

Questions on the State of the Industry:

Understanding the current state of the telecommunications industry is important to determining how any topics should be prioritized in the Innovation Fund, and what level of funding a topic should receive.

1. What are the chief challenges to the adoption and deployment of open and interoperable, standards-based RAN, such as Open RAN? Are those challenges different for public vs. private networks?
 - a. What are the challenges for brownfield deployments, in which existing networks are upgraded to incorporate open, interoperable, and standards-based equipment?
2. What ongoing public and private sector initiatives may be relevant to the Innovation Fund?
 - a. What gaps exist from an R&D, commercialization, and standards perspective?

There are at least 20 to 30 5G testbeds across the United States according to a recent National Spectrum Consortium survey. The majority of them are service provider testbeds that only do their own interoperability testing, industry testbeds that only work with their own products, national labs testbeds that only support 5G when it is a part of a larger project and defense testbeds which are all tactically driven. None of these testbeds have the ability or desire to support small startup firms which is where a lot of the ORAN innovation is going to come from. The rest of the testbeds are academic in nature and while they can fill the above gaps most of them are built exclusively on open source systems which are typically lacking in many features. The 5G Testbed at Texas A&M University as shown in the National Spectrum Consortium (NSC) surveys has by far the most comprehensive set of capabilities of any of the open testbeds in the United States. It contains both open source and commercial ORAN, has 5 cores. This testbed is currently supporting other universities, industry, the Department of Defense and the Department of Homeland Security.

- b. How might NTIA best ensure funding is used in a way that complements existing public and private sector initiatives?

There are very few 5G testbeds that: are open to small industry without having an existing relationship, have the administrative resources to support large grants and have a mix of open source and commercial 5G Core, RAN, MEC and Transport. The Innovation Fund should augment what has already has significant investment by funding full time support staff as well as operational costs for a 5 year period to ensure continuous operation.

3. What kind of workforce constraints impact the development and deployment of open and interoperable, standards-based RAN, such as Open RAN? How (if at all) can the Innovation Fund help alleviate some of these workforce challenges?

These testbeds should be used to help support workforce development. Systems installed could be partitioned to support training and education programs and expertise of operational staff could help to develop curriculum for vocational training as well as 5G ORAN specific undergraduate and graduate courses.

4. What is the current climate for private investment in Open RAN, and how can the Innovation Fund help increase and accelerate the pace of investment by public and private entities?
5. How do global supply chains impact the open, interoperable, and standards-based RAN market, particularly in terms of procuring equipment for trials or deployments?

Questions on Technology Development and Standards:

Understanding the current state of open and interoperable, standards-based RAN and the standards that inform its development will assist NTIA in maximizing the impact of grants.

Questions in this section will be used to assess the maturity of the technology and related standards to help determine which topics should receive additional investment.

6. What open and interoperable, standards-based network elements, including RAN and core network elements, would most benefit from additional research and development (R&D) supported by the Innovation Fund?
7. Are the 5G and open and interoperable RAN standards environments sufficiently mature to produce stable, interoperable, cost-effective, and market-ready RAN products? If not:
 - a. What barriers are faced in the standards environment for open and interoperable RAN?
 - b. What is required, from a standards perspective, to improve stability, interoperability, cost effectiveness, and market readiness?
 - c. What criteria should be used to define equipment as compliant with open standards for multivendor network equipment interoperability? [The development of an open standards conformance test suite built on open source code such as TTCN-3, administered by an ISO 17025 certified test facility with certification managed by someone like NIST or DHS CISA \(responsible for interoperability of critical infrastructure\). This certification system should reside in the open source community with the testing also being offered as a service so as not to exclude startups and small businesses. This model is currently in place for P25 LMR, and](#)

has been funded for Mission Critical Services (MCX) and NG 9-1-1. This is the Department of Homeland Security Certification Assurance Program or CAP <https://www.dhs.gov/science-and-technology/p25-cap>, This program could be combined with the ORAN Alliance OTIC program.

8. What kinds of projects would help ensure 6G and future generation standards are built on a foundation of open and interoperable, standards-based RAN elements?

Facilities that have the ability support use case testing for both 5G and 6G would go a long way towards promoting standards based technology.

Questions on Integration, Interoperability, and Certification:

Challenges associated with systems integration and component interoperability can hinder the adoption of open and interoperable, standards-based RAN. This section will help NTIA structure the NOFOs in a way that most effectively addresses these challenges and facilitates adoption. NTIA also welcomes feedback on the effectiveness of certification regimes in driving open and interoperable, standards-based RAN adoption.

9. How can projects funded through the Innovation Fund most effectively support promoting and deploying compatibility of new 5G equipment with future open, interoperable, and standards-based equipment?

- a. Are interoperability testing and debugging events (e.g., “plugfests”) an effective mechanism to support this goal? Are there other models that work better?

Yes they are effective as they allow vendor to vendor testing so industry does learn much from these events, but they are limited in value. They happen very infrequently, they take a long time to plan and conduct and their results are almost always kept strictly confidential. They should never be considered the only, or even the main form of interoperability testing.

10. How can projects funded through the program most effectively support the “integration of multi-vendor network environments”?

11. How do certification programs impact commercial adoption and deployment?

- a. Is certification of open, interoperable, standards-based equipment necessary for a successful marketplace?

Yes it is. History has shown us that without some sort of formal certification, some manufacturers will claim standards conformance when in fact it is not true. This results in the need for expensive interoperability gateways, an overall increase in costs and reduced functionality.

- b. What bodies or fora would be appropriate to host such a certification process? Most UE certification is done by the ATIS PTCRB today but ATIS is a member driven organization that is supported by the large service providers. Much of

implementation of ORAN is going to be enterprise (private) and small service providers and their specific needs will likely not be supported by ATIS. ATIS also does not do much interoperability testing as their members meet these requirements with their own internal testlabs. To resolve this issue in public safety DHS has established the own Certification process for things such as P25 LMR and NG 9-1-1 referred to as CAP or Compliance Assessment Program <https://www.dhs.gov/science-and-technology/p25-cap>. Under this program DHS determines the testing criteria, verifies the testing facilities and holds the certification of the product.

12. What existing gaps or barriers are presented in the current RAN and open and interoperable, standards-based RAN certification regimes?
 - a. Are there alternative processes to certification that may prove more agile, economical, or effective than certification?
 - b. What role, if any, should NTIA take in addressing gaps and barriers in open and interoperable, standards-based RAN certification regimes?

Questions on Trials, Pilots, Use Cases, and Market Development:

A key aim of the Innovation Fund is to promote and deploy technologies that will enhance competitiveness of 5G and successor open and interoperable, standards-based RAN. We have

seen a range of Open RAN trials, pilots, and use cases underway across the United States and internationally to date. This section will inform the types of NOFOs NTIA publishes and administers as the Department works to accelerate adoption.

13. What are the foreseeable use cases for open and interoperable, standards-based networks, such as Open RAN, including for public and private 5G networks? What kinds of use cases, if any, should be prioritized?
14. What kinds of trials, use cases, feasibility studies, or proofs of concept will help achieve the goals identified in 47 U.S.C. 906(a)(1)(C), including accelerating commercial deployments?
 - a. What kinds of testbeds, trials, and pilots, if any, should be prioritized?
15. How might existing testbeds be utilized to accelerate adoption and deployment?

This is a very important question. The testbeds such as the Texas A&M University System testbed have been in operation for almost 20 years now. We have learned how to adopt to new technology, how to leverage current assets to support new programs and how to support a broad base of industries. In addition, being a land grant university we have “service to the state” as a core mission. For example the State of Texas has provided \$50 million and the Texas A&M University System has contributed another \$80 million towards the construction of the Innovation Proving Ground (IPG) which includes the 5G testbeds. Investing in existing testbeds is more likely to assure the sustainability that is required to support 5G in the 2020s and 6G in the 2030s.

16. What sort of outcomes would be required from proof-of-concept pilots and trials to enable widespread adoption and deployment of open and interoperable, standards-based RAN, such as Open RAN?

There has to be a strong outreach element for any funded project. Helping to educate the industry and future customers is required for success. This is typically a part of most all current academic funded projects.

Questions on Security:

Strengthening supply chain resilience is a critical benefit of open and interoperable, standards-based RAN adoption. In line with the Innovation Fund’s goal of “promoting and deploying security features” to enhance the integrity and availability of multi-vendor network equipment, and Department priorities outlined in the National Strategy to Secure 5G Implementation Plan, this section will inform how NTIA incorporates security into future Innovation Fund NOFOs.

17. “Promoting and deploying security features enhancing the integrity and availability of equipment in multi-vendor networks,” is a key aim of the Innovation Fund (47 U.S.C 906(a)(1)(C)(vi)). How can the projects and initiatives funded through the program best address this goal and alleviate some of the ongoing concerns relating to the security of open and interoperable, standards-based RAN?

a. What role should security reporting play in the program’s criteria?

- b. What role should security elements or requirements, such as industry standards, best practices, and frameworks, play in the program's criteria?
18. What steps are companies already taking to address security concerns?
 19. What role can the Innovation Fund play in strengthening the security of open and interoperable, standards-based RAN?
 20. How is the "zero-trust model" currently applied to 5G network deployment, for both traditional and open and interoperable, standards-based RAN? What work remains in this space?

Questions on Program Execution and Monitoring:

The Innovation Fund is a historic investment in America's 5G future. As such, NTIA is committed to developing a program that results in meaningful progress toward the deployment and adoption of open and interoperable, standards-based RAN. To accomplish this, we welcome feedback from stakeholders on how our program requirements and monitoring can be tailored to achieve the goals set out in 47 U.S.C. 906.

21. Transparency and accountability are critical to programs such as the Innovation Fund. What kind of metrics and data should NTIA collect from awardees to evaluate the impact of the projects being funded?
22. How can NTIA ensure that a diverse array of stakeholders can compete for funding through the program? Are there any types of stakeholders NTIA should ensure are represented?
23. How (if at all) should NTIA promote teaming and/or encourage industry consortiums to apply for grants?
24. How can NTIA maximize matching contributions by entities seeking grants from the Innovation Fund without adversely discouraging participation? Matching requirements can include monetary contributions and/or third-party in-kind contributions (as defined in 2 CFR 200.1).

25. How can the fund ensure that programs promote U.S. competitiveness in the 5G market?
- a. Should NTIA require that grantee projects take place in the U.S.?
 - b. How should NTIA address potential grantees based in the U.S. with significant overseas operations and potential grantees not based in the U.S. (i.e., parent companies headquartered overseas) with significant U.S.-based operations?
 - c. What requirements, if any, should NTIA take to ensure “American-made” network components are used? What criteria (if any) should be used to consider whether a component is “American-made”?
26. How, if at all, should NTIA collaborate with like-minded governments to achieve Innovation Fund goals?

Additional Questions:

NTIA welcomes any additional input that stakeholders believe will prove useful to our implementation efforts.

27. Are there specific kinds of initiatives or projects that should be considered for funding that fall outside of the questions outlined above?
28. In addition to the listening session mentioned above and forthcoming NOFOs, are there other outreach actions NTIA should take to support the goals of the Innovation Fund?