

# Emerging Last Mile Solutions Arising from the FCC's 3.5 GHz “CBRS” Band

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# Overview

- Background on 3.5 GHz band
- A bit of history
- 3.5 GHz sharing regime
- Spectrum assignment and mediation process thru Spectrum Access System (“SAS”) Administrator
- Potential use cases and last mile solutions

# 3.5 GHz CBRS Spectrum Sharing Regime

## Novel spectrum sharing regime

- presenting new unregulated (or “lightly” regulated) last mile solutions

## 3.5 GHz band (3550 MHz-3700 MHz)

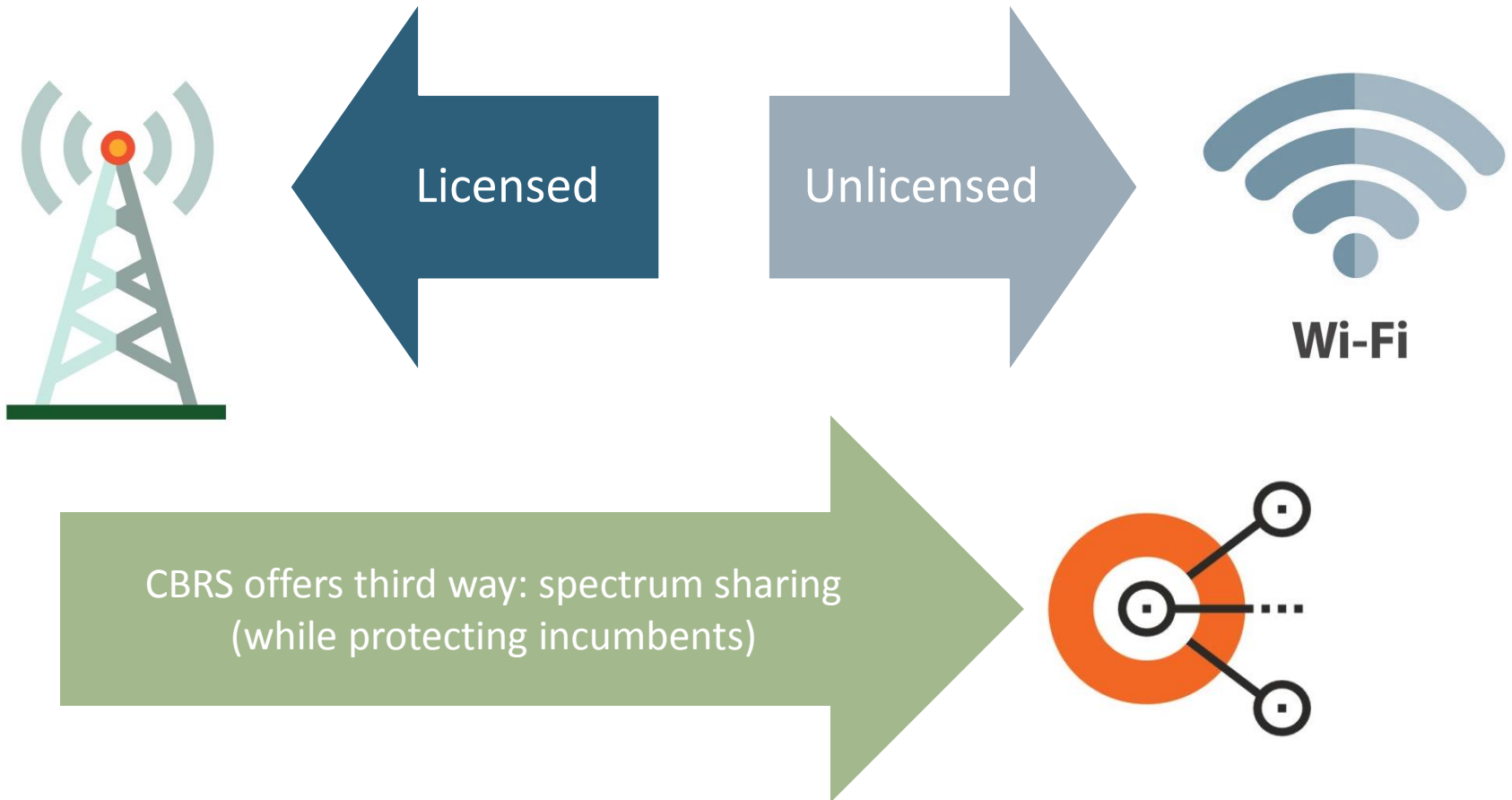
- Citizens Broadband Radio Service (“CBRS”)

## 150 MHz of contiguous spectrum will be available

- Available on shared basis; both licensed and unlicensed (or, more accurately: “license by rule”)
- Assigned via dynamic spectrum allocation

# Novel Policy Tool: Shared Spectrum Access

Spectrum policy options: licensed or unlicensed



# Background: How Did We Get Here?

Spectrum available for commercial use is limited

- Largest spectrum holder today: federal government
- Old way: clearing and reallocation
- New way: sharing regime (that protects incumbent users)



2012 Presidential Commission (PCAST) report

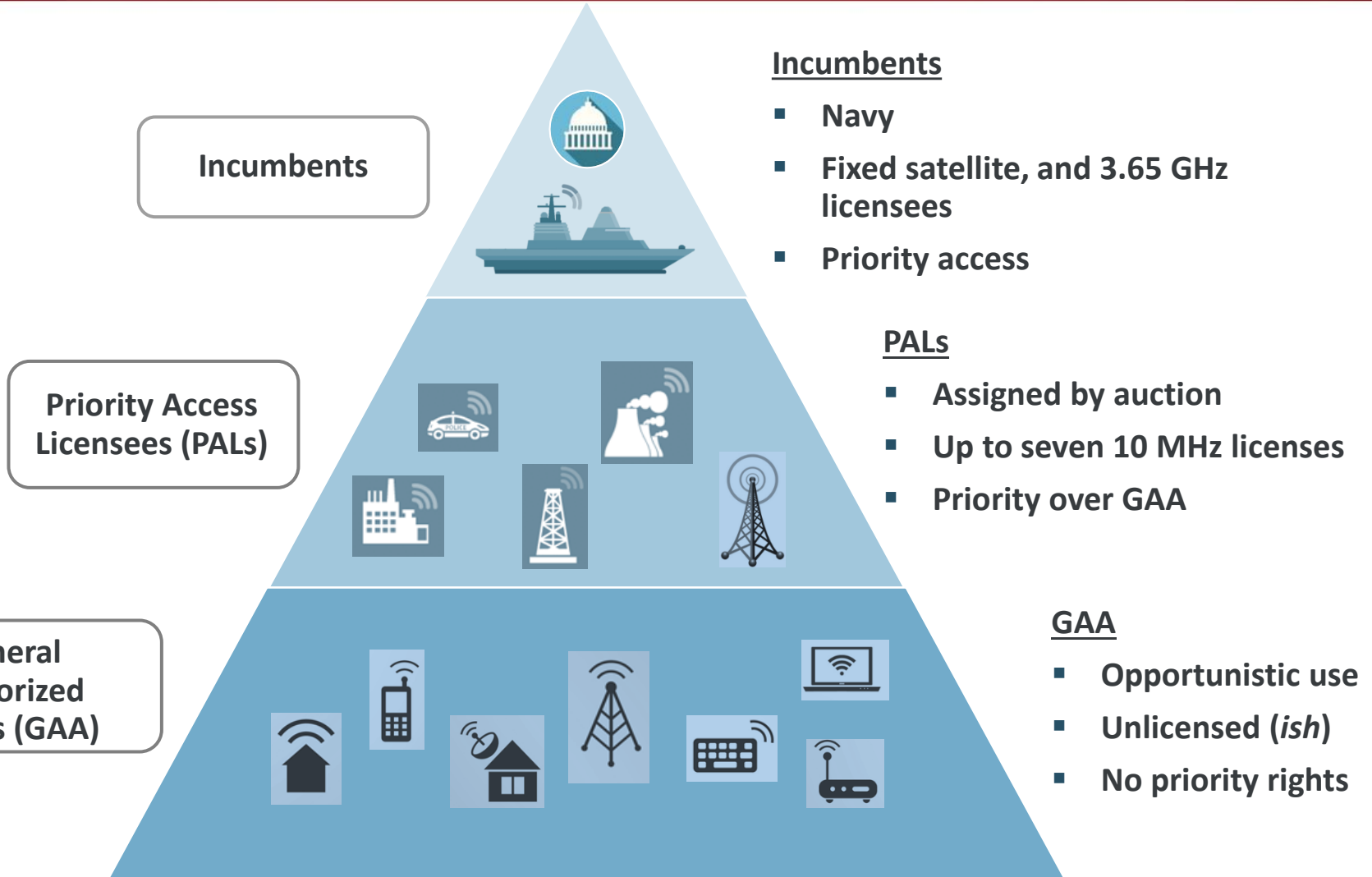
- “clearing and reallocation of Federal spectrum is not a sustainable basis for spectrum policy ...”
- “essential element of this new Federal spectrum architecture is that the norm for spectrum use should be sharing, not exclusivity.”



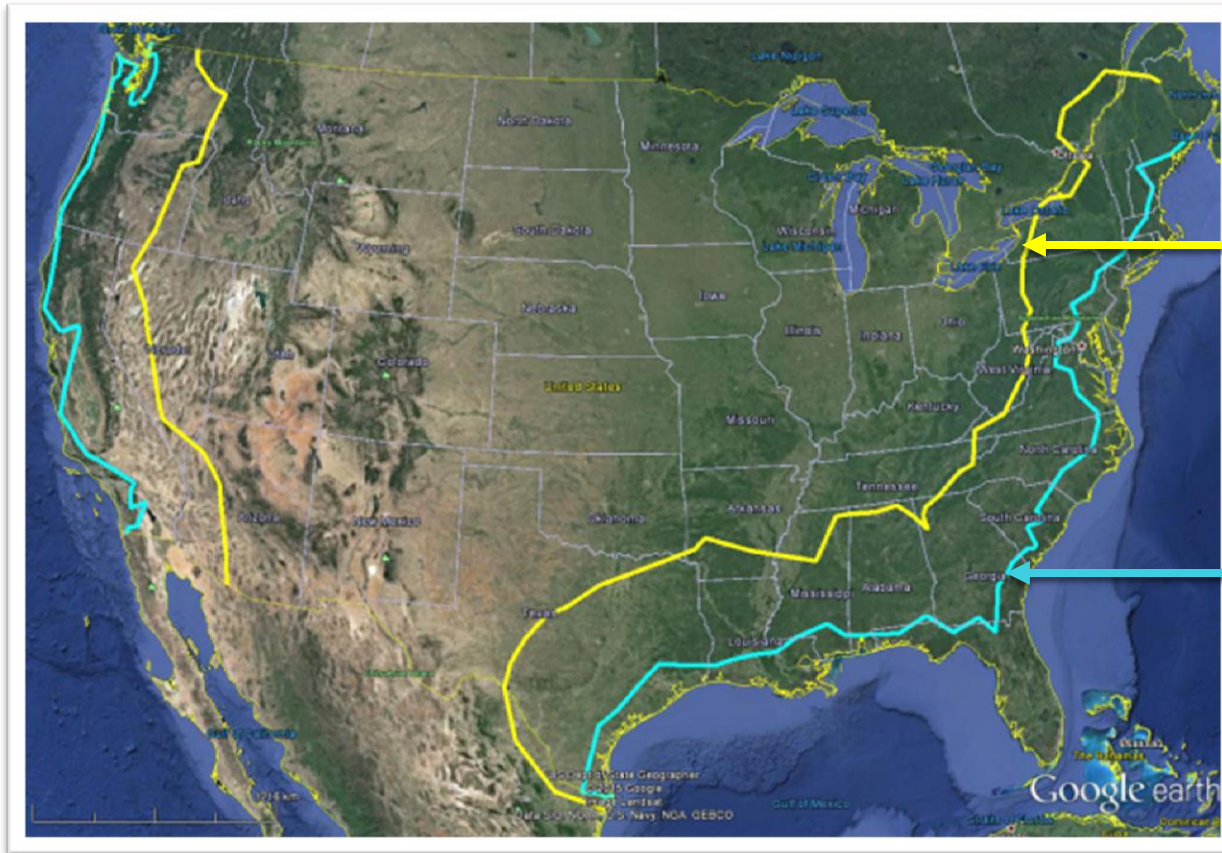
2015 FCC 3.5 GHz CBRN Order

- Adopts PCAST sharing framework
- Uses dynamic spectrum assignment framework to facilitate sharing
- Protects incumbent users (including federal government)
- Access on licensed, and unlicensed basis

# CBRS Sharing Regime: 3-Tiered Access Rights



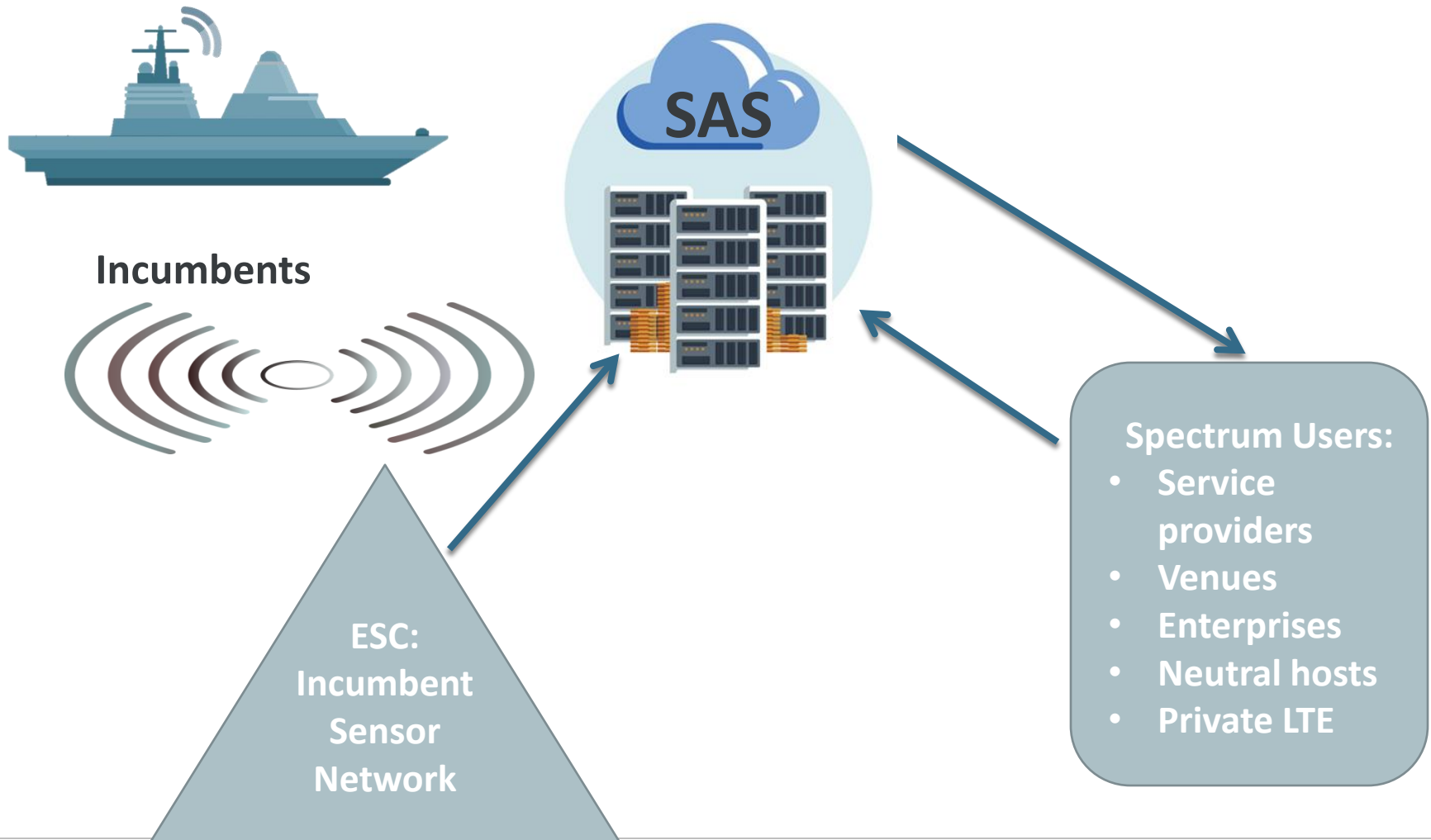
# Exclusion Zones



Proposed  
exclusion zones

Adopted  
exclusion zones

# Spectrum Access System (SAS): coordinating access





# Potential Use Cases

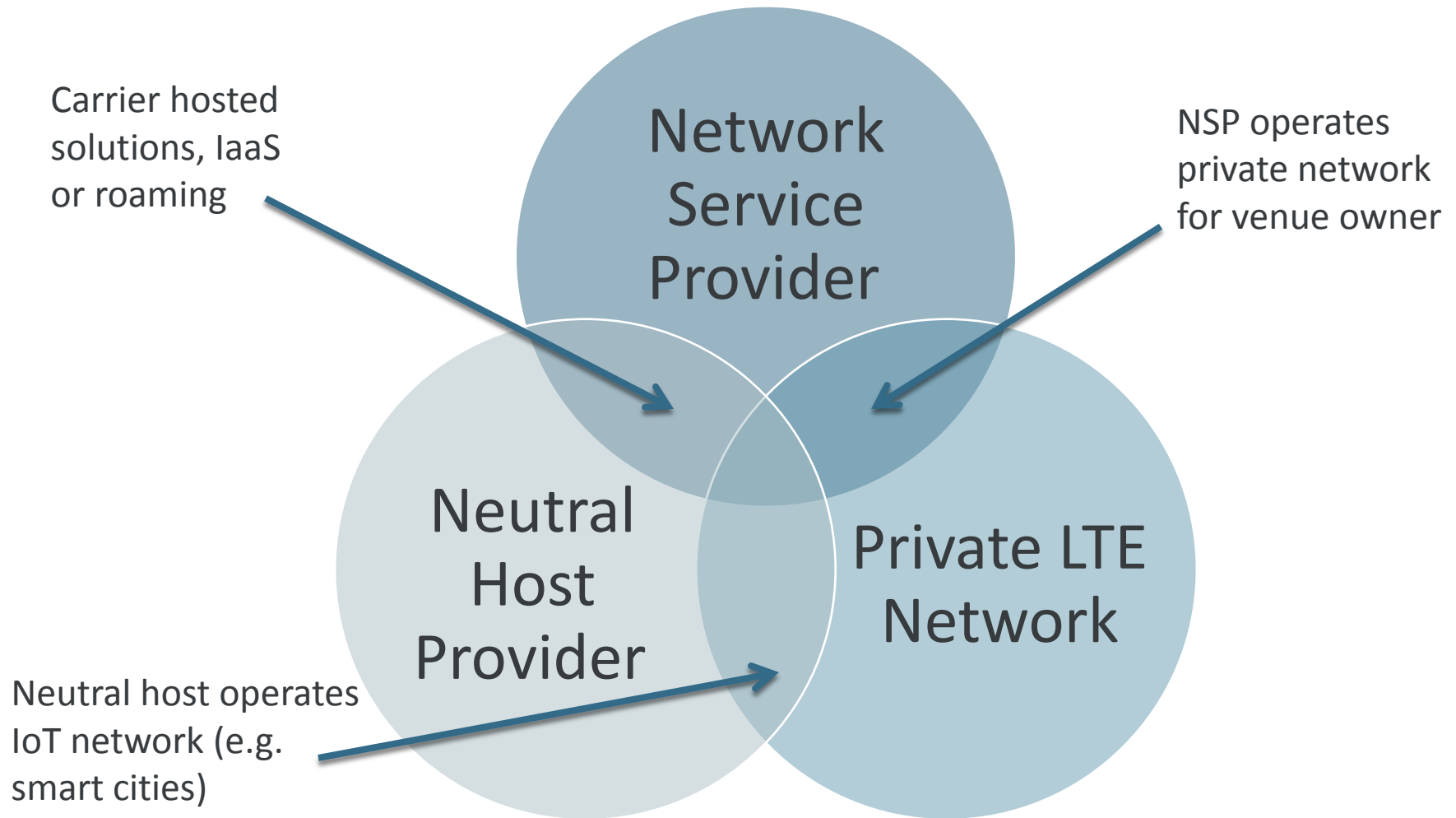
1. **Mobile:** expand small cell capacity for mobile LTE
2. **Fixed wireless:** enhance last-mile & access solutions
3. **Neutral host networks:** hosted services or IaaS
4. **Private LTE networks:** industrial IoT and other applications
5. **Venues/Real Estate:** In-building solutions to meet indoor densification challenges

# Potential Use Cases:

## *CBRS Alliance Companies*

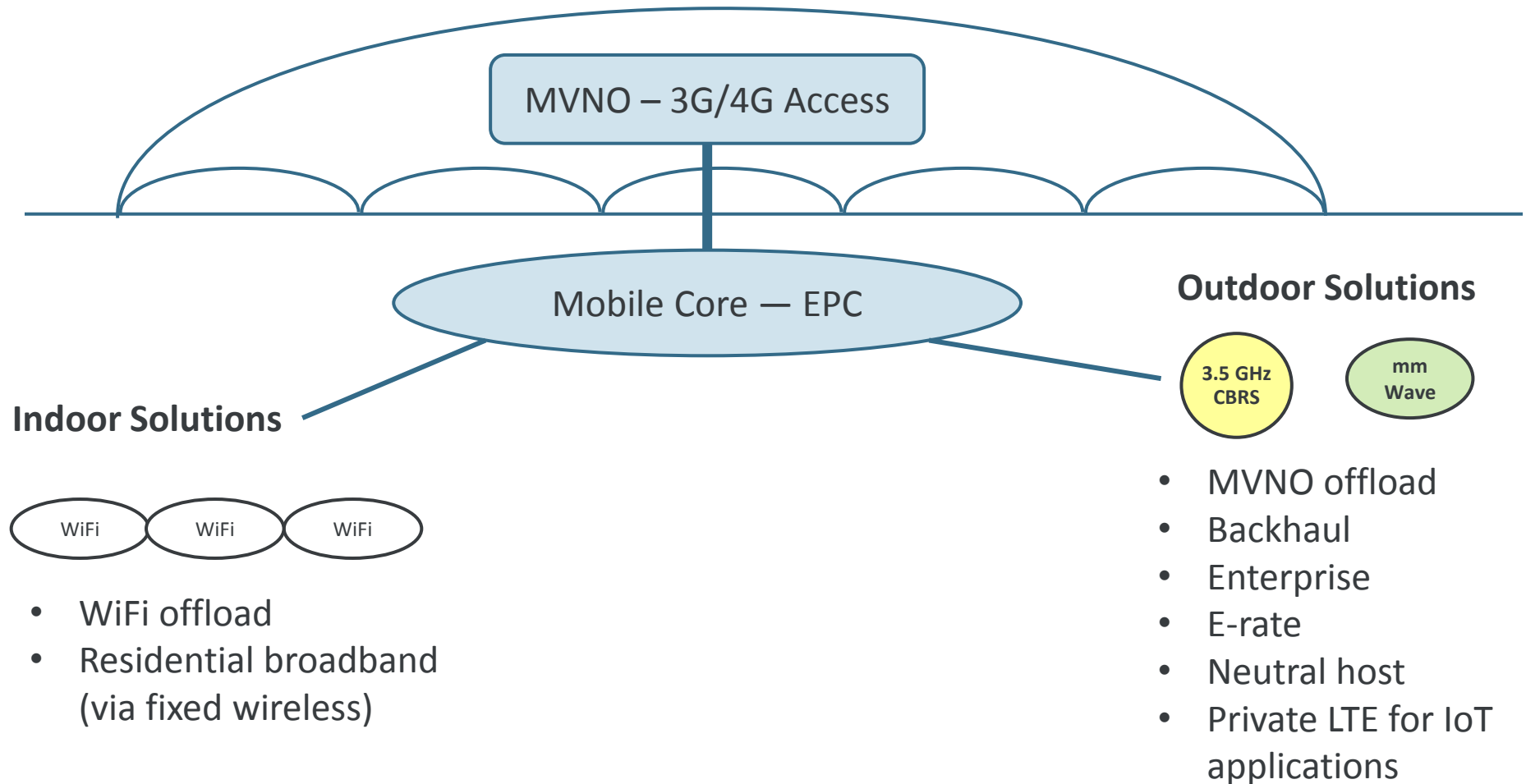
- Airspan Networks
- Alpha Wireless
- American Tower Corporation
- Askey Computer Corp.
- AT&T
- Boingo Wireless
- Cable Television Laboratories, Inc.
- Charter Communications
- Cisco Systems
- Comcast Corporation
- CommScope
- Cox Communications
- Crown Castle
- CTIA
- ExteNet Systems Inc.
- Frontier Communications
- Fujitsu Network Communications
- Huawei Technologies USA
- ip.access Limited
- Ligado Networks
- Mavenir
- Mobilitie
- Motorola Solutions
- Rise Broadband
- Samsung
- Seowonintech Co.
- SerComm USA Inc.
- Sony Corporation
- SpiderCloud Wireless
- Sprint Corporation
- Technicolor Connected Home
- Telrad Networks
- T-Mobile USA
- US Cellular
- Verizon Communications
- Vivint
- ZTE USA, Inc.

# Potential Use Cases: *Hybrid Services & Applications*



# Potential Use Cases:

## *Cable WiFi & MVNO Offload (and more?)*



# Potential Uses Cases:

## *Neutral Host Networks*

- Different potential applications, but common elements

- Provides coverage and capacity to specialized venues and locations
- Single network that can support multiple mobile operators
- Shared backhaul, network management and core network deployments serving multiple network operators or MVNOs



- Potential use cases

- IaaS - Infrastructure as a Service
- Capacity solution - for venues (stadiums, hotels, conference centers and airports)
- Hosted services; wholesale access / roaming



# Potential Use Cases:

## *Private LTE Network for IoT and Industrial IoT*

**General Electric Global Research division** located at 1 Research Circle, Niskayuna, NY requests Special Temporary Authority (STA) to **operate a 2-way Citizens Broadband Radio Service (CBRS) in accordance with CFR Part 96**. Only 3.55GHz to 3.60 GHz of band 48 will be utilized during the experiment. All requirements of Part 96 will be satisfied with one exception. An exception to Part 96.39(h) is requested to **permit the mobile unit to be airborne within 1,500-foot radius of the test location area (fixed base station) specified at a maximum altitude of 250 feet above ground level**. All operations will be conducted within 100 feet of the General Electric property line specified by New York State, County of Schenectady tax map ID 40.1-45.3.

The experiment will **evaluate communications performance of CBRS under various flight conditions and topology locations**. Although not currently permitted it is expected that **future airborne CBRS operations within restricted corridors (private commercial property) will be permitted for rural industrial applications** without causing interference of other nearby users.

# Potential Use Cases:

## *Recent Demos at MWC Americas*

Segment	Deployed By	GAA or PAL	Demo Configuration	Partners	Demo Description
<b>Enterprise</b>	Nokia, Qualcomm, Alphabet	GAA	In-Race-Car Experience	Nokia, Qualcomm, Alphabet	Multi-Frame config, MEC, 360 Video, Chipset
<b>Industrial IoT</b>	Qualcomm, Nokia, GE	Either		Qualcomm, Nokia, GE	MWC demo of a private LTE network for Industrial IoT using CBRS
<b>All</b>	Federated Wireless	All	Spectrum Controller working with multiple ecosystem partner radios and with Alphabet Access SAS	Ericsson, Nokia, Ruckus, SpiderCloud, Alphabet Access	Demo Spectrum Controller (SAS + ESC) role in CBRS deployment
<b>MSP, Enterprise</b>	Ruckus Wireless	Either	20 + 20 MHz		<ul style="list-style-type: none"> <li>Announce OpenG indoor and outdoor CBRS small cells for MSPs and Enterprises</li> <li>Enterprise Self-serve CBRS small cell deployment with Ruckus Cloud</li> <li>In-building coverage with the CBRS Alliance neutral host architecture</li> <li>Ruckus LTE ChannelFly(TM) and N&gt;1 in an indoor mobile environment</li> <li>Video performance comparison between outside-in cellular, unlicensed WiFi and CBRS</li> </ul>
<b>Enterprise, Operator</b>	Accelleran	Either	20MHz	Cavium, Eureka, Quortus, Attocore, AirHop	Live demonstration of E1000 small form-factor outdoor cell in CBRS, 842 and 843
<b>Residential, Enterprise</b>	Sercomm	Either	10/20 MHz.	Sercomm, Federated Wireless, Alphabet Access	Indoor CBRS Small Cell

# Potential Use Cases:

## *NASCAR and Expanding VR/AR Applications*





# Next Steps?

- Resolve open issues surrounding license size and term
- Operationalize SAS and environmental sensors
  - end of 2017
  - spectrum available (on GAA basis) in 2018
- Finalize auction rules and PAL issues
  - PAL auction in 2018?
- Finalize business models and operationalize new last mile solutions



# 3.5 GHz Spectrum Sharing

Thank you!



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