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Request for Information on the National Spectrum Research and Development Plan

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The National Spectrum Strategy (NSS) released on November 13, 2023, states that "NTIA, working with Federal agencies, will continue to pursue development of an enduring, scalable mechanism to manage shared spectrum access, including through the development of a common spectrum management platform." NSS at 15. The concept of a common spectrum management platform is a key aspect of the NSS, because it creates the opportunities to take advantage of advances in technology, and to facilitate the achievement of other goals in the NSS, including the spectrum pipeline. Therefore, the development of an "enduring, scalable mechanism to managed shared spectrum access" should be a top priority in the Implementation Plan, and resources towards this effort should be front-loaded.

Spectrum sharing is by now well-enough developed that there are known elements that transcend bands and use cases. It should be possible to distill these elements into a common platform. A September 2021 paper I co-authored, *Taking Stock of Spectrum Sharing*,[1] included a basic framework with examples of different sharing systems that have been used:

Sharing Mechanism	Centralized	Decentralized
Coordinating (e.g., Database)	TVWS, AFC, SAS	Some CIRN systems
Sensing	ESC	LBT, DFS
Informing	IIC	Beaconing

Fig. 2: Basic Spectrum-Sharing Framework

A common spectrum sharing platform would accommodate these known use cases and anticipate others that might emerge. Its development should draw on past experiences with sharing between Federal and non-Federal users, among Federal agencies, and among commercial users. It will be important to understand stakeholders' experiences with different bands and different use cases and to anticipate the bands and use cases of the future. Expertise from both inside and outside the Federal government will be essential in this regard.

In developing the platform, NTIA should focus on three main components: (1) the architectural vision; (2) the implementing technology platform; and (3) the enabling regulatory framework.

(1) Architecture. NTIA should begin with a time-bound process to align on a common, high-level vision of the future spectrum-sharing architecture. As an output from this process, NTIA should develop a reference document that describes the key elements of the spectrum sharing architecture. This document need not be long or convoluted. In fact, given the need to accommodate change and evolution, an easily referenceable set of high-level diagrams is preferable to a weighty tome. This deliverable should become a living document with specific organizational units at NTIA and the FCC identified as its "keepers," similar to how the Table of Allocations has been managed for decades. The diagram below illustrates a high-level architecture concept.

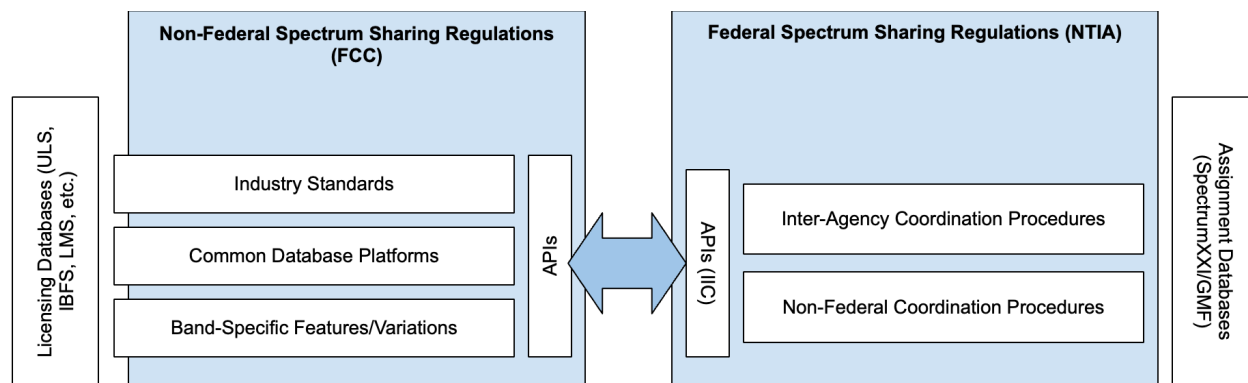[1] https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3916386

Fig. 1: Illustrative High-Level Spectrum Sharing Architecture

The visioning process described above would produce a more fleshed-out version of this diagram – or something similar – that could be used to drive alignment and a common vernacular among spectrum-sharing stakeholders.

(2) Technology Implementation. The implementing technology platform should use a definition of shared spectrum access that is broad enough to cover a wide range of evolving sharing scenarios and enabling technologies. The platform should encompass both dynamic (e.g., "CBRS-style") and slow-time (e.g., "AWS-3 style") sharing among different sets of constituent users both on the government side and the civilian side (e.g., carrier networks, private networks, hybrid networks). The eventual goal should be to replace manual frequency coordination with automated techniques. Modular design would provide flexibility to address sharing solutions tailored to specific bands and use cases, with the ability to upgrade components over time. On the Federal side, the technology platform may include the creation of a reusable, extensible system to facilitate automated sharing among Federal users that also interoperates with non-Federal sharing systems to facilitate commercial spectrum access. (The Incumbent Informing Capability would be one feature set of this system.) On the non-Federal side, modernization of enabling systems (e.g., the FCC's Universal Licensing System) would enable real-time information flows to spectrum-sharing infrastructure. Non-Federal sharing also benefits from development of industry standards (e.g., through standards bodies such as 3GPP) that encourage consistent, competitive implementations of sharing approaches across multiple bands and situations.

(3) Regulatory Framework. NTIA, working with FCC, should develop a modular, reusable, and extensible regulatory framework for spectrum sharing that mirrors its "digital twin", the model technology implementation. The development of spectrum sharing has been hindered by the tendency to develop all-new regulations for each band, rather than creating a generalized regulatory solution that can be reused and refined over time. One symptom of this tendency is the lack of common regulatory vernacular for similar concepts across multiple spectrum bands. The result has been an alphabet soup of acronyms for basically similar regulatory frameworks. For example: "TV White Spaces Database," "Spectrum Access System," and "Automated Frequency Coordination" all refer to essentially the same technology of using a database to deconflict different spectrum users.   The better approach would be to establish a basic set of rules for the use of central databases to enable sharing.   These rules would be codified in the FCC's regulations and in the NTIA Manual. Commonality should be embraced; any necessary band-specific differences could be accommodated as variations from the core rules.

As noted above, modularity is an especially important design principle. The architecture, technology platform, and regulatory framework might include "parallel" modules for various spectrum sharing scenarios (e.g., database coordination, sensing mechanisms, informing capabilities). Over time, other modules could be added (e.g., an Artificial Intelligence (AI) module to implement complex sharing

procedures). These modules could be used individually or in combination to achieve the desired result. Once there is a common regulatory framework, it will be possible to determine which modules apply to which bands. Some bands may require only a subset of the overall system capabilities.

The effort to develop a common spectrum management platform will be best served by full alignment between NTIA and the FCC. Much of the discussion of mechanisms for sharing, especially in the context of the National Spectrum Strategy, has been focused on sharing between Federal government and commercial uses. But future spectrum sharing could potentially be architected in a way that is flexible enough to accommodate non-Federal sharing scenarios as well. Close cooperation between NTIA and the FCC will pay dividends by providing a roadmap to facilitate common technology platforms for sharing across different bands.

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