

Before the
DEPARTMENT OF COMMERCE
National Telecommunications and Information Administration
Washington, DC 20230

In the Matter of)	
)	
Public Wireless Supply Chain Innovation Fund)	Docket No. 221202-0260
Implementation)	RIN 0693-XC05
)	

COMMENTS OF DISH NETWORK CORPORATION

DISH Network Corporation (“DISH”) appreciates the opportunity to respond to the National Telecommunications and Information Agency’s (“NTIA’s”) request for comment (“RFC”) on implementing the Public Wireless Supply Chain Innovation Fund (“Wireless Innovation Fund” or “Fund”).¹

I. INTRODUCTION AND SUMMARY

DISH applauds the U.S. government’s establishment of the Wireless Innovation Fund to support projects that will catalyze deployment of open radio access networks (“Open RAN”). By enhancing interoperability and diversity throughout communications networks, the Fund will foster innovation, drive competition, and build resiliency for generations of networks to come.

As the operator of the world’s first cloud-native standalone Open RAN 5G network, DISH is learning in real time – alongside dozens of partners worldwide – what a successful Open RAN deployment entails. We have witnessed the real-world challenges that can hinder deployment and met them head-on, achieving our 2022 build-out milestones. DISH has seen first-hand how Open RAN virtualization enables the deployment of new technology to accommodate and incorporate innovation, facilitating swift network updates. We provide details of DISH’s deployment in Section II below.

As we explain further in Section III, we have learned valuable lessons that can inform future deployments. We have seen the importance of system integration as diverse vendors come together to contribute to Open RAN networks – in fact, as the first operator to implement Open RAN in a standalone 5G network, DISH embraced the role of serving as its own system integrator. This was not easy, but it was a valuable experience that offers important takeaways for the future. Further, our deployment has underscored the critical nature of security expertise to ensure the secure connectivity that meets the demands of today and the future.

DISH’s experience can and should inform certain principles for implementing the Wireless Innovation Fund. Of note, NTIA should use the Fund to facilitate the development and

¹ Public Wireless Supply Chain Innovation Fund Implementation, 87 Fed. Reg. 76182 (Dec. 13, 2022), <https://www.federalregister.gov/documents/2022/12/13/2022-26938/public-wireless-supply-chain-innovation-fund-implementation>.

testing of innovative deployable solutions that produce a measurable return on investment. Such projects will ultimately improve the quality and richness of Open RAN offerings. In addition, NTIA should boost U.S. contributions to the robust and competitive trusted global Open RAN ecosystem. This means that entities need not be headquartered in the U.S. to receive grant funding, but activities related to the grant should take place in the U.S.

Consistent with these principles, DISH recommends that NTIA focus on two general areas of investment – security and system integration – as well as several other specific issues pertaining to Open RAN hardware, software, performance, deployment, and orchestration. With this focus, the U.S. can lead the way through targeted investments in projects that bolster operators’ confidence in Open RAN products/systems and streamline Open RAN adoption/use, lower barriers to entry for Open RAN vendors and facilitate scalable interoperability, train professionals needed to support Open RAN networks, and materially advance key technologies to support Open RAN deployments and operations. DISH provides specific suggestions for projects that would be worthy of Wireless Innovation Fund investment in Section IV below.

As NTIA works to implement the Fund, it should do so expeditiously, recognizing the need for investments today to make Open RAN a competitive option in both 5G deployments and a mainstay of the 6G development cycle. We look forward to a continued partnership with NTIA throughout the grant process and as the U.S. champions Open RAN on the global stage.

II. DISH’S SUCCESSFUL DEPLOYMENT OF OPEN RAN PROVIDES UNIQUE INSIGHTS FOR THE WIRELESS INNOVATION FUND

In 2019, DISH committed to offering 5G broadband service to at least 20 percent of the U.S. population within three years. In June 2022, DISH achieved this milestone through deployment of a cloud-native, standalone 5G wireless network, consistent with O-RAN Alliance specifications and 3rd Generation Partnership Project (“3GPP”) standards through its Project Genesis brand.² This moment marked a significant industry first and DISH is the only operator in the world to deploy this type of wireless network. As DISH continues to deploy and increase coverage, it will expand the availability of competitive services offered to both consumer and business customers, increasing competitive pressure on the incumbent carriers. This will benefit American consumers and promote U.S. technology leadership abroad.

The road to June 2022 was neither easy nor predictable. Amid the COVID-19 pandemic, DISH battled supply chain, power, and workforce shortages while navigating a complex technological vendor ecosystem to construct a greenfield wireless network using a novel network architecture.³ We were able to overcome these and other substantial obstacles – achieving our

² DISH Network Corporation 5G Buildout Status Report, WTB Docket No. 22-212 (July 14, 2022), <https://www.fcc.gov/ecfs/document/10714418910058/1> (“July 2022 Buildout Report”); Press Release, DISH, *DISH’s Smart 5G™ Wireless Network is Now Available to Over 20 Percent of the U.S. Population* (June 15, 2022), <https://about.dish.com/2022-06-15-DISHs-Smart-5G-TM-Wireless-Network-is-Now-Available-to-Over-20-Percent-of-the-U-S-Population>.

³ July 2022 Buildout Report at 2.

first buildout milestone in 14 months⁴ – through the collaboration, ingenuity, and hard work of our employees and network partners, which include Amazon Web Services (“AWS”), Cisco, Dell, Fujitsu, Intel, JMA, Mavenir, Nokia, Oracle, Palo Alto, Qualcomm, Samsung, VMware, and many other partners and suppliers. We are the only major network in the world built primarily with U.S.-based technology and software vendors.

Through this experience, we have seen how Open RAN architecture combined with software-driven network functions (“virtualization”) enables technological innovation at unprecedented velocity. A network – like DISH’s – that utilizes this pairing can accommodate and leverage innovation by enabling rapid network updates as technology and the need for services evolve. DISH has also experienced some of the challenges to Open RAN deployment in the current environment and identified important lessons learned for future deployments in two key areas: (1) system integration and (2) security.⁵

a. Open RAN Virtualization Enables Deployment of New Technology to Incorporate Innovation Swiftly and Continuously

The disaggregation and interoperability of Open RAN architectures, combined with virtualization, enables more specialization among suppliers and empowers operators to choose between a wider range of diverse vendors that represent the “best-of-breed” for a growing set of network needs.⁶ As described in DISH’s Cloud-Native Principles, these architectures allow the network to adapt, scale, and remain secure from end-to-end.⁷

These capabilities offer new value, particularly for enterprise customers who can use a network designed to meet their unique needs to better serve their employees, customers, and partners.⁸ Open ecosystems give enterprises unprecedented levels of control and visibility into operations and processes throughout the network. They also allow enterprises to add or remove services in real-time to optimize performance and respond to changing conditions. For example, DISH will enable an enterprise to extend its IT architecture to cover its cellular network, providing control over policy management, quality of service and experience, as well as digital twin and real-time reporting.⁹

⁴ Ex Parte Letter from Jeffrey H. Blum, Executive Vice President, External & Legislative Affairs, DISH Network Corporation, to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 21-63 (Mar. 16, 2022), <https://www.fcc.gov/ecfs/document/103161155918353/1>.

⁵ Public Wireless Supply Chain Innovation Fund Implementation, Questions #1-2.

⁶ See Communications Security, Reliability, and Interoperability Council VIII, *Report on Challenges to the Development of ORAN Technology and Recommendations on How to Overcome Them*, at 9 (Dec. 2022), <https://www.fcc.gov/file/24520/download> (“CSRIC Open RAN Report”).

⁷ See Sidd Chenumolu, *This Week in Wireless: 14 Principles of Network Architecture*, DISH Wireless (June 7, 2022), https://www.dishwireless.com/blog_networkprinciples.

⁸ DISH Wireless, *DISH Wireless Systems Integration*, at 2 (Nov. 15, 2022), <https://www.dishwireless.com/content/dam/pdfs/wi-pdf-whitepaper-systems-integration-enterprise-exploring-the-possibilities.pdf> (“DISH Systems Integration White Paper”).

⁹ DISH Systems Integration White Paper at 6.

Moreover, the transparency that governs an enterprise’s interaction with this open ecosystem enables enterprises to drive innovation. Open ecosystems allow enterprises to work with developers to optimize and personalize their networks. This encourages the adoption of best-in-class options for each component of the network, resulting in the creation of entirely new architectures that satisfy real-world demands. Enterprises don’t have to wait on DISH to design solutions or create new value propositions. Instead, innovation becomes an ongoing exercise as enterprises can implement new applications quickly, due to the level of control and transparency now available. The increased level of competition provides the best value to customers and consumers and capitalizes on use cases defined by an enterprise and its partners.¹⁰

Since its launch in June 2022, DISH has seen first-hand the power of Open RAN modularity and virtualization to update the network at speed. As noted above, DISH was able to deploy a first of its kind network thanks to its use of Open RAN technology. DISH expects to spend roughly \$10 billion on its deployment efforts through 2025, significantly less than the cost of legacy networks. As of December 31, 2022, DISH had more than 15,000 towers under construction or on air that utilize Open RAN. DISH expects to maintain its construction pace of approximately 1,000 new Open RAN 5G sites per month to meet its 2023 deployment commitments. This pace is made possible by Open RAN technology.

In addition to facilitating rapid deployment, Open RAN injects new competition into the network stack that helps deliver a better product for a better price to carriers and ultimately consumers. Rather than a closed end-to-end system, Open RAN architecture provides DISH with the flexibility to continually evaluate best-in-breed partners to provide new and innovative solutions for the RAN and other network functions. Just last May, for example, DISH selected Samsung Electronics to collaborate and deploy a 5G Open RAN-compliant virtualized RAN solution and radio unit, adding yet another trusted partner in deploying its Open RAN 5G network. DISH’s flexible Open RAN infrastructure has also enabled the company to deploy other industry firsts. DISH is a leader in deploying 5G voice (“Voice Over New Radio” or “VONR”). This is, in part, due to our ability to continuously upgrade our network software.

b. DISH’s Experience Provides Unique Insights

i. System Integration

DISH has had to become its own system integrator, investing substantial time and resources working with vendors to facilitate reliable end-to-end interoperability and to ensure that technology is optimized for use on DISH’s spectrum.¹¹ This was a challenge – and it provided DISH and its partners with valuable experience. DISH managed dozens of partners to create a 5G network ecosystem and develop a technology roadmap to ease the adoption of Open RAN, including by validating new solutions and releases into DISH’s 5G technology stack.

¹⁰ *Id.* at 7.

¹¹ See Bevin Fletcher, *Dish promises 5G launch in 25 major markets before June deadline*, Fierce Wireless (Feb. 24, 2022), <https://www.fiercewireless.com/5g/dish-marks-5g-progress-plans-launch-5g-25-major-markets-june>.

DISH's Open RAN network architecture consists of radio units ("RUs"), which are deployed on DISH's 5G sites, and distributed units ("DUs"), which control the RUs. The DU operates at or near a 5G site and interfaces with centralized units ("CUs"), which are hosted in AWS. These combined network elements provide a RAN solution that manages all radio-level control and subscriber data traffic. This architecture is compliant with both 3GPP and relevant O-RAN Alliance specifications.¹²

DISH's approach to system integration of its own network provides benefits to its customers. Many current mobile network operators ("MNOs") offer a "one-size-fits-some" connectivity model for their customers, whether they are consumer users or enterprises. Consumer users generally prioritize network connectivity and reliability over network control and transparency, so when an MNO extends this consumer-centric model to an enterprise, it is offering an incomplete solution to an enterprise's complex problems. This results in an inadequate experience that fails to address unique requirements of enterprises, has limited capability for personalization, and remains closed off.¹³

Most MNOs operate on brownfield infrastructure originally designed and built to support consumer-centric offerings. Updates and changes to these networks are expensive and difficult for an MNO to make, and delays in upgrades mean delays in innovation for their customers.¹⁴

Supporting legacy systems while simultaneously building a new network to engage enterprises can present substantial challenges.¹⁵ MNOs often offer a repurposed consumer package that limits visibility of enterprises and prevents control over the ecosystem. Over-the-top solutions can be inadequate as they increase layers of complexity, introduce gaps in functionality, and create additional points of failure. Enterprises have limited visibility into network performance or system conditions. The black box system of traditional consumer models limits these enterprises from observing network operations in real-time or responding to performance issues quickly. Standardized, "one-size-fits-some" packages often don't include offerings that enterprises need, but do include capabilities that enterprises don't want, resulting in added expenses for unnecessary services. Enterprises have broad and diverse network requirements and an enterprise that uses a repurposed network, designed with few options for true personalization, cannot fit the system to its unique needs.

Enterprises deserve networks created with their requirements in mind, including forward-looking needs, that allow for collaborative innovation. As services and resources move to the cloud, multi-platform IT ecosystems require enterprises to manage security, controls, and policies across disparate systems. The ability to provide a seamless and cohesive experience has become a central tenet of enterprise IT at every level. DISH is building its 5G network to offer a unified IT ecosystem that breaks open the black box and enables more and faster innovation in addition to new opportunities for growth and revenue. With Open RAN, enterprises can have

¹² July 2022 Buildout Report at 7.

¹³ DISH System Integration White Paper at 2.

¹⁴ Public Wireless Supply Chain Innovation Fund Implementation, Question #1.

¹⁵ DISH System Integration White Paper at 3-4; Public Wireless Supply Chain Innovation Fund Implementation, Question #1.

full control of the network and unparalleled insight into performance. The network’s open ecosystem and cloud-native architecture facilitate adaptable and consistent experiences across enterprise ecosystems, resulting in (1) improved network control and transparency; (2) flexibility and fit-for-use; and (3) new opportunities for growth and innovation.¹⁶

ii. Security

In today’s software-driven environment, secure connectivity is essential, enabling businesses to increase productivity, transform the way they operate, and generate higher returns on investment. While some stakeholders have raised concerns regarding security in Open RAN networks, experts note that Open RAN networks tend to face the same challenges that information and communications technologies generally face.¹⁷ At the same time, as the Open RAN Policy Coalition (“ORPC”) has described, the benefits of innovation and supplier diversity in an open ecosystem will bring forward additional security solutions today’s networks cannot provide. This architecture can enable a user to address potential threats and mitigate risk because of the ability to monitor, detect, prevent, and respond more quickly, especially in layers of the RAN not previously accessible such as near real-time air interface sensing.¹⁸

A key tenet of the DISH 5G security framework is its zero-trust model.¹⁹ Components of the company’s 5G security design include real-time threat identification and correlation, 5G network security support with a software chain of trust and end-user controllability. These components improve threat detectability and the capability to automatically serve, act, and adapt. DISH 5G adopted a “secure by design” strategy based on a zero-trust model. This model incorporates certification and key management with advanced, multifactor client authentication, allowing DISH 5G to integrate best practices into its products while embracing security design principles. With this construct in place, DISH’s network will be able to rapidly respond to the ever-changing security needs of its customers. As part of the zero-trust model, DISH is taking the “never trust, always verify” approach. Zero-trust provides threat prevention and more control for both DISH 5G’s internal operations and the customers on its network.²⁰ We outline additional security features below.²¹

- Customer Empowerment through Network Slicing and Service Orchestration. Using the most advanced security solutions, DISH’s network will free its customer from many of

¹⁶ *Id.* at 2.

¹⁷ See CISA & NSA, *Open Radio Access Network Security Considerations*, at 3-4 (Sept. 2022), https://media.defense.gov/2022/Sep/15/2003077576/-1/-1/0/ESF_OPEN_RADIO_ACCESS_NETWORK_SECURITY_CONSIDERATIONS.PDF (“ESF Assessment”); CSRIC Open RAN Report at 4.

¹⁸ Open RAN Policy Coalition, *Open RAN Security in 5G* (Apr. 2021), <https://www.openranpolicy.org/wp-content/uploads/2021/06/ORPC-Open-RAN-NOI-Reply-Comment-Letter-as-filed-May-28-2021-c3.pdf>.

¹⁹ Public Wireless Supply Chain Innovation Fund Implementation, Questions #18, 20.

²⁰ DISH Wireless, *DISH lays the foundation for 5G network security*, at 5 (Apr. 8, 2021), https://mma.prnewswire.com/media/1483423/Security_Whitepaper_CLEAN.pdf?p=original. (“DISH Security White Paper”).

²¹ Public Wireless Supply Chain Innovation Fund Implementation, Question #18.

the limitations of traditional technology and will increasingly give customers more control with access to on-demand, secure network slices, encrypted connections, and secure, immersive experiences. A key enabler of this level of control will be support for 5G secure slicing, providing customers with their own private 5G network.

- **End-to-End Security.** By moving the processing of data out of the traditional data center to the edge of the network, we will be able to deliver ultra-low latency required by new applications. The advantages are clear: secure edge computing, hardware and chip-based security, unprecedented customer control and a first-of-its-kind, enterprise-grade wireless infrastructure. Through automation and orchestration, DISH will be able to provide the highest level of security at the speed of system workloads that will allow for confidential computing at the edge. Customers will be able to have full security control from the outset, including flexible user plane protection, policy management and control with system-enabled self-healing, made possible by artificial intelligence and machine learning tools. DISH is also adopting measurable, state-of-the-art security standards beyond those currently found in the industry, to provide a higher level of security for its customers.
- **Firewall, Cloud, and Container Security.** DISH’s network utilizes 5G-native, next-generation containerized firewalls. These firewalls include real-time threat correlation and dynamic security enforcement and integrate a high degree of automation to manage security efficiently. With these services in place, DISH can observe and control security across all network layers and locations, including the full stack of the containers and infrastructure, providing comprehensive protection. The Open RAN model ensures that DISH will be able to stay at the leading edge of security technology by working with best-in-breed security vendors now and in the future. DISH has chosen Palo Alto Networks, a cybersecurity leader based in California, to deliver firewall innovation and enable the secure digital transformation of DISH’s network.

III. GUIDING PRINCIPLES FOR THE WIRELESS INNOVATION FUND

a. NTIA Should Facilitate the Development and Testing of Deployable Solutions That Produce Measurable Real-World Return on Investment

Development of new Open RAN products and testing for commercial adoption in operator networks is critical to achieving full-scale deployment of these systems and thus advancing to the next generation of wireless connectivity. DISH supports academic research; for instance, it sponsors the National Science Foundation’s Platforms for Advanced Wireless Research COSMOS testbed.²² However, DISH believes that additional resources for applied research – such as real-world testing, trials, pilot deployments, and development of automation tools for deployment and life cycle management – are necessary to channel further research and development beyond academic settings toward commercial deployments where the return on

²² *COSMOS – Platform for Advanced Wireless Research*, Wireless & Mobile Networking Lab, <https://wimnet.ee.columbia.edu/portfolio/cosmos/> (last visited Jan. 25, 2023).

research investments can be evaluated via the performance of actual networks.²³ The Wireless Innovation Fund can support these important initiatives.

Grant dollars awarded for research and development of Open RAN solutions should yield a tangible return on investment.²⁴ For instance, large-scale trials in different settings in the United States would advance Open RAN security and performance, while leveraging competition to lower costs and accelerate real-world operational innovations.²⁵ In addition, the funding of specific features of Open RAN, such as network slicing, service orchestration, distributed cloud and edge computing, will facilitate standards configurations for open interfaces and promote integration in a multi-vendor system.²⁶

A recent report by the National Spectrum Consortium (“NSC”) on the capabilities of Open RAN testbeds across the U.S. suggests that “additional resources are needed to make it easier for more players (e.g., equipment suppliers, network integrators) to participate in both basic and applied research and development, and to deliver innovations that meet the greatest challenges of next-generation wireless connectivity.”²⁷ DISH agrees that additional interoperability and performance testing is needed to speed commercial deployments of Open RAN, and supports the NSC’s recommendation that NTIA fund advanced Open RAN research and development, which will in turn accelerate innovation and significantly expand the telecom supplier ecosystem.²⁸

To enable such testing, additional steps such as establishing a common set of test cases shared across Open RAN testbeds and developing automation tools for continuous integration, deployment, and testing are important.²⁹ Such steps can decrease time to market for functionalities and features of individual Open RAN sub-systems. Finally, testing and certification facilities and vendors should share learnings as contributions to O-RAN Alliance specifications in relevant industry working groups.³⁰

NTIA support for common standards across testbeds to promote consistent integration, deployment, and testing will enable facilities to conduct testing in a more efficient and streamlined manner that lends itself to “apples-to-apples” comparisons.³¹ Likewise, the establishment of “blueprints” for testing will guide operators navigating the interconnection of

²³ Public Wireless Supply Chain Innovation Fund Implementation, Questions #8, 14.

²⁴ Public Wireless Supply Chain Innovation Fund Implementation, Question #21.

²⁵ Public Wireless Supply Chain Innovation Fund Implementation, Question #10.

²⁶ Public Wireless Supply Chain Innovation Fund Implementation, Question #10.

²⁷ National Spectrum Consortium, *NSC Releases Executive Summary of Report on U.S. Resources and Capabilities for Accelerating Open RAN* (Jan. 24, 2022), https://www.nationalspectrumconsortium.org/2023/01/24/nsc_releases_executive_summary_01242023.

²⁸ Public Wireless Supply Chain Innovation Fund Implementation, Question #14.

²⁹ Public Wireless Supply Chain Innovation Fund Implementation, Question #14.

³⁰ Public Wireless Supply Chain Innovation Fund Implementation, Question #16.

³¹ Public Wireless Supply Chain Innovation Fund Implementation, Questions #8, 14.

hardware and software between multiple different vendors within one network.³² In addition, NTIA funding for participation in working groups will allow operators, vendors, and system integrators to share resources and lessons learned, thus improving the performance of incumbent players while encouraging new participants to enter the market a lower cost.³³

b. NTIA Should Boost U.S. Contributions to the Robust and Competitive Trusted Global Open RAN Ecosystem

DISH knows well the importance of a robust contribution from U.S. companies to the trusted Open RAN ecosystem, as most of its partners in its 5G buildout, including Mavenir, Amazon, Cisco, Dell, VMware, Intel, and Qualcomm, are U.S.-headquartered companies. As the ORPC noted in its response to this RFC, “Congress appropriated \$1.5 billion of U.S. taxpayer money for the purposes of advancing the interests of the United States and its workers and companies.”³⁴

Based on its own experience, DISH believes that these U.S. interests are directly related to the competitiveness of U.S. research institutions, technology innovators, and manufacturers – and also those U.S. entities’ contributions to a robust global market of trusted suppliers that U.S. network operators can draw on to build their networks. DISH has intentionally focused on U.S. headquartered suppliers in its network buildout and has also benefited from technology provided by entities such as Samsung, Fujitsu, and MTI that are headquartered in U.S. partner and allied countries, and they also have a significant presence in the United States. Therefore, DISH agrees with the ORPC in its assertion that:

[S]erving the interests of U.S. taxpayers will require [Fund] investments to be utilized by a wide variety of global operators, manufacturers, and research and development institutions. The interests of the United States and its companies and workers are best served by a robust and resilient trusted global marketplace of companies within the United States, and in partner countries with deeply integrated technology markets, that compete to develop and sell components and software for use at all layers of the network stack.³⁵

DISH recommends that NTIA consider companies or entities that have a significant presence in the United States eligible for Wireless Innovation Fund grants, on two conditions: (1) the entity is headquartered in the United States or a U.S. partner or allied country, and (2) the entity invests the funding from the grant on activities in the United States.³⁶ Such an approach will redound to the benefit of U.S. interests by increasing U.S. contributions to a robust and competitive trusted global Open RAN ecosystem.

³² Public Wireless Supply Chain Innovation Fund Implementation, Question #10.

³³ Public Wireless Supply Chain Innovation Fund Implementation, Question #23.

³⁴ Comments of the Open RAN Policy Coalition, Docket No. 221202-0260, at 9 (Jan. 27, 2023) (“ORPC Comments”).

³⁵ *Id.*

³⁶ Public Wireless Supply Chain Innovation Fund Implementation, Question #25.

IV. PARTICULAR AREAS OF FOCUS/INVESTMENT

a. Security

As explained above, DISH prioritizes security across all aspects of its 5G network and supports ongoing industry collaboration to ensure the integrity and resiliency of Open RAN network architectures. Because cloud-native Open RAN architectures take on many characteristics of IT networks, Open RAN networks face similar challenges. As industry experts have recommended in recent reports, Open RAN vendors and operators should adopt similar risk management and mitigation strategies.³⁷

At the same time, Open RAN architectures can provide substantial security benefits. For example, traditional wireless networks are challenged to adequately meet customers' future security requirements and expectations. This is because traditional wireless networks are built upon vertically integrated proprietary systems, which are based on closed-network security models. As today's customers seek greater control over their networks, data, and tools that optimize resources supporting their businesses, the cloud-native environment allows for dynamic orchestration and optimization of workloads in both private and public clouds.³⁸

NTIA should consider support for projects that help manage evolving security challenges in the network architecture, while optimizing use of the new security features afforded by Open RAN.³⁹

b. System Integration

As explained above, DISH is the leading system integrator, incorporating dozens of partners from across the world in its network. DISH performed its own system integration, using software and hardware from multiple vendors, and is the world's first true standalone Open RAN 5G network. But while much of the progress to date on Open RAN systems has focused on standardization of open interfaces between disaggregated sub-systems and compliance testing, the Open RAN community lacks a system integration certification.⁴⁰

To facilitate global adoption and deployment of Open RAN in the near term, Wireless Innovation Fund grants should support proposals that help address the system integration gap, not only for initial deployments, but also for ongoing operations.⁴¹ DISH agrees with the ORPC regarding the value of broad industry alignment on a "framework that (1) helps coordinate the entire roadmap and lifecycle process, from the pooling of requirements at an industry level to establishing a 'marketplace' of commercial-ready products and solutions, and (2) creates a

³⁷ ESF Assessment at 13-15; CSRIC Open RAN Report at 4.

³⁸ DISH Security White Paper at 3.

³⁹ Public Wireless Supply Chain Innovation Fund Implementation, Question #19.

⁴⁰ Public Wireless Supply Chain Innovation Fund Implementation, Question #12.

⁴¹ Public Wireless Supply Chain Innovation Fund Implementation, Question #10.

system release validation and certification process.”⁴² This certification program would reduce barriers to entry, both for network operators seeking to maximize the benefits of open systems and for new vendors seeking to enter the market.⁴³

c. Specific Projects Worthy of Wireless Innovation Fund Investment

DISH believes that in addition to meeting the grant criteria established by the statute that created the Fund,⁴⁴ the following projects would address gaps that persist in the field for deploying 5G open architecture networks quickly and affordably, with the ability to perform at scale, and therefore these specific projects are ripe for federal investment.⁴⁵

Hardware Development Projects

1. *Power Efficient Hardware*: Develop more power efficient hardware in new spectrum bands like millimeter wave (“mmwave”) and centimeter wave (“cmwave”), including Integrated Antenna and System on Chip (“SoC”) solutions, particularly in the 6-24 GHz spectrum band in consideration for 6G.
2. *Improved Components*: Invest in material research to develop lightweight materials and components to reduce the weight and dimensions for Open RAN equipment, thereby creating cost-effective solutions and enabling operators to meet sustainability goals.

Architecture, Platform, and Feature Design Projects

1. *Multi-Cloud Enablement*:⁴⁶
 - *Common Integration System (“CIS”)*: Develop CIS with abstraction layer for any cloud, enabling RAN applications to be with minimal integration effort.
 - *Technical Requirements and Testing*: Establishing minimum technical requirements and features for Telco Cloud to enable virtualized DU and CU implementation, with standardized test procedures to validate the performance.
2. *Open RAN as a Service (“ORaaS”)*: Develop innovative business models for faster and broader adoption of Open RAN and revenue generation, including multi-tenant

⁴² ORPC Comments at 18.

⁴³ Public Wireless Supply Chain Innovation Fund Implementation, Question #11.

⁴⁴ 47 U.S.C. § 906(a)(1)(C)(i)-(vii).

⁴⁵ Public Wireless Supply Chain Innovation Fund Implementation, Questions #9, 27.

⁴⁶ Multi-cloud enablement allows companies to operate applications or services in different clouds. More advanced multi-cloud enablement can enable the same application to be located on different clouds and portability of data between different clouds. Multi-cloud enablement increases reliability, accessibility, and efficiency by allowing operators to deploy workloads depending on different circumstances, like one cloud facing greater periods of heavy utilization or an outage. See Tom Howarth, *The art of Multi-Cloud enablement – is it worth it?*, Amazic (Apr. 6, 2021), <https://amazic.com/the-art-of-multi-cloud-enablement-is-it-worth-it/>.

deployment (“IaaS”),⁴⁷ along with flexible licensing models.

3. *Smart Orchestration*: Develop standardized reference architecture for smart orchestration to perform life cycle management of RAN network functions, along with full stack observability enabling automation, such as low touch provisioning for automation of Open RAN deployment.
4. *Enabling Verticals (Private Networks)*: Develop sector specific use cases, deployment models, and roadmaps for private network enablement that can benefit from scalable Open RAN design.

Software Development Projects

1. *Common Application Programming Interfaces (“APIs”)*: Develop industry common APIs that can be used by all Vendors for Zero Touch Provisioning (“ZTP”) for both Day 0 and Day 1 configurations and faster deployments.
2. *RAN Intelligent Controller*:⁴⁸
 - *RAN Intelligent Controller (“RIC”) Application Onboarding*: Enable easy and quick onboarding of cloud-native Kubernetes-based applications onto the RIC platform by developing standard APIs and testing framework.
 - *Cost-saving RIC Applications*: Develop RIC applications that save operational costs focusing on:
 - a. Network Automation
 - b. Energy savings
 - c. Modern radio frequency (“RF”) Optimization

Testing Projects

1. *System Integration*:
 - *Integration Labs*: Design lab environments that can facilitate and test system integration at the commercial deployment level, including simulations at scale to

⁴⁷ Multi-tenant employment (IaaS). Multi-tenancy is an architecture where a single instance of a software application runs on a server and services multiple customers (or tenants), with the resources controlled by one tenant separated and secured from other tenants. It improves agility, scale, and cost-efficiencies of Infrastructure as a service (IaaS) services. See *Multi-tenancy for Cloud*, Tintri (June 2020), <https://www.tintri.com/wp-content/uploads/2020/06/Tintri-At-A-Glance-CSP-Multi-tenancy-for-Cloud-160118T10271.pdf>.

⁴⁸ A RAN Intelligent Controller is a software-defined component of the Open RAN architecture that’s responsible for controlling and optimizing RAN functions. It brings multivendor interoperability, intelligence, agility, and programmability to RAN, and can enable the onboarding of third-party applications that automate and optimize RAN at scale. See *What is the RIC in Open RAN?*, 5GWorldPro (Sept. 12, 2022), <https://www.5gworldpro.com/blog/2022/09/12/what-is-the-ric-in-open-ran/>.

optimize performance; test evaluation of new software/hardware releases in the end-to-end ecosystem for performance and functional validation; and test evaluation of new solutions in a vendor agnostic Open RAN setup to increase innovation and competition.

- *Test Beds*: Develop test beds that can be used to demonstrate and conduct performance testing and integration for MNOs and also of exemplary use cases for multiple business verticals such as hospitality, manufacturing, healthcare, etc.
 - *Device Testing/Labs*: Establish certification and test labs that can be used for chipset and device suppliers to perform interoperability and performance testing with the Open RAN suppliers using standard tools and test cases.
2. *Global Test Repository*: Develop a repository for Open RAN proponents to gather common test object lists, test cases, and methods for uniform testing that can be automated for fast execution and shortening the release cycle of the software.

Skills Development Projects

1. *On-the-Job Training ("OJT") Programs*: Create OJT programs to hire and train engineers, software developers, data analysts and interns on development and operation.
2. *Open RAN Certification*: Create Open RAN certification programs based on capabilities such as Open RAN Associate, Open RAN Principal, Open RAN Solution Architect, etc., as such certification shortens the workforce hiring process.

V. CONCLUSION

DISH has accumulated valuable experience through its Open RAN deployment, giving it unique insights into the questions posed by the RFC and how to style the forthcoming notices of funding opportunity. DISH is eager to leverage its expertise and knowledge in this area in order to make Open RAN a competitive option in both 5G deployments and at the outset of the 6G development cycle, consistent with the Administration's goals. Specifically, DISH recommends that NTIA focus Wireless Innovation Fund investment on security and system integration, by pursuing the specific, concrete, and achievable projects identified above. We look forward to working with NTIA and other stakeholders throughout the grant process and beyond.

Respectfully submitted,

Jeff Blum
Executive Vice President,
External & Legislative Affairs

Sidd Chenumolu
Vice President,
Technology Development

Hadass Kogan
Director & Senior Counsel,
Regulatory Affairs

Michael Essington,
Senior Manager,
Public Policy

DISH NETWORK CORPORATION
1110 Vermont Avenue, N.W.
Suite 450 Washington, D.C. 20005
(202) 463-3702

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