

Wireless Innovation Forum Webinar Series

Webinar #16: Understanding the New U.S. 3.5
GHz Band

17 June 2015

Administrivia

Slides presented during this webinar will be posted here:

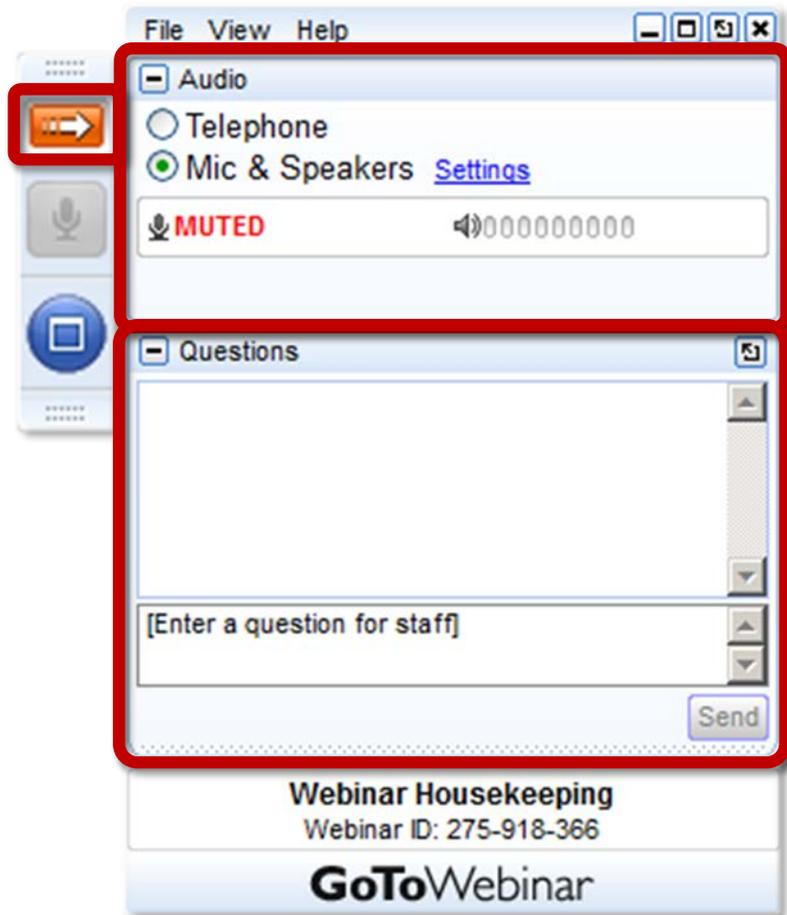
- <http://www.wirelessinnovation.org/webinars>

Email Lee.Pucker@wirelessinnovation.org if you need more information

Acronyms and Definitions from the R&O:

- <http://groups.winnforum.org/page/fcc-definitions>

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Note: Today's presentation is being recorded and will be provided within 48 hours.

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Today's Agenda

Introduction

- Presented by Lee Pucker (WInnForum)

Rules overview

- Presented by Andy Clegg (Google)

Draft Notional Architecture

- Presented by Al Jette (Nokia)

WG1 Overview

- Presented by Andy Clegg (Google)

WG2 Overview

- Presented Charles Clancy (Federated Wireless)

WG3 Overview

- Presented by Jesse Caulfield (Keybridge Global)

WG4 Overview

- Presented by James Neel (Federated Wireless)

Panel Discussion/Audience Questions

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Wireless Innovation Forum Spectrum Sharing Committee Overview

Slide #5

History

July 2013: Multi-stakeholder Group originally proposed in Wireless Innovation Forum's Comments to the FCC regarding the Public Notice on the TAC White Paper and Recommendations for Improving Receiver Performance

December 2013: Group further elaborated in the Forum Comments to the FCC regarding Licensing Models and Technical Requirements in the 3550-3650 Band

June 2014: Formation of the group identified in the Forum's FY2015 Operations Plan

July 2014: Additional Elaboration provided in the Forum's comments to the FCC regarding the Further Notice of Proposed Rulemaking in the Matter of Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band

October 2014: Initial Formation Meeting held in Washington DC

December 2014: Second formation meeting held in Washington DC

January 2015: Final formation meeting held in McLean, VA

Spectrum Sharing Committee Charter

- Draft proposal circulated to participants on January 21, 2015
- Approved by prospective Committee Members at the 27 January Meeting
- Approved by the Wireless Innovation Forum Board of Directors on 10 February 2014

*Charter can be found at
<http://groups.winnforum.org/page/spectrum-sharing-committee>*

Spectrum Sharing Committee: Scope

- **Serve as a common industry and government standards body to support the development and advancement of spectrum sharing technologies**
- **Initial focus on 3.55 GHz, with aims to advance this technology for all applicable spectrum bands that can benefit from it.**
- **This Committee is intended to facilitate the interpretation and implementation of FCC rulemaking to a level that allows industry and government parties to collaborate on implementation of a common efficient, well functioning ecosystem around this technology.**

Spectrum Sharing Committee: Scope

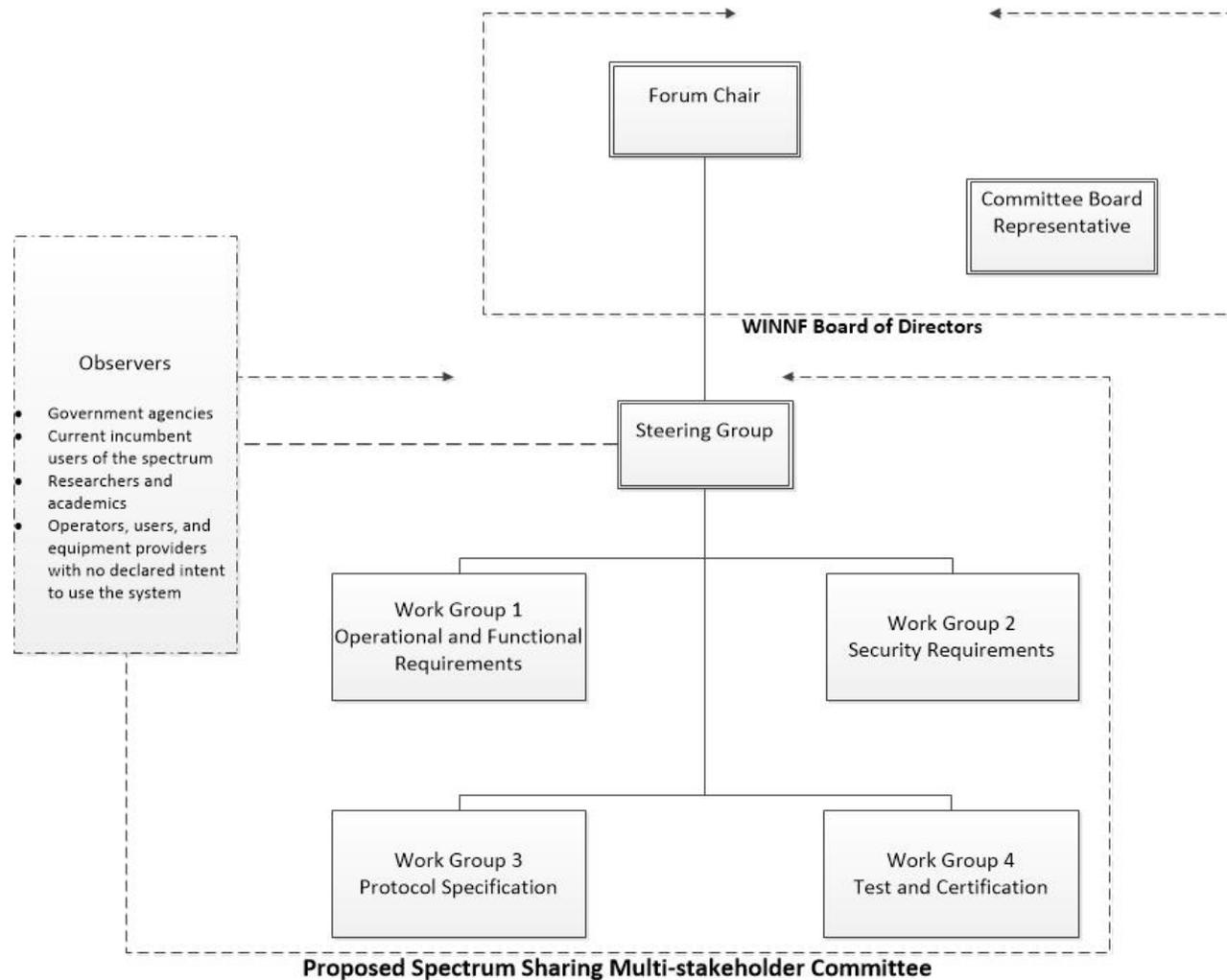
The main activities that will be conducted in the Committee include:

- Detailing common industry and government functionality and architecture for Spectrum Access Systems (SAS), sensors, and devices
- Interoperability requirements and protocol definition to allow for open competitive and well functioning systems
- Common framework for testing and integration of components of spectrum sharing technologies to allow for rapid certification and deployment and predictability, thus expanding the ecosystem and increasing utility of the spectrum
- Details of requirements, processes, and methods for protection of incumbent users as required by the spectrum rules
- Operational procedures definition for the well functioning of the system as it pertains to spectrum assignment, managements and interoperability

Spectrum Sharing Committee: Scope

- **Emphasis on system interoperability and on achieving simplicity in interfaces and requirements, to advance innovation, competition, and time to market.**
- **The Committee is a standards and technical implementation forum for industry and government users and developers of the technology and spectrum.**
- **The Committee is not a policy-making, government certification or liability management body. The committee may, from time to time, make formal technical recommendations to the FCC or other regulatory bodies, to further standards development.**
- **All activities, recommendations, etc. will follow the Forum's standard policies and procedures**

Committee Structure



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Participation to Date – 115 People, 40+ Organizations

Members

- Alcatel-Lucent Bell Labs*
- AT&T*
- Comsearch*
- Communications Research Centre, Canada
- Federated Wireless*
- Google*
- Harris Corporation
- Huawei
- Idaho National Labs
- Intel
- INTELSAT
- Keybridge Global*
- Lockheed Martin
- MITRE
- Motorola Solutions*
- Nokia Networks*
- Pathfinder Wireless*
- Rockwell Collins
- Shared Spectrum Company
- Spectrum Bridge
- T-Mobile*
- Verizon*
- Virginia Tech
- Vistology

** Denotes Steering Group Member*

Observers

- IEEE DySPAN-SC
- DMI for US DoD
- Kingfisher Systems for US DoD
- Roberson and Associates for US DoD
- US DISA DSO
- US DoD/CIO
- US Navy
- US NIST
- US NSWC
- US NTIA
- Utilities Telecom Council
- WiMAX Forum

Rules Overview

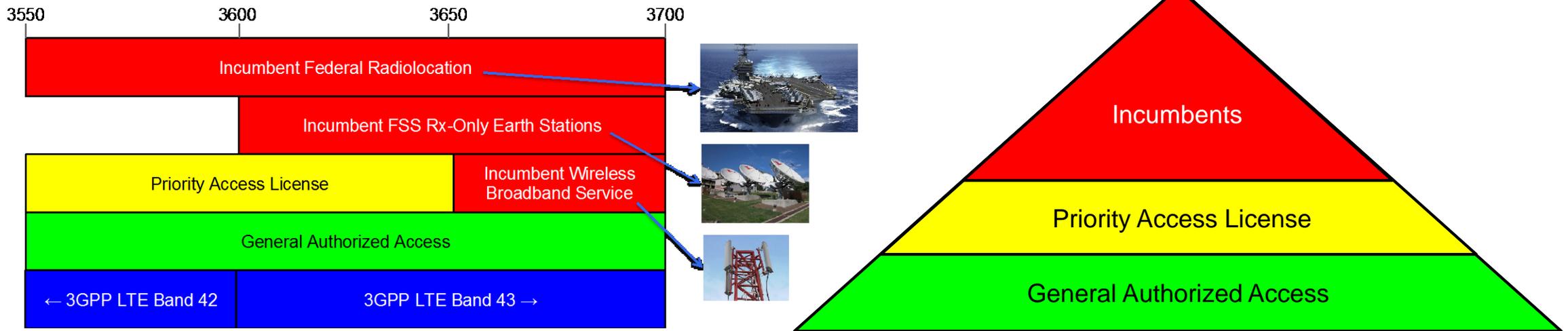
Andrew Clegg

Google

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General

- April 2015: FCC adopts three-tiered spectrum sharing architecture as proposed in the 2012 Report of the President's Council of Advisors on Science and Technology (PCAST Report)
- Utilizes "fast-track" band (3550-3700 MHz) identified by PCAST and the National Telecommunications and Information Administration (NTIA, the regulator of U.S. federal government spectrum use)
- Rules are optimized for small-cell use, but also accommodate point-to-point and point-to-multipoint, especially in rural areas



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Three-Tier Architecture

- **Tier 1: Incumbents**
- **Tier 2: Priority Access Licenses**
- **Tier 3: General Authorized Access**
- **Tiers 2 & 3 are regulated under a new *Citizens Broadband Radio Service (CBRS)***
- ***Citizens Broadband Radio Service Devices (CBSDs)* are the fixed base stations/access points operating under this new service**
- **CBSDs can only operate under the authority and management of a centralized *Spectrum Access System***
 - SAS manages interference to incumbents by Tiers 2 and 3, interference among Tier 2 devices, and interference from Tier 3 into Tier 2

Incumbents



- **Military ship-borne radar**

- Operate in 3550-3650 MHz in coastal areas
- Only 17 ships with current-generation radar in the world; about 75% of this total are homeported in Norfolk, VA, San Diego, CA, and Seattle, WA



- **Military ground-based radar**

- Occasional in-band operations in 3650-3700 MHz at three sites: St. Inigoes, MD, Pensacola, FL, and Pascagoula, MS
- Below 3500 MHz radar operations at isolated military bases spread around U.S.



- **Fixed-satellite service earth stations (receive-only)**

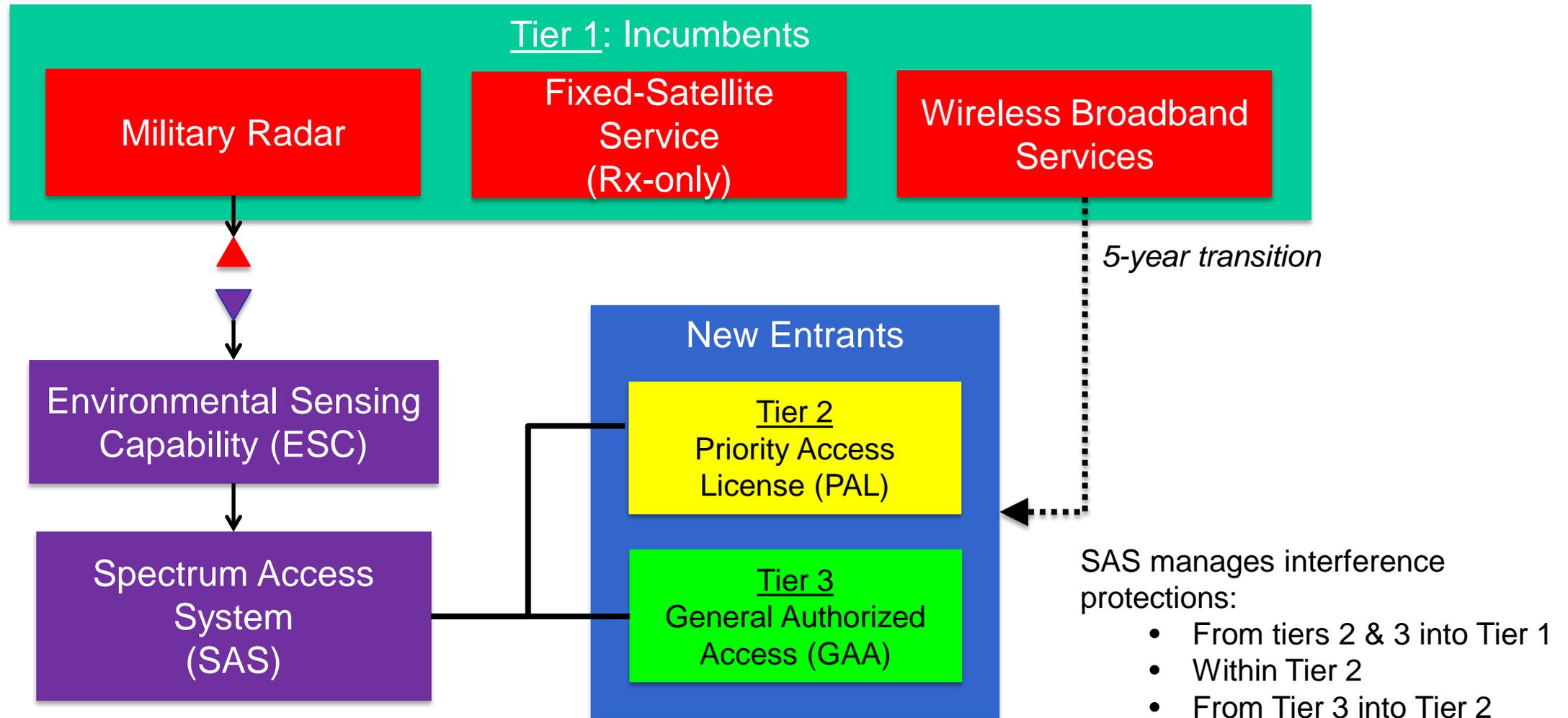
- In-band: 35 sites around the U.S.; mostly coastal sites, limited to intercontinental international satellites
- Adjacent band (3700-4200 MHz): Thousands of sites around U.S.
- Protection criteria TBD (strict OOB limits adopted to help protect adjacent band)



- **Wireless Broadband Services (3650-3700 MHz)**

- Many thousands around the country
- These stations will be transitioned to Tier 2 or 3 operation after 5 years

High-Level Schematic



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Priority Access License (PAL)

- **Licensed by auction for three-year term**
- **License areas are census tracts**
 - ~74,000 census tracts in U.S., each with ~4,000 pops
- **One PAL = 10 MHz channel in one census tract**
- **Each census tract will have a maximum of seven and a minimum of 0 PALs**
- **PALs will be within 3550-3650 MHz**
- **Example use cases**
 - Capacity/offload networks for established wireless service providers
 - QoS-managed enterprise networks
 - Utility networks
 - Backhaul
 - Wireless Broadband Service (after 5-year sunset on Part 90 3650-3700 MHz operations)

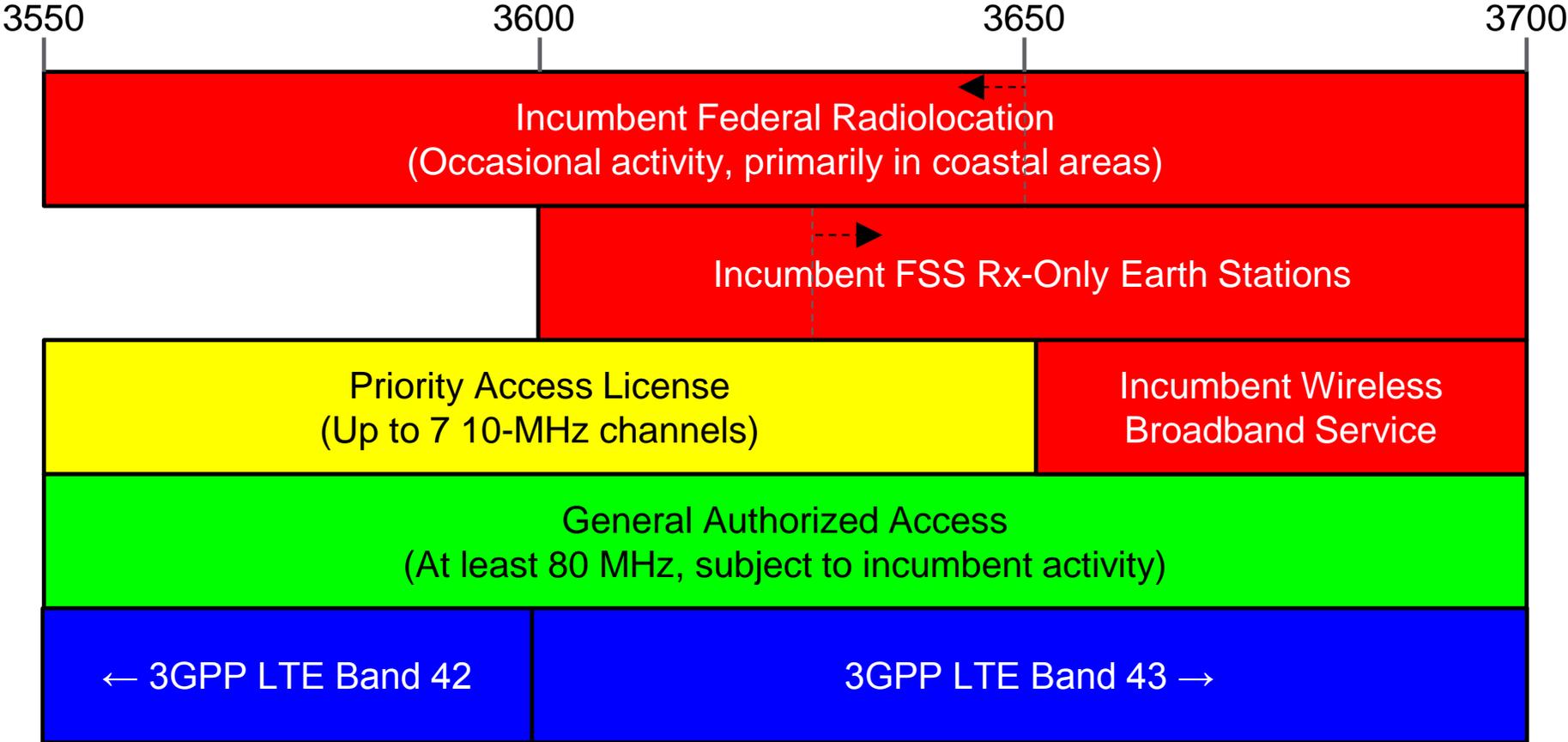
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General Authorized Access (GAA)

- **No interference protections; must protect incumbents and PALs**
- **No *a priori* bandwidth limit or license area**
- **May utilize unused PAL spectrum (“unused” to be defined)**
- **Minimum of 80 and maximum of 150 MHz of GAA spectrum in each area, subject to incumbent activity**
- **GAA can utilize any frequency in 3550-3700 MHz**
- **Licensed by rule**
- **Example use cases**
 - Personal & small business hot spots
 - Campus hot spots
 - PAL offload during periods of incumbent activity interrupting PAL spectrum
 - Unprotected capacity/offload for established wireless providers
 - Wireless Broadband Services
 - Backhaul

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Band Overview



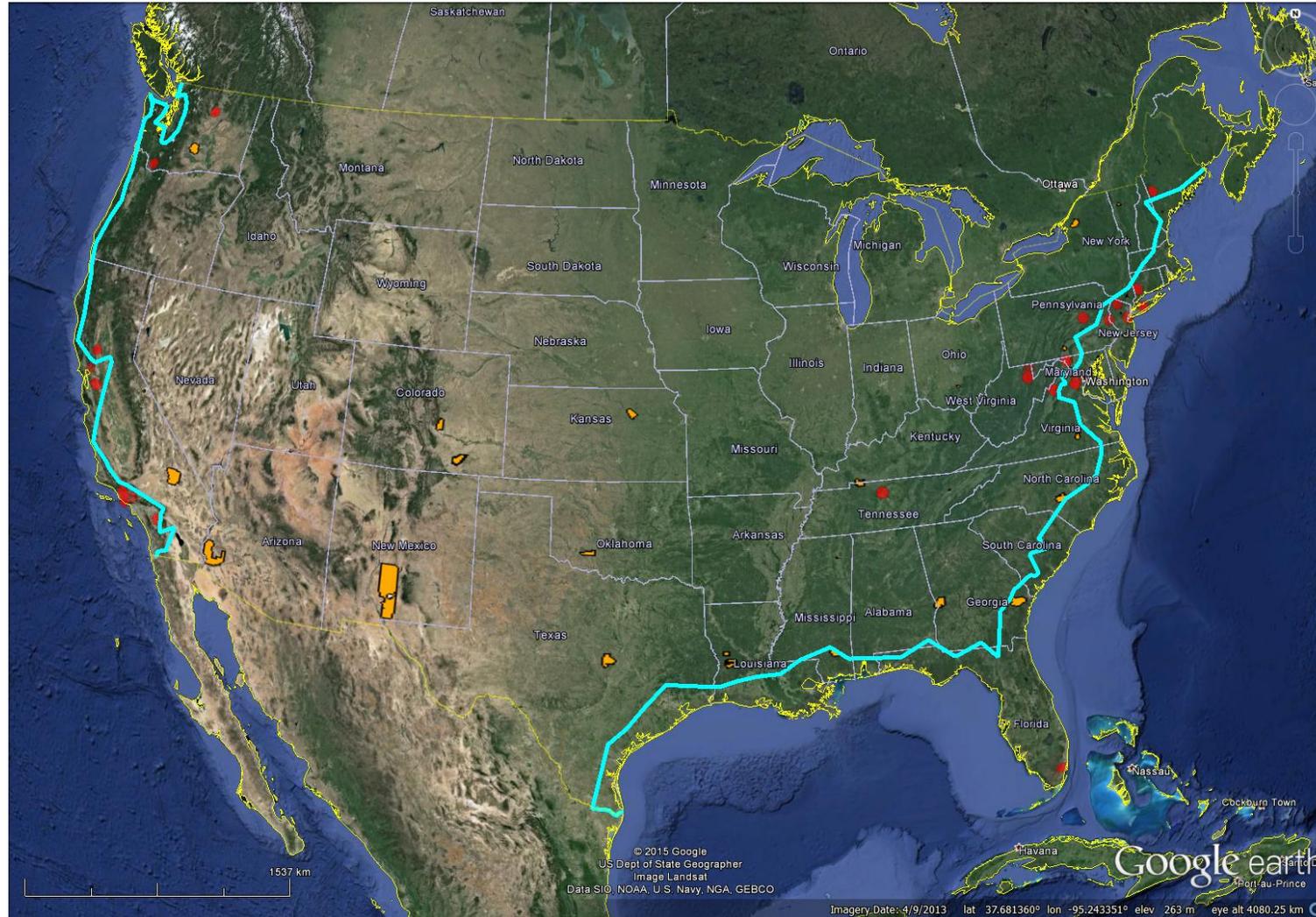
Devices

- **Category A CBSD**
 - Access points, femtocells, etc.
 - Indoor; outdoor with HAAT limited to 6 m
 - Lower antenna gain/EIRP allowed compared to Cat B
 - 30 dBm max EIRP
- **Category B CBSD**
 - ~Point-to-point/multipoint rules
 - Professionally installed
 - Outdoor only
 - 40 dBm max EIRP non-rural; 47 dBm max EIRP rural
- **End User Devices**
 - 23 dBm max EIRP
 - No peer-to-peer
- **All CBSDs/EUDs must be capable of two-way communications on any authorized frequency**
- **CBSD location requirements**
 - ± 50 m horizontal by ± 3 m vertical
 - Report to SAS within 60 s if moved

ESCs

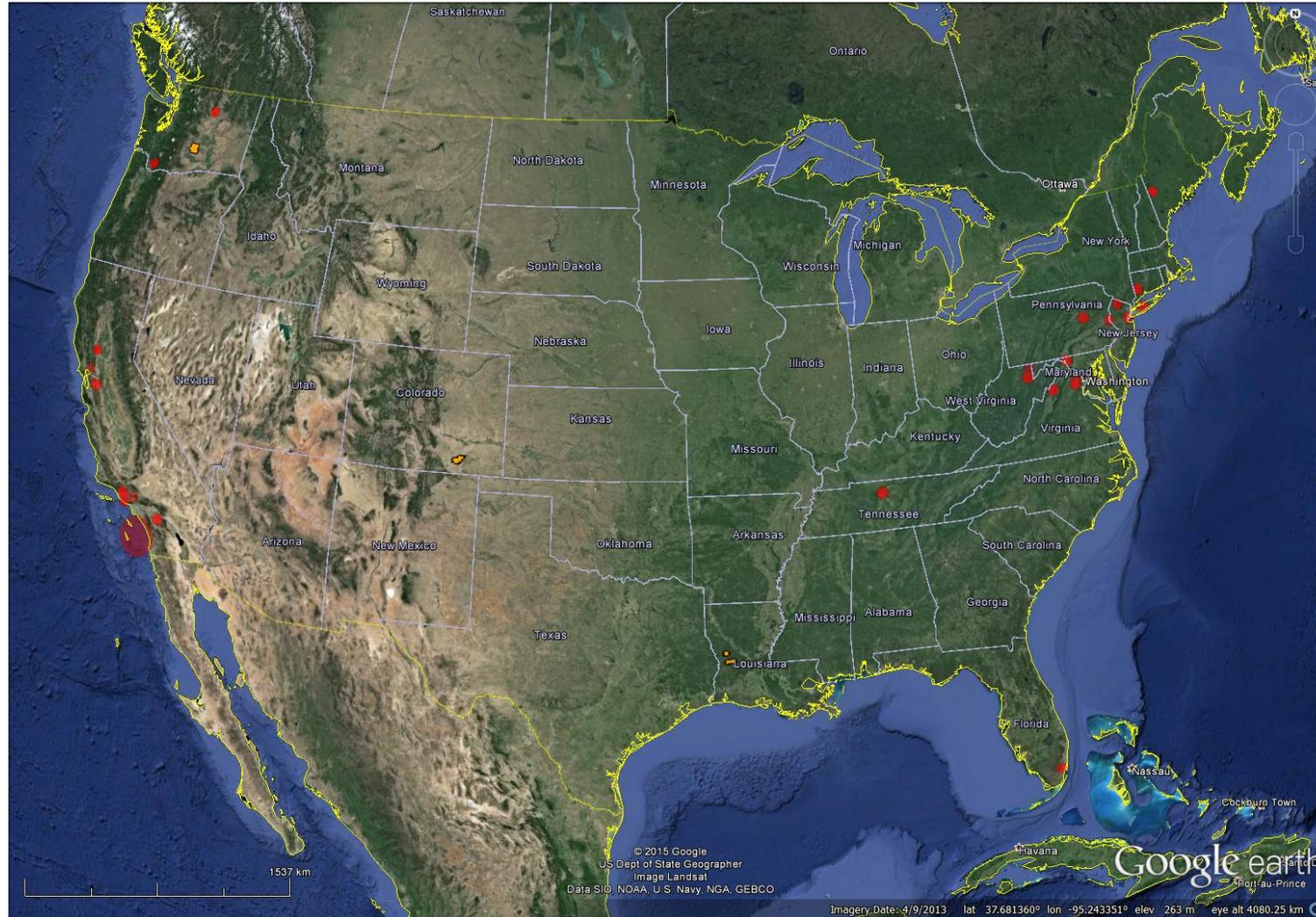
- **Environmental Sensing Capability (ESCs) must monitor for incumbent radar activity in coastal areas and near inland military bases**
- **When incumbent activity is detected, and ESC communicates that information to a SAS**
- **The SAS or SASs will reconfigure local devices within 60 s to avoid interfering with incumbent radars**
 - Current incumbent radar will impact at most two channels in one area
 - Area of impact is TBD, but will be ~tens of km in radius
- **There are only ~20 total radars around the world, and each operates infrequently**

Exclusion Zones: Initial/Worst Case 3550-3650 MHz



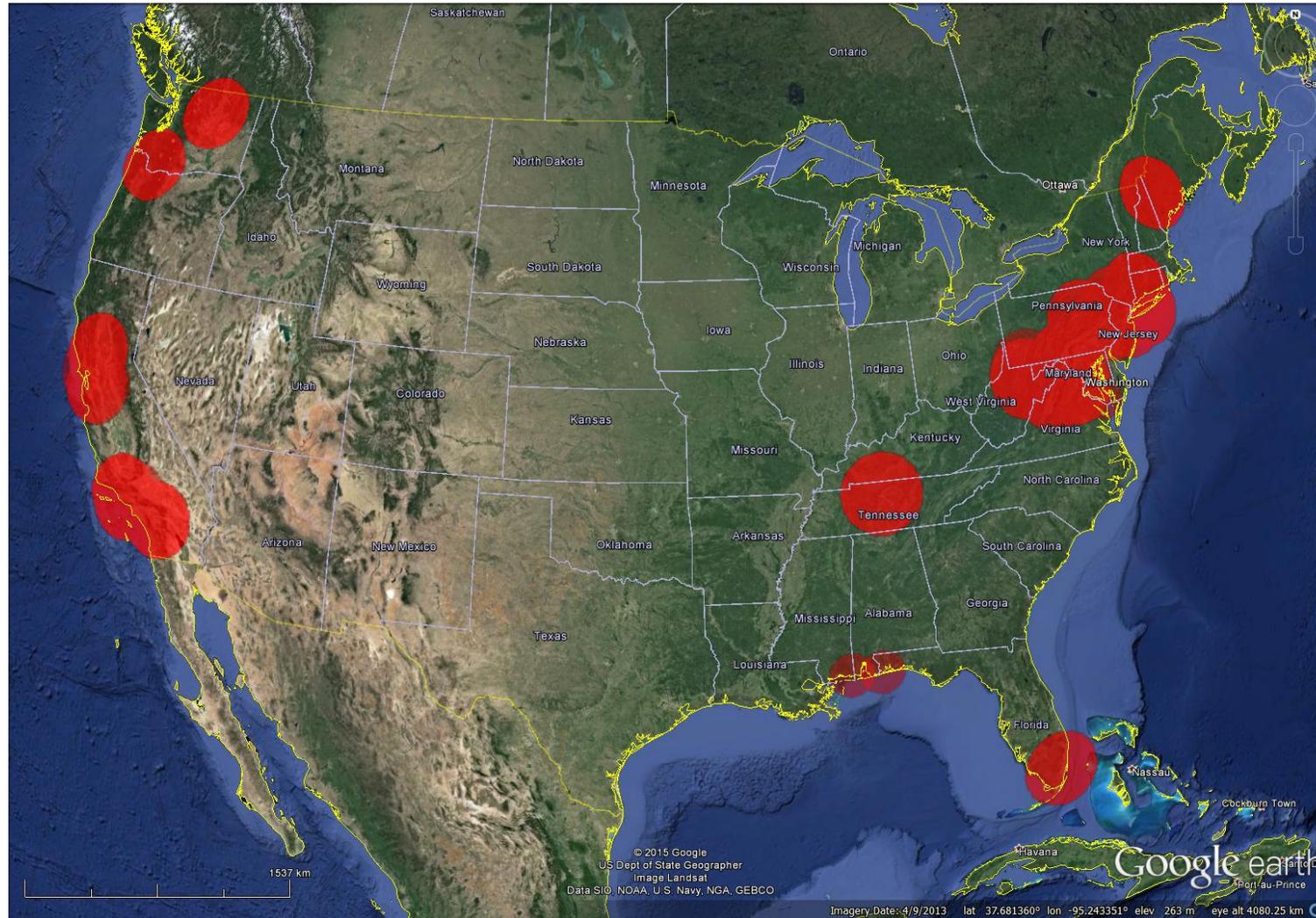
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Exclusion/Protection Zones: Typical 3550-3650 MHz



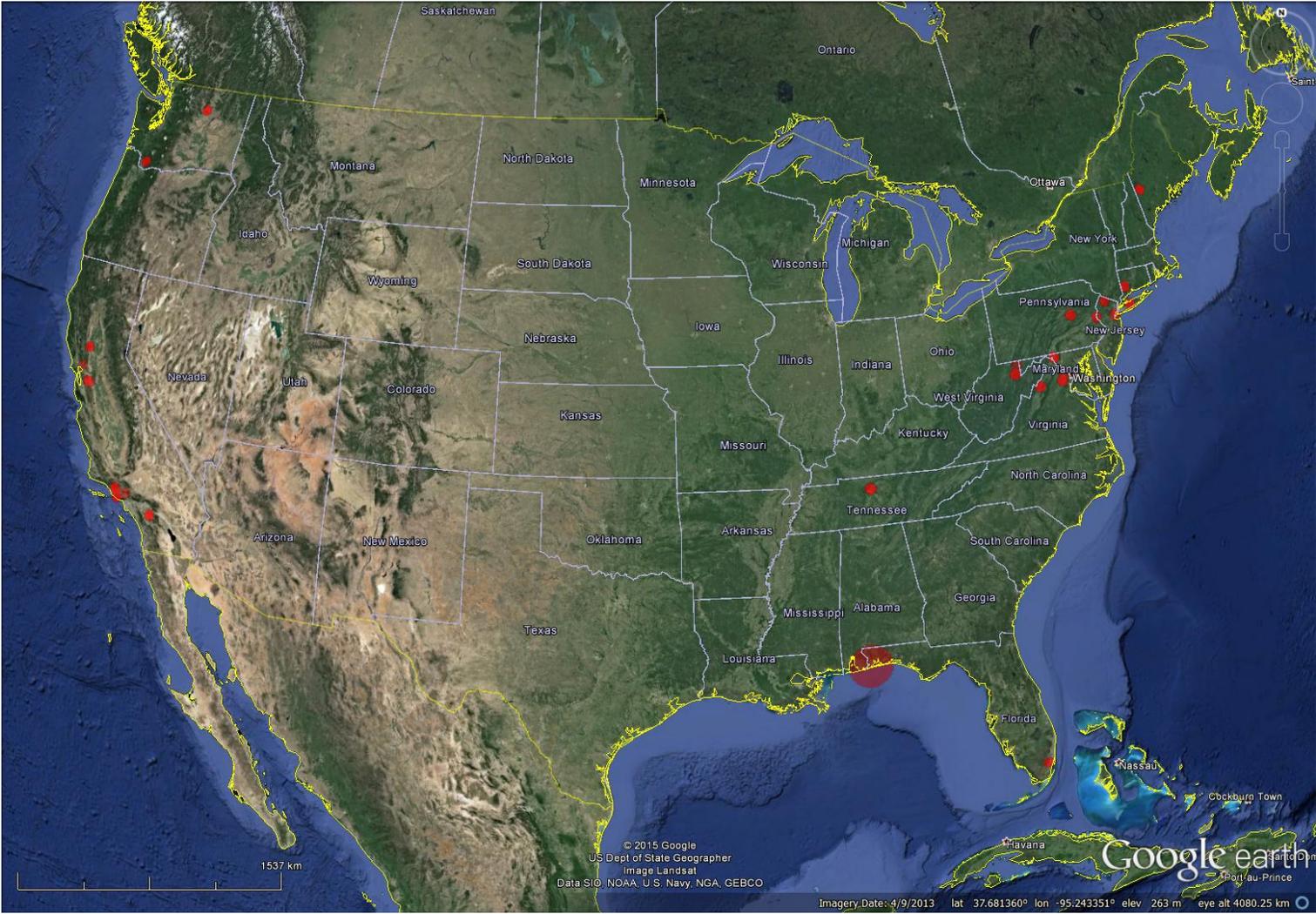
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Excl/Coord Zones: Initial/Worst-Case 3650-3700 MHz



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Protection/Coord Zones: Typical 3650-3700 MHz



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Summary

- **FCC has adopted rules to implement the first three-tier spectrum sharing architecture in the world**
- **Will allow access to up to 150 MHz of licensed spectrum for small-cell, point-to-point, and point-to-multipoint access**
- **Management of interference protections will be accomplished through one or more centralized Spectrum Access Systems**
- **Rules just adopted, ecosystem will develop over the coming months**
- **Many implementation details are to be worked out. FCC has called upon a multistakeholder group (the WinnForum Spectrum Sharing Committee) to develop industry-consensus procedures and standards**

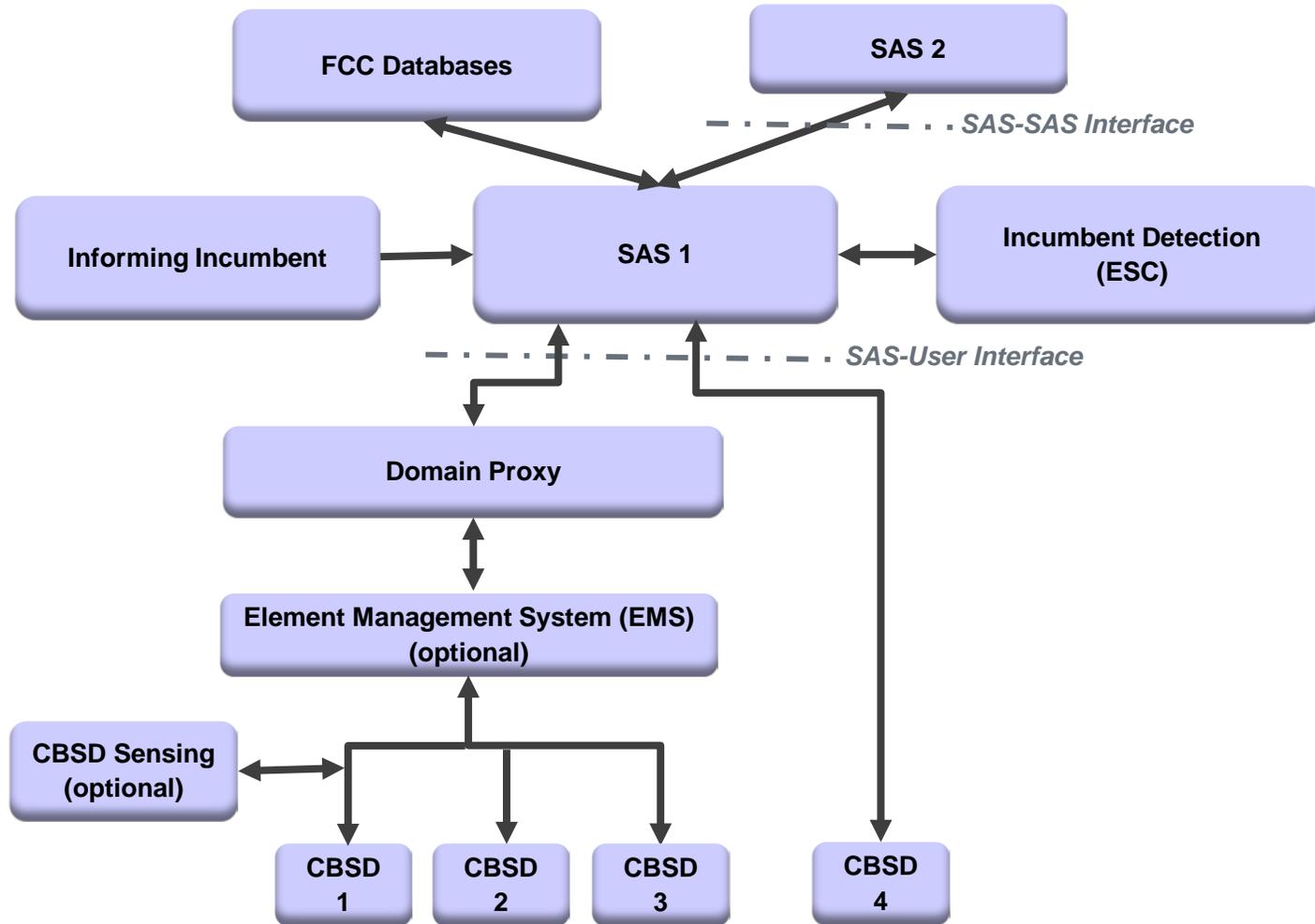
WINNFORUM FUNCTIONAL ARCHITECTURE

Al Jette

Nokia Networks

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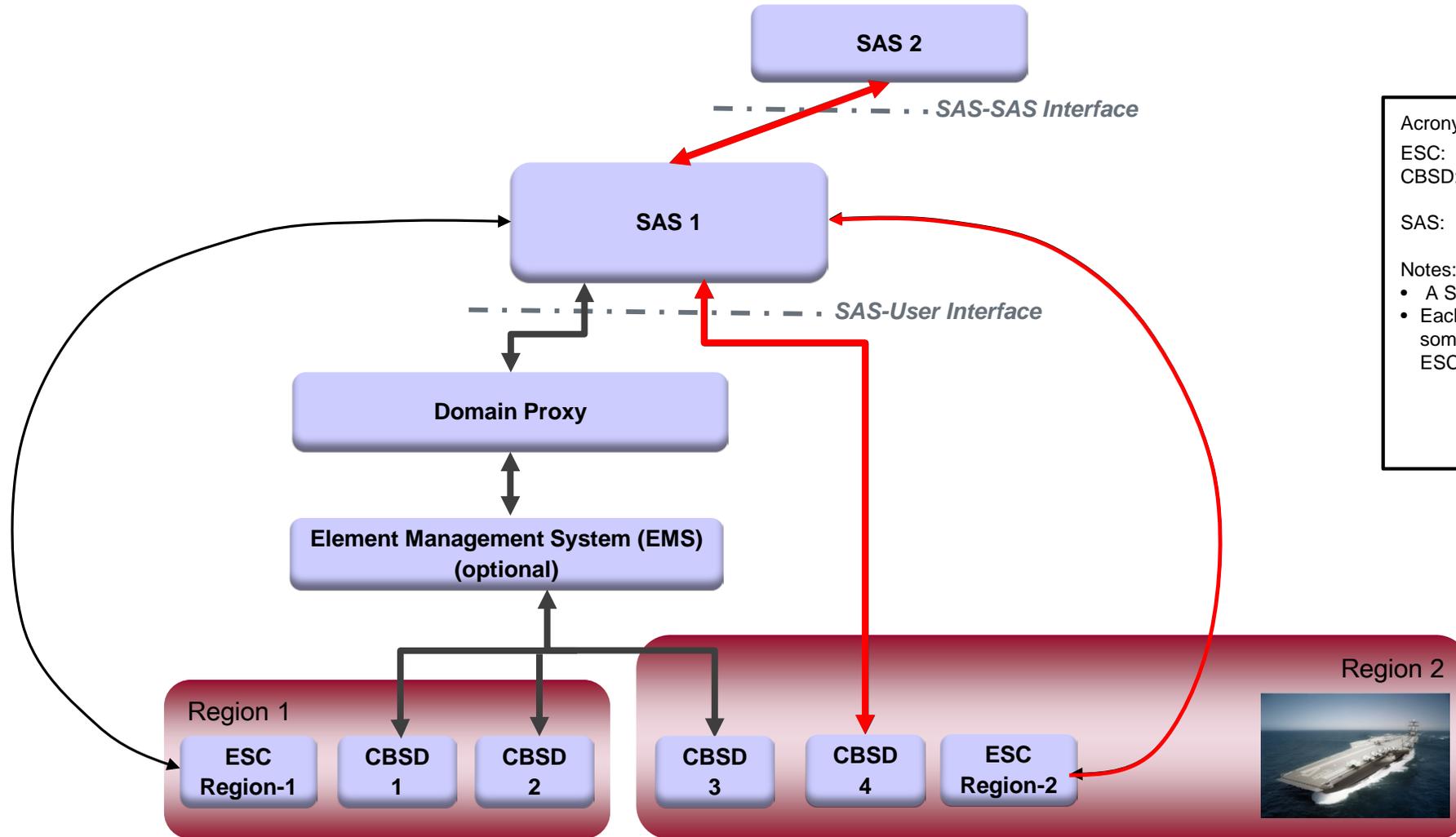
Functional Architecture



Acronyms:
 ESC: Environmental Sensing Capability
 CBSD: Citizens Broadband Radio Service Device
 SAS: Spectrum Access System

Notes:
 • A SAS may not need to support all interfaces.
 • Each CBSD domain may optionally include some sensing capability (including possibly an ESC).

Functional Architecture



Acronyms:
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SAS Purpose and Functionality

(from FCC R&O, Annex A, 96.53)

- Enact and enforce all policies and procedures developed by the SAS Administrator pursuant to section 96.63.
- Determine and provide to CBSDs the permissible channels or frequencies at their location.
- Determine and provide to CBSDs the maximum permissible transmission power level at their location.
- Retain information on, and enforce, Exclusion Zones and Protection Zones in accordance with sections 96.15 and 96.17.
- Communicate with the ESC to obtain information about federal Incumbent User transmissions and instruct CBSDs to move to another frequency range or cease transmissions.
- Ensure that CBSDs operate in geographic areas and within the maximum power levels required to protect federal Incumbent Users from harmful interference, consistent with the requirements of sections 96.15 and 96.21.
- Register and authenticate the identification information and location of CBSDs.
- Ensure that CBSDs protect non-federal Incumbent Users from harmful interference, consistent with the requirements of section 96.17 and 96.21.
- Protect Priority Access Licensees from interference caused by other PALs and from General Authorized Access Users consistent with section 96.25.
- Facilitate coordination between GAA users operating Category B CBSDs, consistent with section 96.35.
- Resolve conflicting uses of the band while maintaining, as much as possible, a stable radio frequency environment.
- Ensure secure and reliable transmission of information between the SAS and CBSDs.
- Protect Grandfathered Wireless Broadband Licensees consistent with section 90.1307, 90.1338, and 96.21.
- Implement the terms of current and future international agreements as they relate to the Citizens Broadband Radio Service.

Domain Proxy Functionality

A Domain Proxy is a managing intermediary.

- **A Domain Proxy's function is to:**

- Accept a set of one or more available channels and select channels for use by specific CBSDs, or alternatively pass the available channels to the carrier EMS for CBSD channel selection
 - EMS may optionally be co-located with the domain proxy
- Back report selected channels to SAS optionally received via EMS
- Receives confirmation of channel assignment from SAS
- Performs bidirectional bulk CBSD registration and directive processing, optionally through carrier EMS if present.
- Perform bidirectional information processing and routing.
 - E.g. interference reporting, etc.

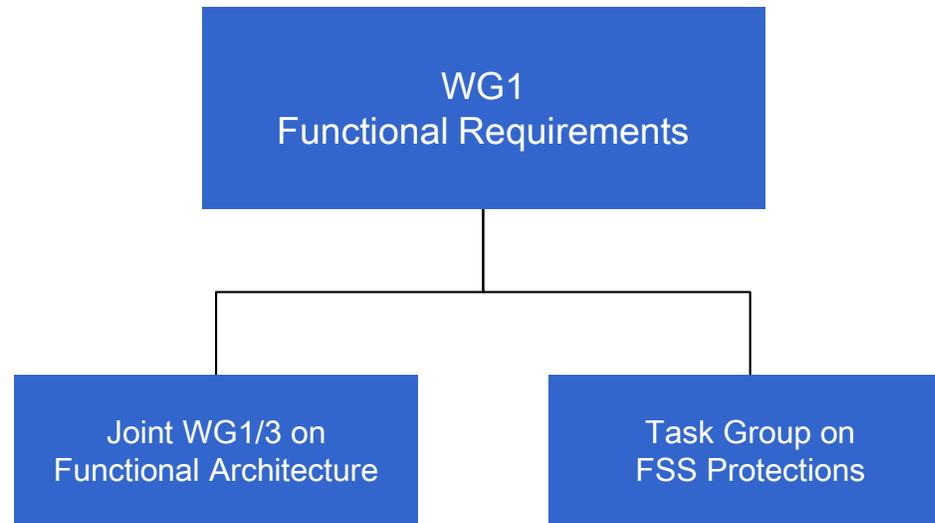
SPECTRUM SHARING COMMITTEE WORK GROUP 1: OPERATIONAL AND FUNCTIONAL REQUIREMENTS

Andy Clegg
Google

Slide #33

Spectrum Sharing Committee Work Group 1

- Operational and Function Requirements
- Focus on interoperability among components of ecosystem
- “Fill-in-the-blanks” in FCC rules



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Spectrum Sharing Committee Work Group 1

- **Deliverables**

- Spectrum Sharing System Functionality
 - Common functional requirements for systems interoperability that are needed for the SAS systems to interface properly and function in a similar fashion where coordination is required on functionality. Examples include the information required to be exchanged between systems, to include data input by external systems (e.g. sensor systems). Behavior when interference occurs due to incumbent activity, and freedom in assignment of spectrum channels.
- SAS Privacy Policies and Considerations
 - Common practices and rules to be observed by developers and users of the system to protect the privacy of the users of the system. Examples include practices for data retention and backup and how to mask data before sharing across subsystem operators.

Spectrum Sharing Committee Work Group 1

- **Example Work Items**
 - 3.6 GHz band plan
 - Physical device damage
 - Channel grant management
 - EUD cloud modeling
 - Large-scale spectrum reclamation
 - Common terminology
 - CBSD SAS registration requirements
 - FSS protections
 - PAL census tract border protection
 - Congestion metric
 - Enforcement
 - Life cycle considerations

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Spectrum Sharing Committee Work Group 1

- **Working Group Facilitators**

- Chair: Andrew Clegg, Google
- Vice Chair: Al Jette, Nokia

- **Meetings**

- Meets by telecon every two weeks (next meeting June 29th)
- Meets face-to-face (with Spectrum Sharing Committee) ~every 2 months (next face-to-face June 25th)

- **Participants**

- SAS providers, equipment manufacturers, service providers, FSS operators, DoD, NTIA, others

- **How to Join**

- Inquire with Lee Pucker, Wireless Innovation Forum CEO

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SPECTRUM SHARING COMMITTEE WORK GROUP 2: SECURITY REQUIREMENTS

Charles Clancy
Federated Wireless

Slide #38

Spectrum Sharing Committee Work Group 2

Addressing two sets of security requirements:

Operational Security (OPSEC)

- System design characteristics to protect the operational privacy of federal incumbent activity, principally focused on limiting exposure of US Navy ship movements/activity

Communication Security (COMSEC)

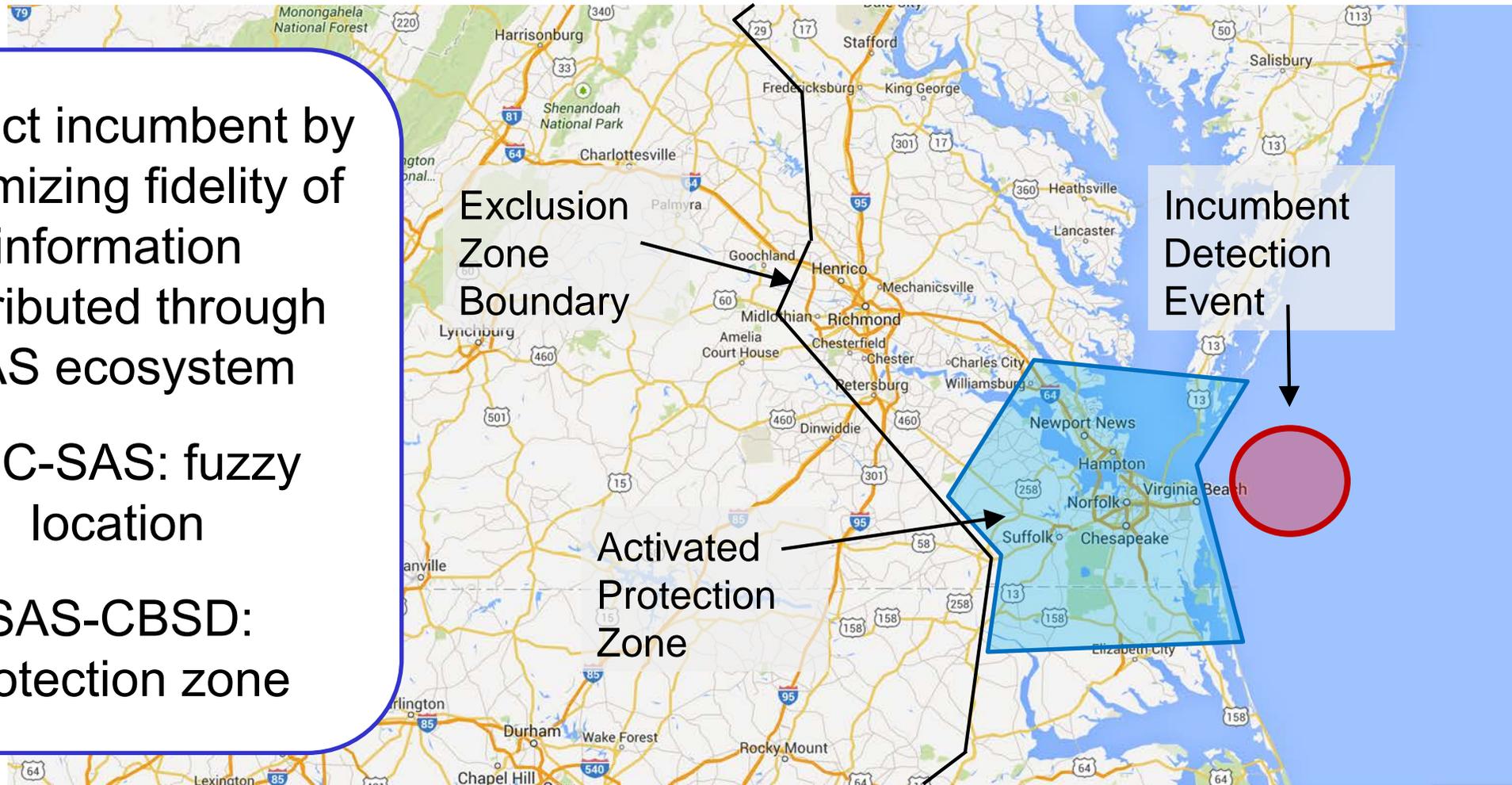
- Authentication, authorization, and encryption of SAS-SAS, SAS-Proxy, and SAS-CBSD interfaces

OPSEC Work

Protect incumbent by
minimizing fidelity of
information
distributed through
SAS ecosystem

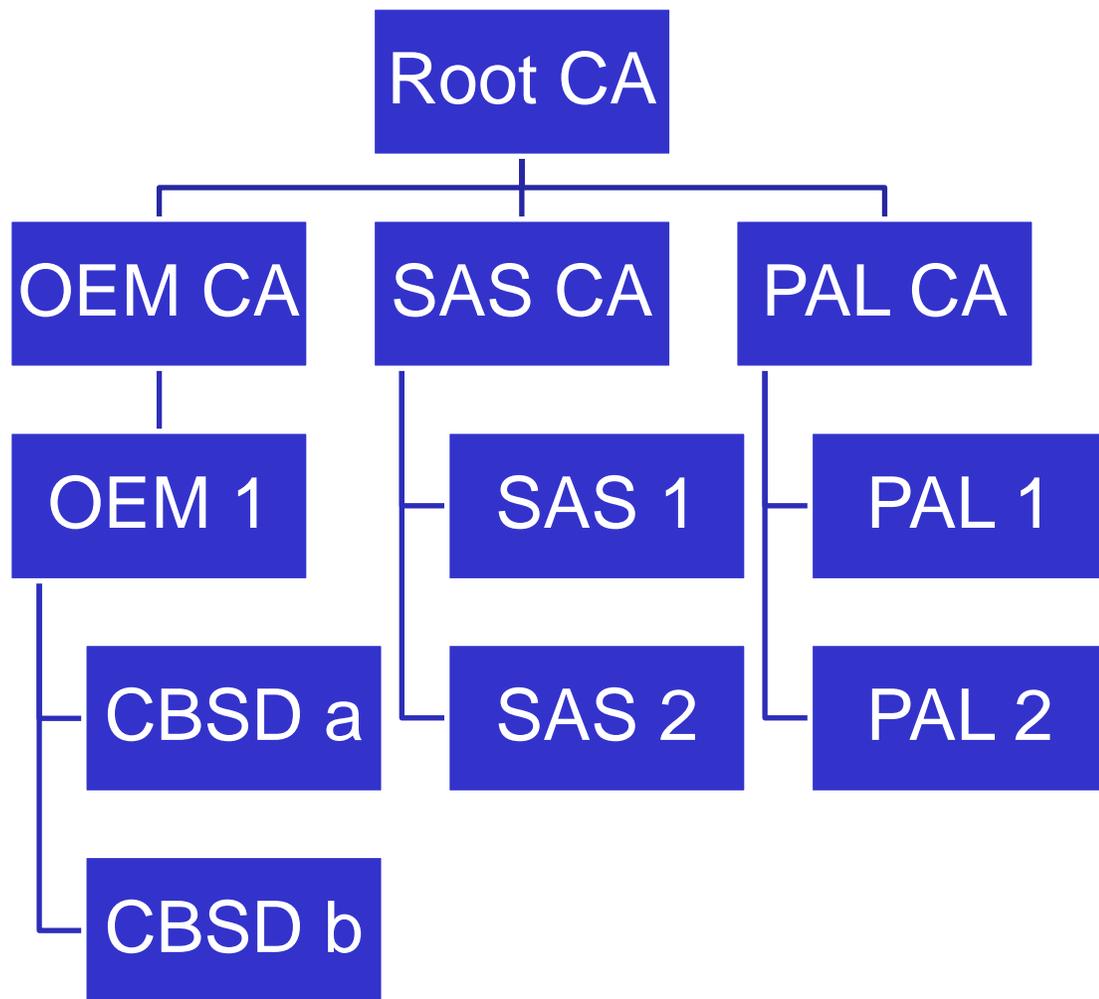
ESC-SAS: fuzzy
location

SAS-CBSD:
protection zone



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COMSEC Work



- PKI used to provide overall governance for the system
 - Certificates used for all machine-to-machine interactions
 - Use TLS 1.2 to protect protocols
- User-to-machine interfaces (user registration, trusted installers) use password authentication
- Security associated with device registration and enrollment

WG2 Status

OPSEC Document – Federated Wireless

COMSEC Document – Google, Nokia

Still in early stages of document development

WG2 is key point of coordination with DOD to understand constraints

Welcome additional inputs

- **Still need to address device firmware security**

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SPECTRUM SHARING COMMITTEE WORK GROUP 3: PROTOCOL SPECIFICATIONS

Jesse Caulfield
Keybridge Global

Slide #43

Define the detailed protocols for data and communications across the various open interfaces within the system

Spectrum Access System (SAS) interface specifications should be limited to the minimum requirement needed for an open and interoperable system.

Prefer light weight, extensible protocols

WG3 Organization

Group Chair

**Jesse
Caulfield**
Key Bridge

Deliverables,
organization,
policies,
resources

SAS-User Protocol

**Prakash
Moorut**
Nokia

Specification,
contributions,
editorial

SAS-SAS Protocol

James Ni
Federated
Wireless

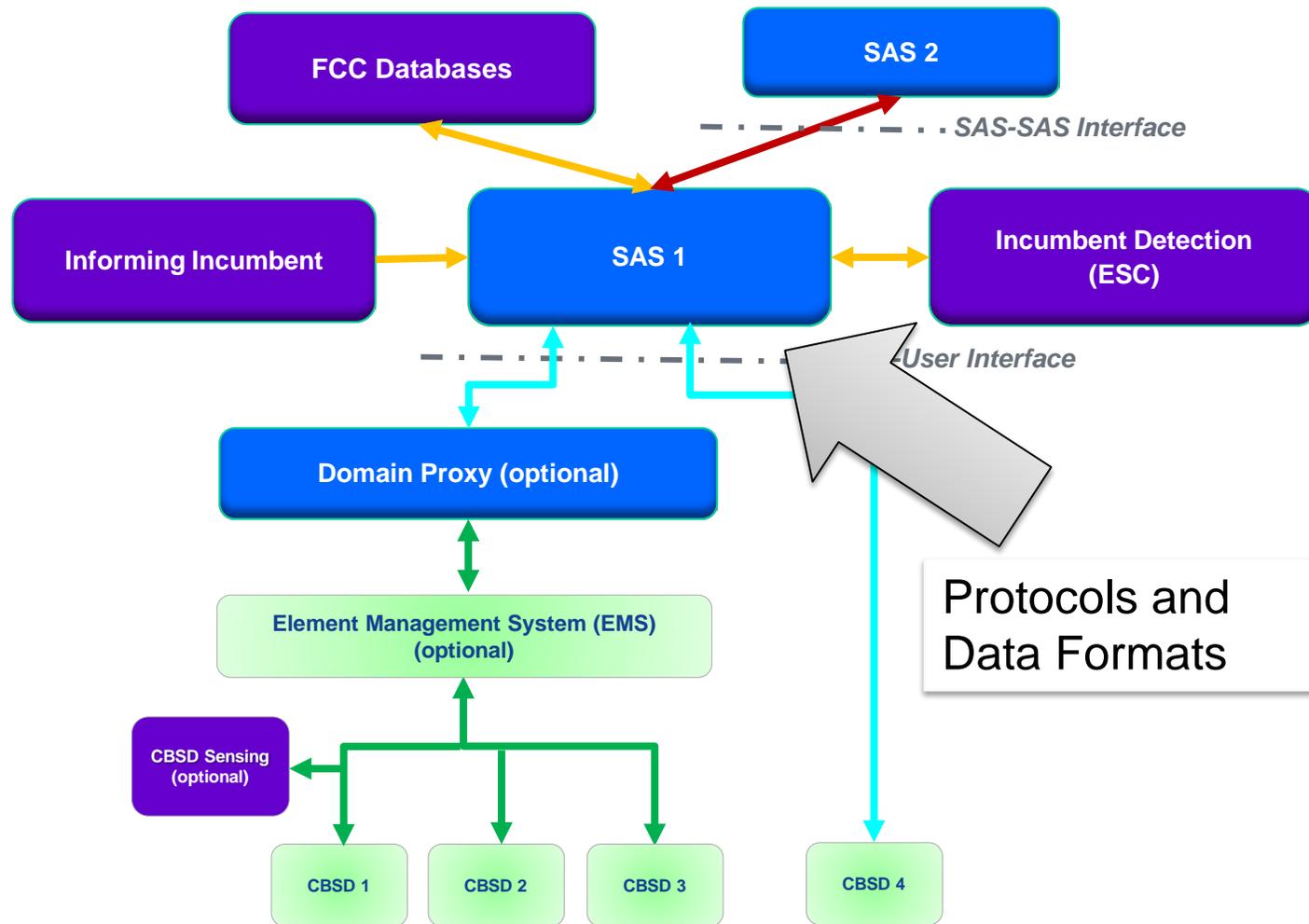
Specification,
contributions,
editorial

Other Protocols

*Other
protocols and
specifications
as required*

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SAS Notional Architecture



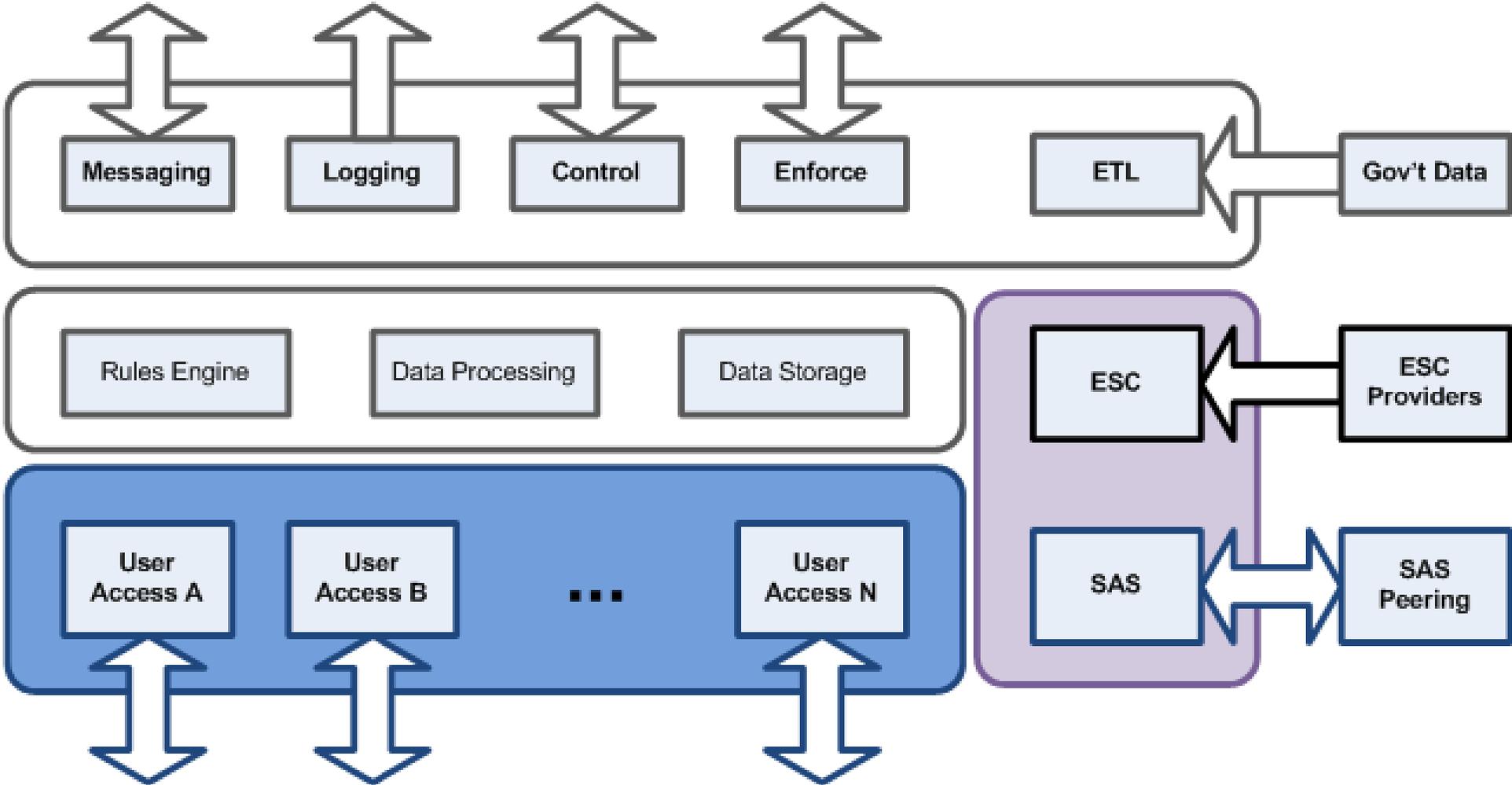
Key
 ESC: Environmental Sensing Capability

- WG3 to Standardize
- WG3 to Standardize
- WG3 to consider
- Beyond WG3 scope

Notes:

- A SAS may not need to support all interfaces.
- Each CBSD domain may optionally include some sensing capability (including possibly an ESC).

SAS Component Model and Interface Concept



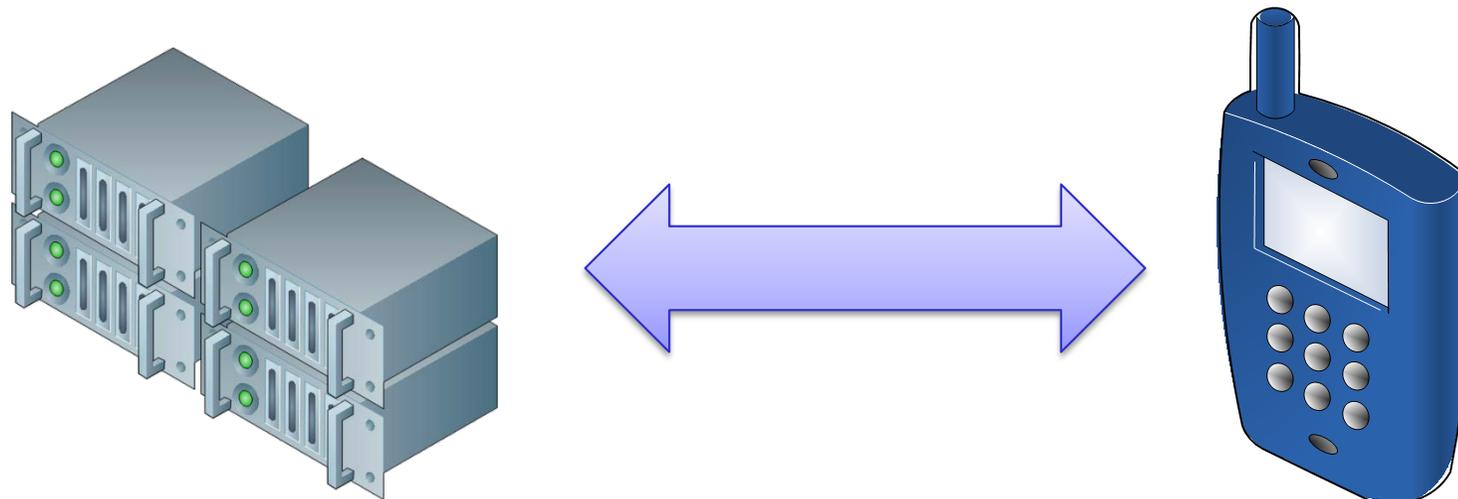
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SAS to User Protocol

The SAS to User Protocol enables User devices to access the 3.5GHz band

We expect there will be a number of type-specific SAS-User protocol implementations. E.g. TD-LTE, WiMax, 802.11, etc.

Each of these must be Rules-compliant.



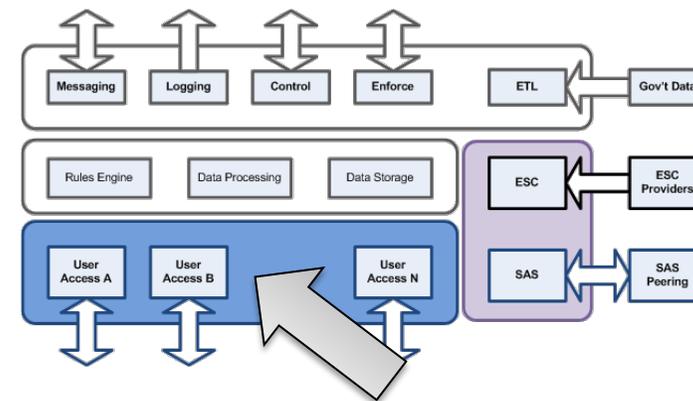
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SAS to User Protocol

The SAS-User protocol establishes a baseline configuration for Rules compliant operation with details for

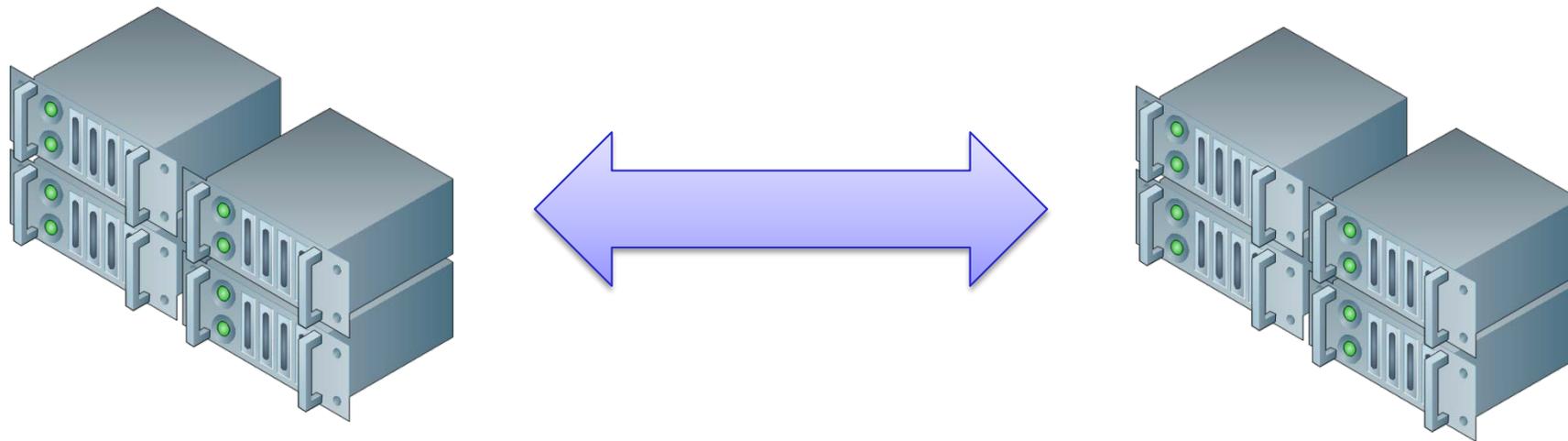
- **CBSD required installation parameters**
- **Client / Server communication security**
- **SAS Discovery**
- **SAS to CBSD and CBSD to SAS messaging**
- **CBSD device registration and finite state machine**
- **CBSD spectrum request and relinquish**
- **SAS spectrum reassignment and revocation**

And other required functions



SAS to SAS Protocol

The **SAS to SAS Protocol** enables **SAS** multi-party interoperability
We expect there will be *one* SAS-SAS protocol implementation
This implementation must be **Rules-compliant**.



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SAS to SAS Protocol

The SAS to SAS protocol enables inter-SAS peering.

SAS-to-SAS data exchange is modeled upon an autonomous system with exterior gateways. The internal structure of a SAS is not externally relevant and must be hidden behind a peering gateway.

Each SAS is atomic and autonomous, authoritative and complete for its users

A SAS peering gateway enables complete and incremental data synchronization

The SAS peering concept borrows, at a high level, from Internet peering and also from database synchronization

Other SAS Protocols

SAS to ESC enables SAS interoperation with an Environmental Sensing Capability

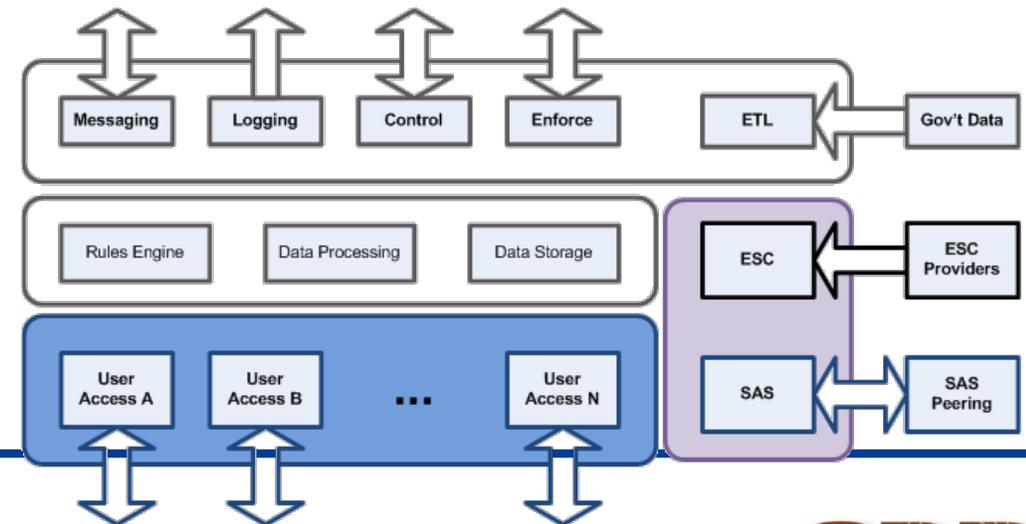
ETL facilitates import and loading of U.S. Gov't data sources

Messaging facilitates real-time information reporting

Logging preserves a historical record

Enforcement facilitates U.S. Gov't administration

Other interfaces possible



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WG3 Summary

Define the detailed protocols for data and communications across the various open interfaces within the system

We are presently working on two industry standards:

- **SAS to User Protocol Specification**
- **SAS to SAS Protocol Specification**

SAS to User is a baseline configuration; intended to inform type-specific implementations.

We will address other interfaces going forward.

We invite your participation!

SPECTRUM SHARING COMMITTEE WORK GROUP 4: TESTING AND CERTIFICATION

James Neel
Federated Wireless

Slide #54

Spectrum Sharing Committee Work Group 4

WG4: Test and Certification

- Define the Test and Certification standards for the 3.5 GHz shared spectrum ecosystem
- Leverage common industry testing processes to preserve innovation and enable development of the subsystems in a competitive environment

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Spectrum Sharing Committee Work Group 4

WG4: Test and Certification

- Amalgamate requirements of various stakeholders into a single test and certification framework
- Focus solely on test and certification standards for ecosystem advancement
- Advance the FCC's certification goals and provide industry support where possible

Spectrum Sharing Committee Work Group 4

As detailed in the 3.5 GHz Report and Order, the FCC will require certification of:

- Spectrum Access System(s)
- Environmental Sensing Capability (ESC)
- Citizens Band Radio Service Device (CBSDs) and End User Devices

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Spectrum Sharing Committee Work Group 4

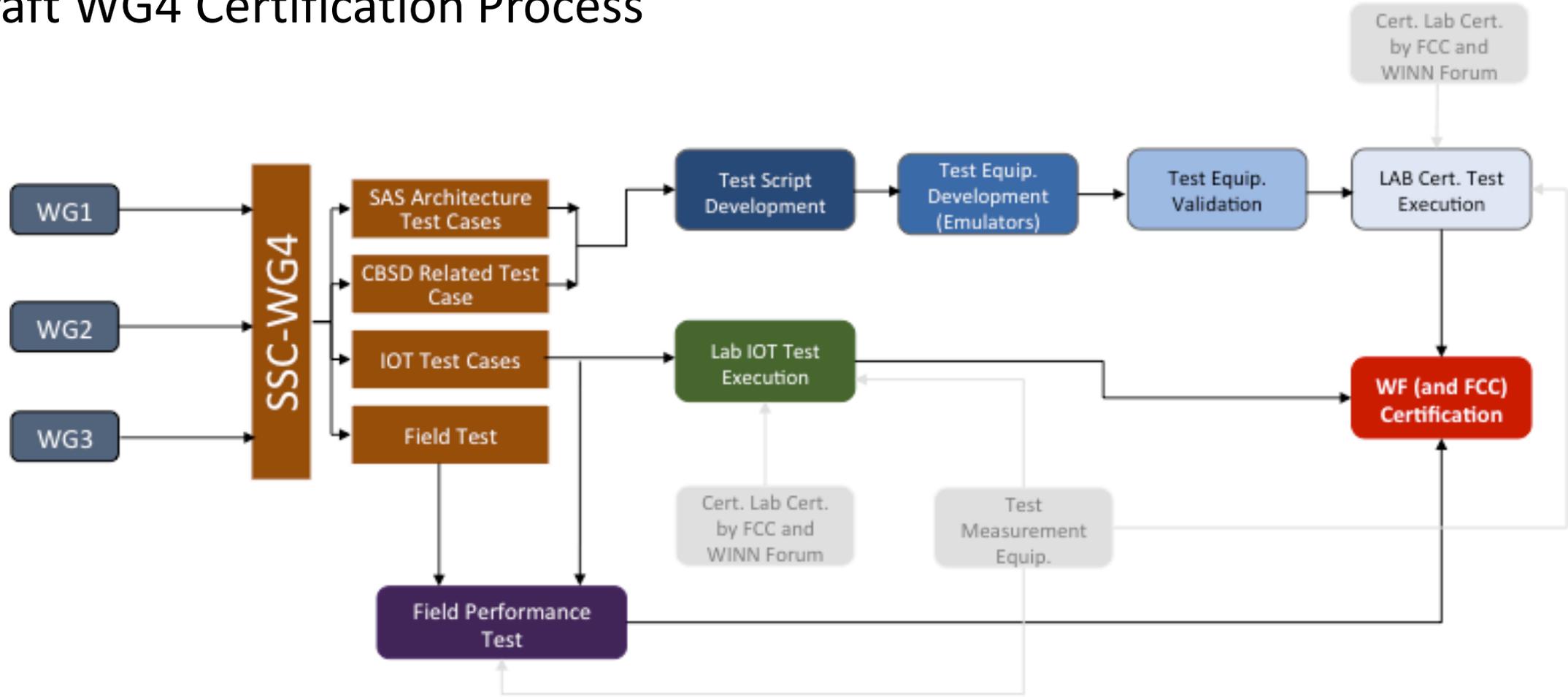
Current focus:

- Developing SAS test and certification framework
 - Based on requirements from FCC R&O, other WGs
 - Incorporate lessons learned from TVWS framework
 - Developing testing approach and process, including test automation
- ESC, CBSD, and End User Device test and certification framework to follow

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Spectrum Sharing Committee Work Group 4

Draft WG4 Certification Process



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Spectrum Sharing Committee Work Group 4

- Facilitator: Kurt Schaubach (Federated Wireless)
- Bi-weekly online meetings
 - Next session: Monday, June 22nd, 11 AM – 1 PM ET
- Participants
 - SAS developers, equipment manufacturers, service providers, FSS operators, DoD, NTIA, others
- How to Join
 - Inquire with Lee Pucker, Wireless Innovation Forum CEO

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REPORT AND ORDER MULTI-STAKEHOLDER GROUP (MSG) CALLOUTS

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MSG Callouts

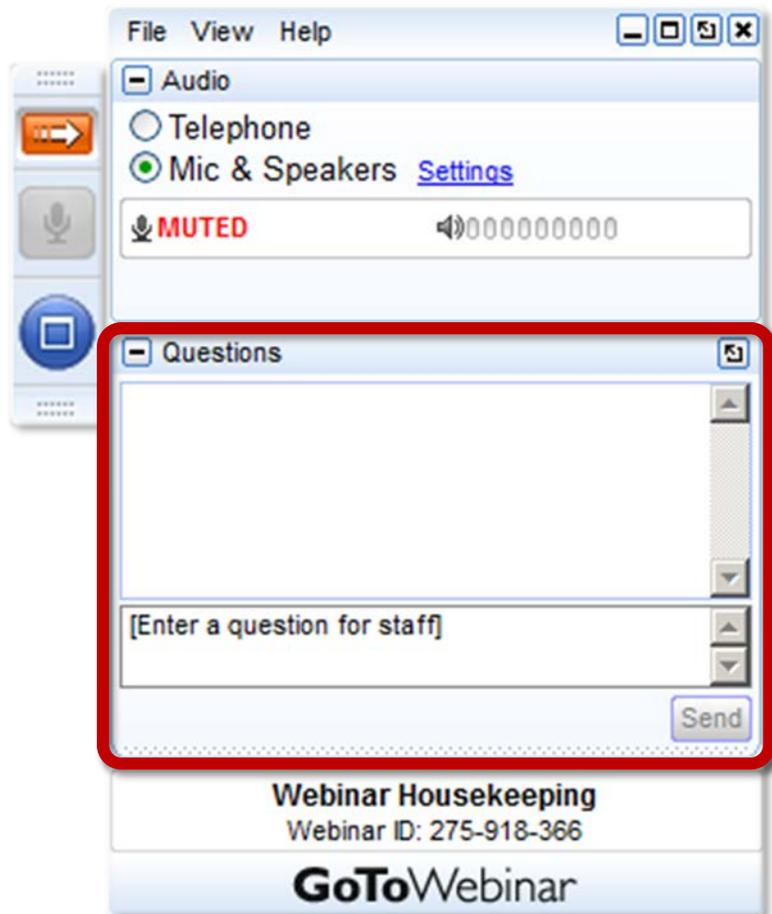
Paragraph	Call Out	Work Group
59	We acknowledge that SAS Administrators, potential licensees, and other industry stakeholders will need to develop various implementation details to facilitate development of the Citizens Broadband Radio Service. As described elsewhere in this Report and Order, we believe that many of these issues can be addressed during the SAS Approval Process and through the efforts of a multistakeholder group.	WG1
195	We recognize that ensuring compliance with this limit at the boundary is likely challenging on a real-time basis and there are legitimate questions relative to how to develop appropriate predictive models. We also recognize that the use of an aggregate metric could be challenging in a multi-user environment. ⁴⁴⁹ We encourage any multi-stakeholder group formed to address technical issues raised by this proceeding to consider how this limit should be applied.	WG1
214	For example, it might be possible that instead of the bright-line urban/rural distinction implemented in these initial rules, industry stakeholders (perhaps working through a multi-stakeholder forum) could agree on a “congestion metric” and associated methodology for SASs to reduce CBSD power levels in high-demand areas. We intend to continue an informal dialog with stakeholders on this topic and welcome the submission of additional technical analysis or reports of technological developments that can inform us going forward.	WG1
222	Given the importance of accurate reporting by professional installers, we strongly encourage the SAS and user community, through multi-stakeholder fora or industry associations, to develop programs for accrediting professional installers who receive training in the relevant Part 96 rules and associated technical best practices.	WG4 in partnership with another organization TBD
234	We encourage multi-stakeholder groups to consider the issues raised by the registration rules described in this section, including acceptable contact intervals between CBSDs and SASs, and to suggest appropriate operational parameters.	WG1
237	We encourage industry to develop detailed metrics regarding issues like received signal strength, packet error rate, and technology specific parameters of signal and interference metrics. These metrics could be developed by an industry multistakeholder group. Such guidance could be incorporated in the SAS Approval process described in section IIIH)(3)(b) or incorporated independently by authorized SAS Administrators, subject to Commission review.	WG3
240	We encourage the industry to develop best practices for end-to-end security that can be validated in the equipment and SAS certification processes.	WG2
268	We also require SAS Administrators to implement protocols to respond to directions from the President of the United States or another designated federal entity to manually discontinue operations of its associated CBSDs in a given area pursuant to 47 U.S.C. § 606. SAS Administrators must also implement protocols to manually discontinue operations of their associated CBSDs in response to enforcement actions taken by the Commission.	WG3

MSG Callout (cont.)

Paragraph	Call Out	Work Group
289	We agree with Federated Wireless, Google, Motorola Solutions, SIA, the Wireless Innovation Forum, and others, that a multi-stakeholder process could provide insight into the technical factors and interference limits between coexisting services in the 3.5 GHz Band.	WG1
319	We continue to believe that a “light touch” regulatory approach is appropriate for this band and that the rules should include only the high-level requirements necessary to ensure the effective development and operation of fully functional SASs. We agree with commenters that support collaborative, industry-wide efforts to create standards and best practices governing SAS operations. The Commission will assist these efforts through the SAS Administrator approval process, as set forth in III(H)(3)(b). We also believe that an active multi-stakeholder group could help develop industry consensus around the best methods of meeting the SAS requirements.	All
346	We require potential SAS Administrators to develop and demonstrate that their systems include robust communications and information security features during the SAS Approval process. 745 CBSDs shall demonstrate compliant security features during the equipment authorization process. These security protocols will be subject to the Commission’s review and approval, with input from NTIA and DoD. We anticipate that given the immense value of industry-wide interoperability, groups – such as the types of multi-stakeholder groups discussed in section III(K) – will develop security models that SAS Administrators may consider, subject to Commission review.	WG2
438	We seek comment on what propagation model(s) are best suited for SAS-based protections of FSS. We solicit measurement results that validate model parameters for combined short range and long range propagation scenarios, involving indoor and outdoor propagation channels. What model(s) are the most accurate in accounting for urban clutter and other environmental factors such as rain attenuation, ducting, etc., and most suitable for modeling statistical variations to support analysis – including possible Monte-Carlo analysis – of many potential interfering sources? In order to generate the same exclusion distances between CBSDs and any individual FSS earth stations in 3650-3700 MHz, we expect each SAS to enforce the same minimum separation distance and we tentatively conclude that each SAS must use the same propagation model. We seek comment and objective analysis from anyone who believes otherwise.	WG1
440	We also invite comment as to whether we can establish a default earth station protection area based on an assumed minimum earth station receiving system gain-to-temperature ratio (G/T) and minimum antenna elevation angle, and what the assumed values of the G/T and elevation angle should be. CBSD operation outside of such a default protection area would be assumed not to cause interference to earth stations receiving in the 3700-4200 MHz band. Such a default protection area would be adjusted by the SAS to accommodate the actual operating characteristics of earth stations that are registered in order to achieve additional protection.	WG1

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Time for Questions



Your Participation

Please continue to submit your text questions and comments using the Questions panel

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<http://groups.winnforum.org/page/spectrum-sharing-committee>

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