

Public Wireless Supply Chain Innovation Fund Implementation

National Telecommunications and Information Administration

[Docket No. 221202-0260] RIN 0693-XC053

Battelle Memorial Institute, a non-profit organization focusing on bridging science and technology is pleased to respond to the NTIA request for comment to support the deployment of Open RAN.

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?

Global supply chains, their lack of predictability, and order of magnitude pricing discrepancies have hampered the ability of new innovators to drive the performance and economic benefits of the standards-based RAN market. Ultimately standards-based RANs must provide value differentiation to achieve broad adoption and deployment. Standards provide access to innovative companies and business models into the market to create that value differentiation, but the risk and costs in obtaining fundamental components through global supply chains are a key blocker in investment into innovation. For example, our business received an invite to trial a small number of highly differentiated RAN components. A key micro-electronic component had a year and a half lead time creating a challenging business decision to either agree to the demo and reserve static resources for that time or focus outside of the standards-based RAN market where availability risk was lower risk. New market entrants do not have service level agreements for availability and pricing, relegating domestic innovation to the pace of distributors receiving stock. One should not expect a global, high-volume component manufacturer to treat low volume buyers the same as high volume incumbents. The CHIPS act works over many years to increase domestic supply, and therefore increases predictability and availability; in the interim the government could support new entrants through aggregate buying and strategic reserves of critical components, accessible to companies that are accelerating national objectives with a demonstrated need for those components.

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?

An open-source Distributed Unit (DU) and Central Unit (CU) reference design are critical needs to support industry adoption and innovation within standards-based RAN. Industry's current tendency is to favor vertically integrated suppliers delivering the full Radio Unit (RU), DU, CU and core stack. While these suppliers support open standards through compliance or 'in spirit', the result is ultimately a pseudo-open system where the stove-pipes, the standards-based RAN approach aims to eliminate, are maintained. If a non-disclosure agreement is required to integrate two standard compliant components, a standard does not truly exist. Through creating a reference implementation of the DU, the stove-pipe is cut at the middle, rather than at the edge (as core and RU investments provide). Vertical integration can successfully resist intrusion from the edges, but is ultimately disrupted by changes in the middle. Current 'open' instances of the DU are either not defined at standard boundaries, are extremely low performant, or provided as binary blobs sourced from foreign nations. A reference design in the middle enables innovations to happen on that component, either through improving the performance or hosting the function more efficiently, but also at both edges, and in a trusted manner.

A second opportunity is investing in domestically produced, frequency agile, highly performant coherent MU-MIMO radio units that would be purchasable in low quantities by research institutions and innovation drivers. A key challenge to algorithm development and the deployment of AI/ML, particularly on the RAN intelligent controller (RIC) is the access to physical spectrum through the RU with such advanced features. It is nearly impossible to procure single unit quantity RUs. Software defined radios are often used, but require an abstraction layer and complex integration. There is good reason to make high power radio transmitters generally unavailable. But a test instrument power classification unit with some FCC leniency on coherent beam forming EIRP when tested within laboratory environments, would be greatly enabling.

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?

Projects that de-risk a mobile network operators long term performance, stability, and reliability concerns using 5G design models will provide the impetus for their driving of 6G standards into the standards based RAN direction. Domestic mobile network operators are rightly risk adverse, with high reliability constraints and costs to acquire customers. Particularly, confidence needs to be built in outdoor environments serving customer loads. These projects must be long duration, not contrived use cases, and using heterogenous suppliers for a variety of components. A motivated entity who is not the network technology provider should be accountable for its operation to act in the place of the mobile network operator. These projects could be encouraged through access to government lands/facilities and access to spectrum. Further, to ensure active participation of US entities, deference should be given to domestic suppliers that design and build their equipment and software on shore instead of white-boxing foreign devices.

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?

The plug-fest approach is useful, but limiting in that it simply tests the ability of two systems to interoperate. A plug-fest does not solve the problem of creating and demonstrating a value proposition for standards-based RAN. Two vendors can simply verify interoperability and then shelve the product while vertically integrated sales are favored. A value proposition of standards-based RAN is that the best price-performance point can be chosen for a particular application, maximizing network cost efficiency. A plug fest should have a targeted performance metric and be deployed sufficiently long for that measurement to be validated. For example, a power efficiency plug-fest could see teams form that target creating the lowest operating power per EIRP and bandwidth, and after the first round the best performing RU, DU and CU components are down-selected and mixed to create new teams for the second round, and continue until an optimum is demonstrated. The operating costs saved are then computed and compared to the best vertically integrated system. This approach benchmarks the system, and shows that standards-based RAN is competitive, or what is needed to become competitive. Other performance metrics could be driven, such as for a DoD operate through test range, frequency and bandwidth agility would be key needs to mimic diverse environments; a small cell metric could measure size per performance; a sensitive site could measure security and so forth. When companies are paid for 6 months of work integrating their components together, they will integrate their components. If they are paid for 6 months of work to demonstrate a key performance parameter that differentiates standards based RAN, they will instead demonstrate that performance parameter.

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

The government should first fund prototyping, test, and evaluation of individual components (e.g., RU, CU, DU) with critical value proposition improvements in isolation so that it is ensured that vendors have focused on creating differentiated performance of a component, which ultimately creates the business case for standards-based RAN. For example, a DU vendor could be funded to improve the power performance without sacrificing throughput. Then fund the integration of the components to create best in class pairings that are from multiple vendors. Without encouraging differentiation of the components, there is no impetus to integrate across multiple vendors, and the standards-based RAN itself is the value proposition. As NTIA recognizes through the requesting this information, to date, simply being standards based is not a sufficient value proposition to accelerate commercial deployment.

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?

The efforts funded should show one or more key figure of merit that is desired by network operators, and potential operators, and extend that effort over sufficient period of time to create reliability and maintainability metrics, while also demonstrating those vendor’s ability to support the network operation and maintain a minimum service level. These studies must begin at a component level and go through integration levels. The approach of funding only integrated and complete systems thus far has not resulted in a surge of innovation or disaggregation of the stove pipes. The trials should ultimately show how the technology will reduce total cost of ownership via capex/opex reduction, or market growth through new verticals and capabilities. Reducing capex could use trials that result in lower expenditures to deploy the network per unit bandwidth, including permitting, installation, networking, verification, etc. Opex reduction could use trials that show reduced power, increased reliability, decreased lease rates etc. These trials could begin at the component level, move through plug-fest and down-selection, and ultimately move to a trial deployment of hundreds of units on a base or campus. While using turn-key vendors for trials and deployments is an efficient buying approach, particularly for federal customers, using a singular turn-key integrator naturally precludes an optimization of components.

For growth in new verticals, trials could focus on medium density suburb fixed wireless access (throughput per unit size), sensing networks (range), vehicle to everything communications and enterprise. The federal government could further drive enterprise deployments through CMMC compliance recognizing the superior security architecture of 5G over WLAN for corporate networking to encourage participation in experiments, while also giving enterprise customers added capability.

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

Highly favor participants who have a domestic supply of software and can produce an accurate software bill of material and are capable of submitting to a software audit. Funding of red team analysis of the interfaces is also of great importance.

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?

The NTIA should ensure that both commercial and traditional federal contractors can compete utilizing contract terms for which they are familiar. For example, commercial companies will tend towards firm fixed price contracts because of their accounting systems, while federal contractors will tend towards cost plus type contracts due to risk. Specifying a specific type of contract can preclude participants. While

commercial industry growth is targeted, much innovation is spurred, particularly in the RF realm, from the defense industrial base and these participants should not be discounted simply because of the commercial objectives.

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.?

Yes. While an overarching goal is for foreign countries to select U.S. products over others, if the other goals such as crossing the digital divide at home are of importance, the particular needs of the U.S. market should be emphasized.

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?

A critical need is generating the domestic talent pool to ensure the U.S. leads in the development of 6G networks. A second need is ensuring the security and integrity of our mobile networks which are critical infrastructure. Science, engineering, integration and management of projects should be domestic to mitigate concerns of developing foreign talent and security threats. Foreign ownership maintains a domestic talent pool but could impart other security risks. Ultimately the talent pool and not the individual company will drive U.S. leadership provided the company does not usurp security controls from domestic staff.

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”?

NTIA should ensure that “American-made” components are used. American Made should be measured on a sliding scale using three categories, location of design, assembly, and software creation. A vendor should supply where the final integrated design, assembly, and software are produced. For any sub-component over a threshold, say \$1k at single unit, non-negotiated prices the vendor should provide a location of design and location of assembly. A component could be designed and assembled in the U.S., but run foreign software. Such a system would not be American-Made, but be viewed more favorably than a component assembled in a foreign nation, and selectable in the absence of a component that was designed, assembled, and running domestic software.