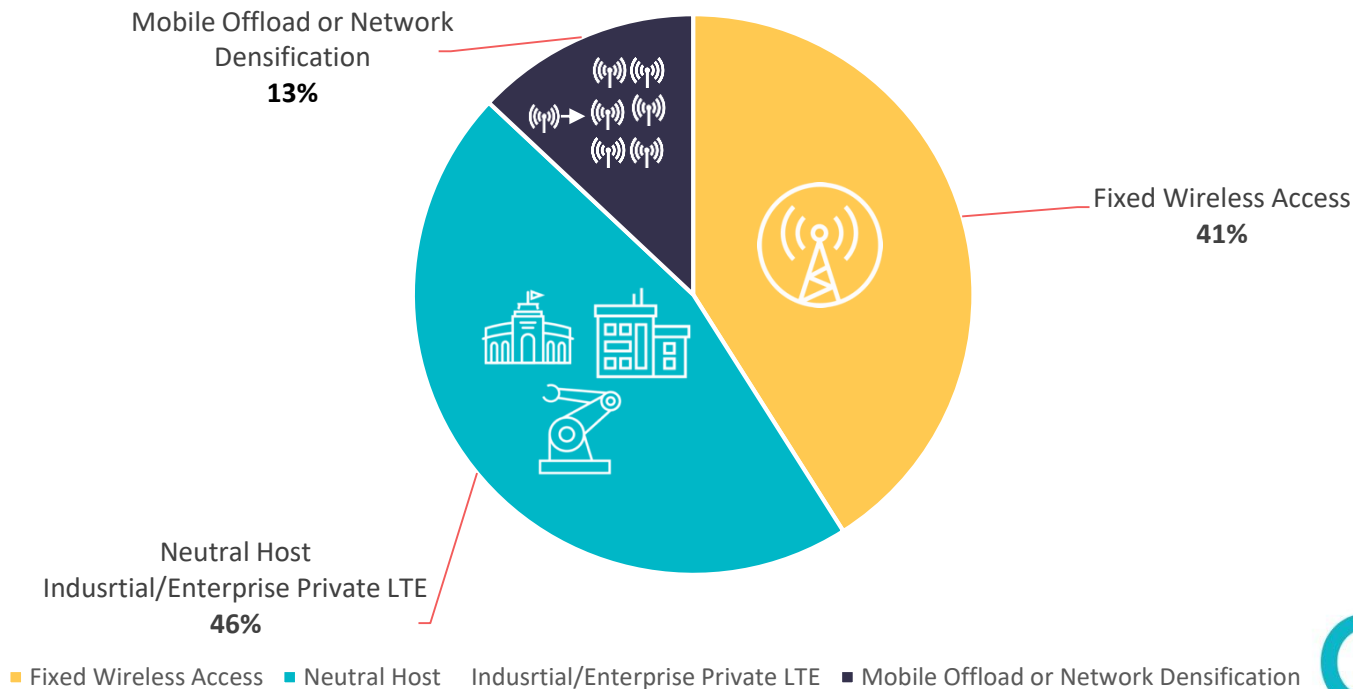| MNO	MSO	Neutral Host/MSP	Enterprise	WISP
• Network Densification • Capacity expansion	• Wireless MVNO Offload • Smart Home	• Cost-effective DAS alternative • Venues, MDUs, Dorms	• Private LTE Networks • Industrial IoT	• Incumbent band users • Rural Broadband
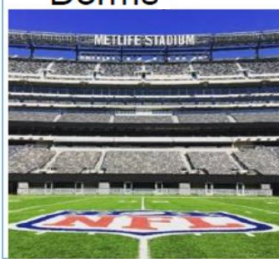
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The Imminent Impact of OnGo

Initial Commercial Deployments **by Use Case***

Mobile Offload or Network
Densification
13%

Fixed Wireless Access
41%

Neutral Host
Indusrtial/Enterprise Private LTE
46%

Fixed Wireless Access Neutral Host Indusrtial/Enterprise Private LTE Mobile Offload or Network Densification

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The Imminent Impact of OnGo

Initial Commercial Deployments **by Vertical Markets**

- Hotels
- Shopping Malls
- Sports Venues

- Offices
- Restaurants
- Rural

- Education
- Energy
- Entertainment

- Seaports
- Smart Cities
- Urban

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Industrial IoT Example – California Ports

Port Rankings by Containers

Global Ranking (2016)		North American Ranking (2017)	
1. Shanghai, China	37.1	1. Los Angeles	9.3
2. Singapore	30.9	2. Long Beach	7.5
3. Shenzhen, China	24.0	3. NY/NJ	6.7
4. Ningbo, China	23.3	4. Savannah	4.0
5. Hong Kong	19.8	5. Tacoma/Seattle	3.7
6. Busan, South Korea	19.4	6. Vancouver	n/a
7. Guangzhou, China	18.9	7. Hampton Roads	2.8
8. Qingdao, China	18.0	8. Manzanillo	2.8
9. Los Angeles & LB	15.6	9. Houston	2.5
10. Dubai, Arab Emirate	14.8	10. Oakland	2.4

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Port Eco-System

ALLIANCE cbrs
Shared spectrum. Expanded opportunities.

Shipping Lines
3 Alliances — 16

Rail Roads
2 Class 1 and PHL — 3

Truckers
Companies — 1,600

Labor
ILWU Members — 14K

Ports Authorities
LA and LGB — 2
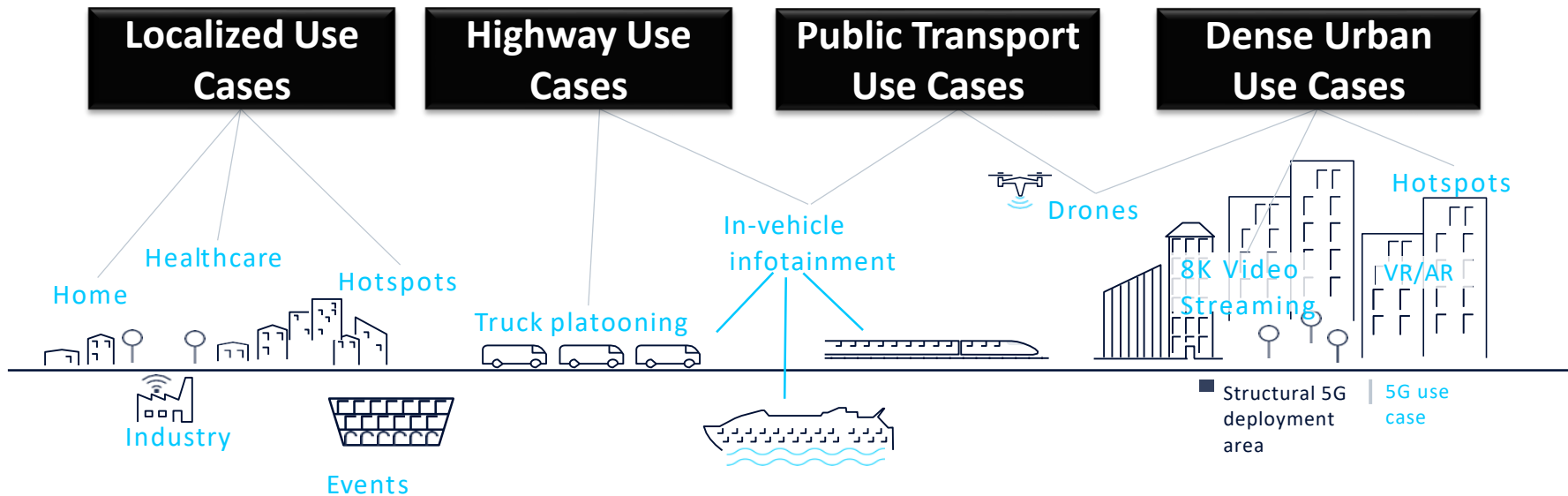
Chassis
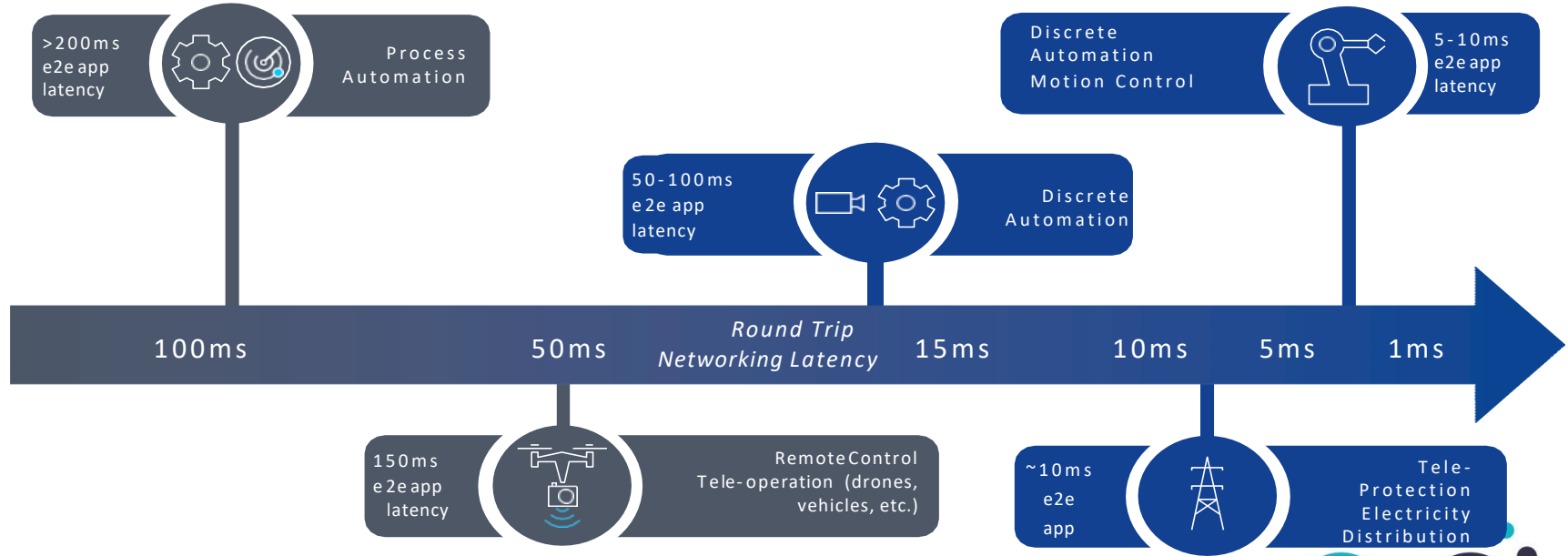Pool of Pools — 3

BCO
240,0000

Terminals
Containers — 13

5G Use Cases (for starters)

Latency Performance Classes for Industrial Automation

2019: Realizing the Vision

- Real Deployments under Part 96 Rules
  - Initial Commercial Services
  - Full Commercial Services
- Ecosystem Readiness
  - Infrastructure and Clients
  - SAS and ESC Certification
- Continued Development
  - CBRS Alliance Release 2 Specs
  - Roadmap to 5G NR

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Learning the Lingo

- ## Use "OnGo"

    - When describing the use of shared spectrum technology. In the 3.5 GHz band: "*OnGo enables connectivity without compromise.*"

    - To describe the Certification Program: "*Radios will be OnGo-Certified.*"

- ## Use "CBRS Alliance"

    - When referencing the organization behind the OnGo brand: "*The CBRS Alliance is exhibiting at Realcomm 2018, where the organization's member companies will demonstrate the latest OnGo-ready technologies.*"

- ## Use "CBRS"

    - To describe the band and/or the FCC ruling: OnGo will enable expanded business opportunities in the CBRS* band.

    - *Suggested use of "3.5 GHz" or "Band 48" as the preferred terminology, whenever possible.*

Thank You!

Additional information and resources (e.g. whitepapers, studies, videos,…) available at: www.cbrsalliance.org