***AINetANTX* Networks Prize Challenge Q&A**

Updated 16 July 2021

1. **Where can I find the White Paper and Quad Chart Template?**
    a. Please see **White Paper Submission Guidelines** and **Quad Chart Submission Guidelines**. They are hyperlinked at "Appendix A" and "Appendix B."
2. **Do we need to have a SECRET clearance to attend or participate in the Networks Challenge?**
    a. No, you do not need a clearance to participate! The competition is UNCLASSIFIED.
3. **Do we need to have a SECRET clearance to attend or participate in the AI Challenge?**
    a. No, you do not need a clearance to participate! The competition is UNCLASSIFIED. However, a Common Access Card (CAC) is required for the AI challenge.
4. **Does the "Naval Force" refer to only traditionally associated Naval assets such as ships and submarines? Does it include elements for other Services or expeditionary forces? I.e., does my submission need to be specific to only traditional Naval Force use cases?**
    a. Great question! The test scenarios will encompass platforms for land, surface, sub-surface, and air. However, we are looking for general-use protocols that are radio-independent. Note that the solution needs to work in existing networks. Radios and hardware are beyond the scope of this competition.
5. **We have technology that may be applicable to this competition, but it is tied to our hardware. There may be an issue in compatibility with a virtual environment, which may not accurately portray the results our system is capable of achieving. Can we still participate, and what allowances are provided in the challenge for unique solutions?**
    a. Great question! We are seeking technologies that can be deployed in existing Navy networks rather than field new hardware, and therefore evaluating new radios are beyond the scope of this competition.

        We are using a network simulator to approximate interference and other channel effects on transmissions. If the radio can output via ethernet, rather than RF, it can be evaluated in the simulator, however, that is beyond scope.

        We are interested in algorithms and protocols that would work well in a system-of-systems environment, and if you can extract the routing protocol, that might be more applicable to this challenge.

        While we are looking for a purely software solution for this challenge, we understand the complexity of moving your software to a new environment in a short time-frame. We will be allowing participants a choice between CentOS or Android docker solutions. However, we cannot allow the use of out of band information (e.g. GPS location information).

These requirements are driven by our desire to potentially field the solution in legacy Navy systems in the near term, where adding new hardware will be infeasible for many reasons. We do appreciate your enthusiasm for the challenge and hope you can participate.

6. **We are an international company. Is this challenge open to non-U.S. companies?**
    a. Thank you for your interest, but per the Prize Challenge eligibility requirements, participant entities must be incorporated in and maintain its primary place of business in the United States.
7. **What Technical Readiness Levels are required for this Challenge?**
    a. It should be at least TRL 4. We are looking for effective solutions that needs to be at the point where it can be evaluated. In this case, that means that it must run as a system in Linux containers in a simulated network.

    NAVWAR may award, pursuant to Title 10 U.S.C. § 2371b, a follow-on prototype agreement or transaction, or Limited Procurement for Experimentation Title 10 U.S.C. § 2373 to one or more participants who successfully demonstrate an operationally relevant networking technology during the Challenge. If the selected technologies are not yet mature enough for prototype awards, other agreements such as Cooperative Research and Development Agreement (CRADA) may be utilized. This Challenge, however, does not in any way obligate NAVWAR to procure any of the items within the scope of this challenge from the winners. For full language, please see **Agreements**.
8. **Does our product have to be FedRamp Certified prior to the submission?**
    a. No, it does not have to be FedRamp Certified.
9. **Can we reuse and update open source code and technology to use as part of our submission?**
    a. Yes, as long as you have the rights to do so according to the licensing of the software. However, one of the requirements of the challenge is no dependency on the MAC or PHY layer, therefore DLEP interface to the radio will not be allowed.
10. **Does our product need to be compatible with any existing fielded GOTS / COTS software?**
    a. It does not need to be compatible with any existing software. It must route packets generated in a Linux container out to the determined interface.
11. **What are the threshold and objective requirements for latency?**
    a. No threshold objective on latency, but lower is better. Longer latency will probably result in lower goodput, which will also have a negative impact.
12. **What are the threshold and objective requirements for throughput at each latency?**
    a. This challenge is not focused on QoS (though we do have this scoped for a future challenge), therefore there is no defined threshold for throughput, but you should maximize goodput.

13. **What transport do we assume to be operational?**
    a. Flows will use UDP or TCP at the transport layer. You can create tunnels between nodes as part of your routing protocol and of course balance the tradeoff of a better transport with the added overhead. Let us know if this does not answer the question and you meant something different.
14. **As an academic institute, we have several departments and schools. Would a submission from us be considered as a single academic entity or does the department or school constitute an academic entity?**
    a. Individual academic departments may submit one entry.
15. **Are you looking for a means of connecting end point to the network or are you looking at securing that communication once already established?**
    a. Consider a multi-hop radio network, where the radios can communicate if they are within range. They are already "connected" to the network in this sense. We are looking for an efficient means of setting up routes so that packets from applications connected to any of the radios will show up the right destination radio.
16. **What do you mean regarding "low kilobit per second data rate links?" What qualifies as "low?"**
    a. We are targeting links/networks that are 10kbps – 500 kbps.
17. **Please clarify "dynamic and unpredictable connectivity based on locations and radio frequency (RF) channel effects," i.e., are you looking to make your communications more dynamic and unpredictable (thus LPI/LPD) or are you describing the constraints in which our solution needs to operate?**
    a. This describes the constraints. LPI/LPD is relevant, but not a consideration for this challenge. Specifically, "dynamic and unpredictable connectivity..." describes the operating environment in which the solution should work.
18. **Is there a formal Performance Work Statement (PWS) that we can get in order to submit to the challenge?**
    a. All information pertaining to the challenge is located at the challenge.gov postings for the AI and Networks AINet ANTX Challenges. There is no Performance Work Statement (PWS) connected to this challenge as this is not a procurement; however, NAVWAR may award, pursuant to Title 10 U.S.C. § 2371b, a follow-on prototype contract or transaction to one or more participants who successfully demonstrate an operationally relevant networking technology during the Challenge.
19. **In the Challenge announcement, it states "Team entries or commercial entity entries must have an individual identified as the primary point of contact and prize recipient. By submitting an entry, a participant authorizes his or her name and organization to be released to the media if the participant wins the prize." Is it possible for multiple such entities to comprise a single team?**
    a. Yes, a team can consist of members from different entities.
20. **Will efforts for undersea acoustic comms also be of interest?**

a. The scope of this challenge includes RF comms. However, acoustic comms is of general interest to us and there may be a future challenge that includes this.

21. How does SATCOM play into Networks Challenge, is T-SCAN SBIR relevant, is WiFi6 or WiFi7 of interest at the edge with Commercial Solutions for Classified (CSfC) based wireless security.

a. Not specifically. The networks prize challenge is seeking layer 3 routing protocol layer technologies for RF networks which may route over SATCOM, but the SATCOM aspects would not be exposed to participants.

22. What level of RF conditions knowledge can be assumed?

a. Very limited RF condition data is available in the scenario and data provided. You may have to deduce conditions based on observed effects. Any other non-obvious assumptions contained within your submission should be explained in the white paper or demonstration materials.

23. Is a hop like a layer 3 hop (in the traditional sense)? Or is it the multi-hop feature of BGP?

a. Yes, this challenge is focused on Networking layer, or layer 3 routing protocols.

24. This example will need caching to allow disruption tolerant data plane operation? Are you saying we can drop the packet if there exists no paths between a source and a destination?

a. For this challenge, we are assuming packets may be dropped. Future challenges may focus on DTN, but this is not the focus for AINet 2021.

25. Is ubuntu container ok? or you prefer redhat/centos?

a. We generally prefer redhat/centos, but if this is a showstopper for your specific technology submission, this is something we can discuss during the integration workshop.

26. Will the router MAC address be available?

a. You will have access to the containers and their local MAC addresses. However, requiring MAC addresses in configuration will be a burden in deployment, and should be avoided. If you had a way to figure out the local MAC addresses, that would be preferred to configuration. Same applies to remote MAC address, you can use signaling or ARP tables, but should not rely on configuration.

27. Are the parameters for the Network challenge being discussed here assumed to be the environment (architecture + infrastructure) for supporting AI solutions?

a. The parameters, architecture, and infrastructure for the Network and AI challenge are separate with little to no overlap.

28. I assume routing protocol has to work across multiple heterogeneous networks with both IP and non-IP based?

a. Yes, these technologies should be applicable to multiple and heterogenous systems of systems architectures. However, this will be abstracted away for this challenge and all networks will appear to be IP based.

29. Can we create arbitrary control signaling for information exchange between neighbor nodes?

a. Yes. You can write your own packets. There is no restriction on this element.

30. Will test data packages be provided? If so, would data have any metadata (age, quality, event info...) to help with prioritization?

a. Quality of Service routing is not the focus of this particular prize challenge. Future AINet prize challenges may look at QoS aspects.

31. Should it be assumed that the data creation nodes have specific known/intended end node(s) (IP address) that the data is intended for?

a. Yes the data creation nodes have an origin and are fixed.

32. Can you discuss the level of fidelity in your Simulation Based Environment? For example, how have the simulation results it provides been verified and validated against real world performance?

a. Our models have been built to spec and validated against high fidelity computations e.g. RF Builder.

33. Can we assume there's a central routing controller that other devices can always communicate with, or is the kind of desired routing protocols more distributed in nature, i.e. running among the radios themselves?

a. You should assume a distributed network with no central routing mechanisms. You may use a central controller and SDN-like approach, however there is no stable back channel for coordination, so you will have to deal with link failures.

34. Are we considering wireless (RF) links only between the nodes or can we assume a mix of wireline and wireless links between nodes (e.g: assuming a land based connectivity requirement between Naval H/Q & Command Center nodes)?

a. For the Networks prize challenge, we are focused on multiple, heterogenous, RF links connecting highly distributed nodes.

35. Are protocols / algorithms that implement Quality of Service / Traffic Engineering on top of existing routing protocols in scope for the networks challenge?

a. No, Quality of Service routing is not the focus of this particular prize challenge.

36. Can we assume the 5G Integrated Access & Backhaul (IAB) based solution & 5G Sidelink (Direct device-to-device) solution; where ever necessary for the Wireless links between nodes requirement?

a. Not specifically. For the Networks prize challenge, we are focused on multiple, heterogenous, RF links connecting highly distributed and dynamic nodes.

37. Is the Network totally closed off, i.e., there is no internet connectivity?

a. The simulation environment is contained in a VM. Within the scenario it is assumed to be closed off from the internet.

38. Will application traffic have different QoS/ToS (e.g. chat vs shooting instruction)

a. No. Quality of Service may be a focus of future AINet Prize Challenges.

39. Will the submission be graded differently based on whether one uses IP routing tables vs raw sockets?

a. That would fall under assessing the ease of transitioning the technology into existing architectures. IP routing tables help to plug and play technologies within relevant architectures, other approaches are not a show stopper.

40. **Apart from the latency & overhead reduction requirements, would congestion control also to be considered as an important requirement?**
    a. Congestion control is not a direct metric that we are looking at in this challenge.
41. **Can you talk about the size of the network? Approximately how many nodes?**
    a. Yes, you should anticipate that technology submissions will be evaluated in architectures with between 20 and 30 nodes.
42. **What are the sources of variation of link quality besides the platform movement?**
    a. Platform movement is a primary factor. Interference from other networks and background noise are the other main contributors to the variation.
43. **To what extent will existing (quantitative) results be evaluated in the whitepaper due on July 27th? How will you compare reported results across participants?**
    a. Any quantitative results that can be provided will be very insightful. It is also recommended that you include analytics and extrapolation of any results.
44. **What IP layer(s) is the solution expected to run in, considering that an IP Layer categorization is generally Application Layer, Transport Layer, Internet Layer, Data Link Layer, Physical?**
    a. The focus of this challenge is on the network layer. Future prize challenges may be focused on technologies that optimize the data link, physical layer, etc.
45. **Can you elaborate on the timescale of the dynamics impacting the network? Are the changes occurring in seconds, minutes, hours.**
    a. The timescale depends on the platform, so you should assume it is not uniform. Consider the various movements of ships, aircraft and the speed at which the platforms can move. The scenario itself, evaluates between 20 and 30 heterogenous nodes.
46. **Would the simulation run in real time?**
    a. Yes the simulator will run in real time. The government team will capture the data and summarize the run through dashboards and clips, which may be used for the purposes of the demonstrations.