

Proposal Title: NEXTT: Nebraska Experimental Testbed of Advanced Things
PI: Mehmet Can Vuran



February 27, 2019

Dear Mehmet Can Vuran,

The Platforms for Advanced Wireless Research (PAWR) Project Office (PPO) would like to thank you and your team for the hard work that was evident in your response to the PAWR Request for Proposals (RFP). Based on a review process designed in consultation with and monitored by NSF and members of the Industry Consortium, your proposal was **recommended** to proceed to the site visit phase.

As part of the review process, the PPO engaged an external panel of non-conflicted expert reviewers spanning academia, industry, federal agencies, and local communities who provided detailed feedback about each proposal. The panel was specifically focused on the programmatic, technical, research, and community engagement elements of each proposal. A summary of the panel's specific comments is attached to this message, and we encourage you to carefully consider all of the feedback in this summary. In particular, we recommend that you carefully consider the following subset of the panel's site visit questions:

- How does the police camera streaming relate to the other testbeds? What is the synergy in this domain? Is there any contingency for privacy-related issues?
- Provide a walk-through to the bring your own device (BYOD) idea. What are the necessary steps to integrate proposer-developed RF hardware?
- Provide a sample experimental workflow using the access portal to perform experiments from a remote place.

Please note that this site visit question list is not meant to be exhaustive. We will be sending you additional guidelines and questions to help prepare for your site visit based on the PPO's analysis of the proposed budget, the facilities, equipment, and other resources specified, and the operational and management capabilities discussed.

Your site visit has been scheduled from the morning of March 19th through mid-morning of March 20th. Please confirm that these dates remain acceptable to you and your team via one response to this email by the end of the day on Thursday (February 28). Later next week, you will be receiving additional questions from us to help prepare for your visit. We will also be reaching out next week to schedule a call to discuss these questions and other logistical details of the site visit.

Thanks again,
PAWR Project Office



Vision and Technical Merit

Strengths

- The proposed NEXTT platform (Nebraska Experimental Testbed of Advanced Things) is incorporating a tremendous amount of uprising wireless technologies for a wide range of applications ranging from real-time video streaming to urban underground monitoring to real-time soil monitoring, thus covering a huge variety of mobile and stationary applications both urban and in the agricultural environments.
- Overall, the proposal is extremely balanced between suggesting novel disruptive and transformative research and in-depth discussion of possible wireless communication technologies. The proposed platform has a strong focus on emerging (understudied) frequency band, from mmWave radio to TeraHertz to infrared. It is highly likely that the proposed research platform will succeed in facilitating transdisciplinary research on a variety of applications.
- The development plan is technically sound and builds upon expertises of all involved PIs. They demonstrated their ability to work on large-scale experimentation in the past and outlined consequent and still ambitious new road for covering almost all possible wireless communication technologies in a comprehensive testbed. This includes the X-haul platform for high level SDN control and communication technologies such as mmWave, underground communication, THz communication in combination with more standard spectrum sharing and broadband communication. The platform will interconnect all experimental stations using a high-speed fiber network, which is capable of even transporting high bandwidth signal samples for later post processing. The open source ORCA SDR system builds a common basis for many experiments.
- All platform details are outlined in sufficient detail to understand all concepts of the system architecture and the experimental platforms. Furthermore, clear evidence is provided for awareness of other testbeds and research projects. The testbed would nicely complement existing PAWR sites.

Weaknesses

- Multiple verticals and segmented testbed(s) for each had a loose inter-connection description. A synergistic or complementary vision is desired for such an ambitious project.

Research Community

Strengths

- The proposal received commitment from more than 35 academic researchers and significant (and concrete) contribution from local communities (from fiber backbone, supercomputing facilities, to software development).
- The geographical coverage of the academic users (in the US) is impressive. All these users are leading experts and it is very likely that the projected experimentation platform will lead to novel experimental solutions beyond current state of the art. All system parts from IoT to 5G to THz to video streaming to cloud and fog are covered by experts in the field.

Community Engagement

Strengths

- The NEXTT platform has a user range from all over the US with a core in Nebraska. Local companies and institutions support both deployment and operations of the platform and will also be able to help sustaining the efforts.
- NEXTT plans to install an organizational structure that will help to coordinate effectively between all key stakeholders.



Weaknesses

- Limited discussion of public engagement and ongoing inclusion. Not necessarily important for the underground or agricultural testbeds, but the real-time streaming of body worn video will require careful community stakeholder management to prevent backlash or development of limiting regulation.
- There is no detailed plan for regular coordination within the team of diversified key stakeholders.

Alignment with PAWR Vision

Strengths

- The proposal demonstrates an excellent alignment with all elements of the PAWR vision.
- Diversity: NEXTT supports a wide range of current and upcoming wireless communication technologies and offers room for experimentation beyond current standards
- Reproducibility: an RF database is planned for storing large scale experimental scenarios down to raw radio level signals. Such database is an outstanding tool for carrying out reproducible experimental on novel radio technologies
- Interoperability: the use of the ORCA system helps supporting interoperability even though hand-tuned SDR code is the counterexample for interoperability; the proposal also aims using ExoGENI for supporting existing NSF-funded network testbeds and there is a strong focus on using standardized protocols wherever available
- Usability and reprogrammability: both aspects are addressed by a hierarchical programming environment covering all testbed components including ORCA for the physical layer.

Implementation Plan

Strengths

- The proposal includes a concrete implementation plan, which is feasible and carefully developed for each sub-component. It particularly emphasizes on early deployment of first experimental nodes and functionality. This helps integrating a wide user base from an early project phase to learn about their needs and fine-tune the developments.
- All tracks (software, smart city IoAT, rural broadband, mmWave, underground, THz) are running in parallel, so that each team can enable a stepwise development of the track's testbed functionalities.
- The involved teams have an excellent track record and will be able to develop and operate the experimental testbed throughout the project.

Weaknesses

- It was not clear as to how the police camera streaming relate to the other testbed(s)? What is the synergy in this domain? Is there any contingency for privacy-related issues?
- The support of the ORCA control framework for wireless substrates and the description of the augmentation and enhancements needed was found lacking.

Sustainability Plan

Strengths

- The plan is operate NEXTT as a strategic investment in a start-up operation. A business plan has been carried out to enable long-term sustainability for the project. In particular, local stakeholders in Nebraska will team up to catalyze public-private partnership collaborations to ensure continuous funding for the testbed. Several companies have already committed to

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continuously add nodes and capacity to the system in the first five years and will likely continue doing so if the system is running and enabling novel types of experiments.

- Nebraska has an economic development concept that also supports local industry to join academic R&D grants and, thus, the testbed. Overall the operational model appears to be sound and financially sustainable at the long run.

Weaknesses

- There is limited discussion of anticipated feasibility to cover sustainment costs.