TEG Response to NTIA Public Wireless Supply Chain Innovation Fund RFC

Submission Preamble

This submission is from the Telecom Ecosystem Group. We welcome this initiative by the NTIA which we believe will significantly boost investment in the telecom supply chain. The Telecom Ecosystem Group (TEG) is an informal organisation working to boost innovation and diversity in the telecom ecosystem with a particular emphasis on encouraging investment in start-ups and adoption of their innovative technologies by telecom operators. As an example of why we believe this to be important, we cite the accelerating industry discussions on 6G. In our view, 6G should be a foundation for revolutionary innovation that could transform industry and society in a manner last seen with the creation of the iPhone and broadband internet. However, today, the telecommunications innovation ecosystem lacks the imagination, richness and diversity required. Without a "re-seeding" of the telecommunications innovation ecosystem, 6G will be an incremental - damp squib improvement on 5G. Re-seeding has to start now to support the innovative entrepreneurs who will create the bold new 6G technologies and imaginative applications.

The TEG has a linked-in page here: https://www.linkedin.com/company/telecom-ecosystem-group/

We attach two documents: 1) Our answers to the RFC Questions (this document); 2) Our Recommendations for A Best Practices Framework for the Telecom Ecosystem

We commend our comments for your consideration and would welcome follow-up engagement to explore how our group can help ensure the PWSC Innovation Fund is directed to the right recipients and is spent wisely.

Introduction to the Telecommunications Ecosystem Group

The Telecom Ecosystem Group (TEG) exists to promote the development of a sustainable healthy telecom ecosystem that is attractive to start-ups and investors. As an example of why we believe this to be important, we cite the accelerating industry discussions on 6G. In our view, 6G should be a foundation for revolutionary innovation that could transform industry and society in a manner last seen with the creation of the iPhone and broadband internet. However, today, the telecommunications innovation ecosystem lacks the imagination, richness and diversity required. Without a "re-seeding" of the telecommunications innovation ecosystem, 6G will be an incremental - damp squib improvement on 5G. Re-seeding has to start now to support the innovative entrepreneurs who will create the bold new 6G technologies and imaginative applications.

The TEG has a linked-in page here: https://www.linkedin.com/company/telecom-ecosystem-group/

TEG Answers to the NTIA RFC

TEG answers are in italics. Where we do not have an opinion, we state "No comment".

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?**

   The chief challenges are that of:

   i. *Scaling the suppliers of Open RAN technology to meet the stringent demands of public network operators. These demands are: covering financial, technical, supply, security and safety liabilities. Providing 24x7 (global) support and logistics.*
   ii. *Competition from the incumbent legacy suppliers that have more mature and superior technology to Open RAN.*
   iii. *Integration into existing networks and operational support systems.*
   iv. *Interoperability, between software vendors particularly, but also between local hardware platforms and cloud infrastructures. I.e. Software needs to be both interoperable and independent of platform, physical, virtual, or any Cloud native.*

   Private networks are smaller and service more agile enterprises than the public network operators which reduces the scale of the challenges. In some cases the private network is a green field which mitigates the majority of the above challenges.

   Unpicking monolithic brownfield networks to incorporate some open components, even when those networks claim compliance with standards-based architectures, is an intensive and expensive task equivalent to, and in some cases more expensive than, replacing the brownfield network.

2. **What ongoing public and private sector initiatives may be relevant to the Innovation Fund?**

   The Telecommunications Ecosystem Group shares the same objectives as the NTIA to strengthen and broaden the Telecommunications Ecosystem. The TEG has a wide body of experience in telecommunications but is entirely neutral as it does not have commercial interests in any specific Communications Service Provider or equipment vendor. The TEG is thus well placed to provide unbiased inputs to NTIA.

a) What gaps exist from an R&D, commercialization, and standards perspective?

A very significant gap is the lack of an innovation ecosystem where R&D and start-ups can have open conversations with CSPs and incumbent vendors about their challenges. Today only incumbent vendors get to see the CSPs' RFPs. There is no open publication of commercial and technical challenges, driven by the need to protect intellectual property and promote competition by protecting service differentiation. As a result resources are wasted on developing and selling technology to CSPs that do not address their challenges.

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

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?

As evidenced by AT&T's partnership with Microsoft to run AT&T's 5G network we note that CSPs in general lack a workforce with the necessary cloud and open source skills. Mainstream generic Cloud skills (e.g. AWS, Microsoft Azure) are not sufficient as Open RAN, and other NFV use cases, requires significant development of generic Cloud software and capabilities to address the unique CSP requirements. One approach to address this with Innovation Funding would be to open-source the required knowledge base and fund open labs for training purposes (rather than R&D).

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?

Venture capital investment into technology, media and telecommunication companies is down in 2022 compared to last year, both in terms of invested capital and deal count. From January through October, venture capital investment in TMT companies totalled $141.61 billion on 10,672 deals compared to $226.73 billion on 15,066 deals for the year ending Dec. 31, 2021. This is not a good climate for private investment in Open RAN, the innovation fund can certainly help here.

See: https://realeconomy.rsmus.com/private-equity-investment-a-bright-spot-for-tech-media-telecom-companies/

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?

We need a better initiative than BuyIn; The world's biggest procurement alliance in telecommunication. The problem is that going for the lowest price point and global scale delivery just precludes small innovative companies, so for them there needs to be a different approach for innovative start-ups so they can build scale though the ecosystem and all can benefit.

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?

There needs to be a new approach to "Standards", more plug fests and less paper work we need to; harness the power of Open-Source projects, collaborative working between operators and vendors. The TEG and NTIA could play a significant role here.

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?

Incumbent vendors manipulate the standards to:

i. Embed their own intellectual property.
ii. Embed ambiguity that prevents interoperability to produce "lock-in" and allow product differentiation.

CSPs have reduced their investment and resourcing of standards activities. Some CSPs also fail to understand or leverage open source projects, whilst Venture Capitalists do not value open source developments.

b) What is required, from a standards perspective, to improve stability, interoperability, cost effectiveness, and market readiness?

Concerted effort, resourcing and funding, from stakeholders, CSPs and Government, to drive stability, interoperability, cost effectiveness, and market readiness into Standards. Allowing incumbent vendors to dominate standards activities will not deliver the desired outcomes.

c) What criteria should be used to define equipment as compliant with open standards for multivendor network equipment interoperability?

The Tier 1 CSPs have significant resources (>$ Billions) dedicated to testing network equipment interoperability for use in their own networks. The CSPs test against criteria that have taken months to generate and many months to test. Defining open standard test criteria is a significant R&D effort in itself that could be supported by Innovation Funding (some standards bodies develop their own test criteria).

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?

It is time for a major rethink here on how the Lego of elements for 6G services are defined, certainly we need standards to link components and we need a composable infrastructure of scalable micro services assembled into some consistent frame work with defined interfaces. We need real time interfaces between components and not just REST, we need to think about the data architecture as well and this is complex. Latency is an issue and real time geographic distribution of components as needs arise is also key. 6G should have a composable infrastructure which is optimised in real time by an AI layer of intelligence. How this AI layer will connect, be secured and operated is a largely missing in the standards space.

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?

No comment.

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

Plugfests are a necessary but not sufficient mechanism for compatibility of new 5G equipment. Plugfests only manifest and test a small part of the overall 5G and CSPs' systems. Creation of a national test facility supported by the CSPs, R&D institutions, standards bodies and government should be considered. The test

facility should be as complete representation of CSPs' systems and environments as possible (within the allocated budget).

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

Projects must integrate into the national test facility and should integrate into some open international test facilities

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

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

Certification is necessary but not sufficient. The value of certification varies according to the standards and motivations of the organisation offering the certification. Often certification carries no guarantee of interoperability.

b. What bodies or fora would be appropriate to host such a certification process?

No comment.

12. What existing gaps or barriers are presented in the current RAN and open and interoperable, standards-*based RAN certification regimes?*

No comment.

a. Are there alternative processes to certification that may prove more agile, economical, or effective than certification?

No comment.

b. What role, if any, should NTIA take in addressing gaps and barriers in open and interoperable, standards-based RAN certification regimes?

No comment.

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?

Today a 5G Open RAN testbed with a 5G Stand Alone core with an interoperable management layer would be the platform level. Use cases are mostly around testing the 5G services of today We need a completely new model for 6G.

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?

Scale and completeness of testbeds, trials and pilots is an important consideration. Better results may be obtained from fewer, larger more complete testbeds, trails and pilots than many small sub-scale testbeds, trials and pilots. It will also be important that these larger and more complete testbeds are open to wider participation. This will require consideration of how competing entities can share common test resources. Points again to the need for an independent test-bed serving the Global community

15. How might existing testbeds be utilized to accelerate adoption and deployment?

Existing testbeds are often sub-scale and individually only represent a small part of the CSP. Interconnecting these existing testbeds may help but only if the organisations can collaborate to realise scale and end to end testing (not simply an interconnection of many independent separate tests).

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?

Successful operation at scale and completeness. Proof of 24x7 operation including operational challenges such as in-life software upgrades and hardware repair/replacement. Delivering service to end customers through complete concept to market, lead to cash and fault to repair processes.

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 multivendor 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 multivendor 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?

Projects/organisations submitting requests for funding should state how their project will be "secure by design" and specify which security best practices they will implement.

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

Program participants should report any discovered security flaws and breeches to the program. It would be reasonable to request participants to provide proof of implementation of the selected security best practices. Penetration testing of the project by a third party should be considered.

b. What role should security elements or requirements, such as industry standards, best practices, and frameworks, play in the program's criteria?

Implementation of industry security standards and best practices should be an essential requirement of any project participating in the program. Participants should list the best practices and standards they will implement as part of their application for funding. The program should evaluate the application statements to check they are sufficient.

18. What steps are companies already taking to address security concerns?

No comment.

19. What role can the Innovation Fund play in strengthening the security of open and interoperable, standards-based RAN?

The program could fund a publication of recommended security standards and best practices for participants to use. This needs to take into account any novel aspects of the technologies being developed that would mean existing best practices would not be fully applicable. The program could fund third party penetration testing of projects.

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?

No comment.

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?

Impact is best measured by implementation in live CSP networks. Given the long time required for technology to be implemented in CSPs then it may be that in the early years of the project nothing is implemented in live CSP networks therefore progress towards implementation in live networks can be measured as:

i. *Progress of the technology through Technology Readiness Levels.*
ii. *Engagement of CSPs. This should be measured on number and seniority of CSP employees engaged with recognition biased towards operations e.g. in order of preference: operations, engineering, architects, research.*
iii. *Awardees' deliverables endorsed by CSPs, especially: business cases, designs, system architectures, test plans, test results.*
iv. *Testing in CSP labs by CSP employees.*

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?

Stakeholders who can contribute to building innovation ecosystems should be represented.

23. How (if at all) should NTIA promote teaming and/or encourage industry consortiums to apply for grants?

Cross-industry consortiums should be encouraged as this helps the development of the innovation ecosystem. Some of the funding could be set aside specifically for consortiums. The criterion for consortiums should be carefully constructed to:

i. *Promote consortiums with a genuine goal of eventual implementation in a CSP. A CSP should be able to provide a clear plan as to when, where and how the technology would be deployed.*
ii. *Include participants from CSPs in addition to researchers e.g., have sponsorship from an operational or commercial executive.*
iii. *Participants in the consortium are aligned on common goals at the same technology readiness level (a mismatch in targeted TRLs between participants could indicate the consortium is simply a construct for many individual organisations to get funding).*
iv. *Have a mix of organisations that would **not** normally work together e.g. avoid a consortium of only CSPs and incumbent vendors or a consortium of Universities and start-ups that have previously worked together or where the start-up is a University spin-out.*

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).

No comment.

25. How can the fund ensure that programs promote U.S. competitiveness in the 5G market?

No comment.

a. Should NTIA require that grantee projects take place in the U.S.?

No comment.

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?

No comment.

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''?

No comment.

26. How, if at all, should NTIA collaborate with like-minded governments to achieve Innovation Fund goals?

Like minded governments will have similar funding programs to the NTIA. The other governments funding organisations could be approached to discuss the joint funding of consortiums, where the NTIA would fund USA participants, and the other governments their own participants. See Eureka | Home (eurekanetwork.org) for an example.

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?

Much research and innovation resources are lost, do not achieve the end-goal of implementation in CSP networks, because they have not understood how to engage CSPs and address the CSPs' challenges. Whilst many CSPs are resource constrained and cannot possibly engage all the innovators and entrepreneurs targeting telecommunications (5G, 6G). The NTIA should therefore consider funding initiatives that address this. Such initiatives could include: ones targeting building an innovation ecosystem specifically for telecommunications, publications/advice for start-ups in the telecoms sector, documentation of CSP challenges and requirements, forums to bring CSP executives and innovators together with the purpose to inform innovators of the CSPs' challenges and optimise how CSPs' downstream innovations.

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?

The Telecommunications Ecosystem Group would welcome discussions with the NTIA about ideas to achieve our common objectives.

End of Telecom Ecosystem Group Response