2 February 2021

Ms. Rebecca Dorch
Senior Spectrum Policy Analyst
National Telecommunications and Information Administration
325 Broadway
Boulder, CO 80305

Re: 5G Challenge Notice of Inquiry (Docket No. 210105-0001)

Dear Ms. Dorch:

I am writing on behalf of Juniper Networks regarding the National Telecommunications and Information Administration's (NTIA) 5G Challenge Notice of Inquiry. Juniper appreciates that NTIA and the US Department of Defense (DoD) are interested in advancing the development and deployment of open 5G stack ecosystems. Juniper has been involved in several 5G network builds and test beds. We believe that creating test systems where the complex integration of edge cloud, security, ORAN, 5G SA Core and transport, with the associated accurate phase timing, is the right way to assess the technology and application use for NTIA and US DoD. Juniper would welcome the chance to work with the NTIA and US DoD to create these test systems and production solutions.

Juniper understands that the NTIA and DOD are looking at both homeland base and tactical applications for the US military. Both areas can use ORAN and Edge Cloud capabilities to create Private 5G networks on US bases; using either local private spectrum or leased spectrum from the national operator(s) or tactical solutions that can be deployed using spectrum sharing techniques with existing US military spectrum.

Juniper Networks welcomes the approach and benefits of using open systems. Juniper is a founding member of the Open RAN Policy Coalition (ORPC) and is actively participating in the ORAN Alliance, within WG2 (Radio Intelligent Controller), WG6 (Cloud) and WG9 (Transport). Juniper believes that ORAN, combined with a secure edge cloud and 5G core functionality, can deliver the 5G connectivity solution for NTIA/DoD test beds to allow 5G's

use in various applications to be assessed. The US military base applications require an architecture that follows those being built for Private 5G networks around the world, notably in the US, UK and Germany.

Private networks require the ORAN radio components, RU (Radio Unit), DU (Distributed Unit) and CU (Central Unit) where the DU and CU are software components. The DU can run on suitable hardware close to the RU or in the edge cloud with the CU. Suitable cloud software as well as security capability, combined with the 5G SA (standalone) core and/or ETSI MEC (Multi-Access Edge Computing) enables the 5G network sessions to be set up and controlled with traffic passing to the applications hosted on the same edge cloud.

The diagram below shows a high-level diagram of a Private 5G network:
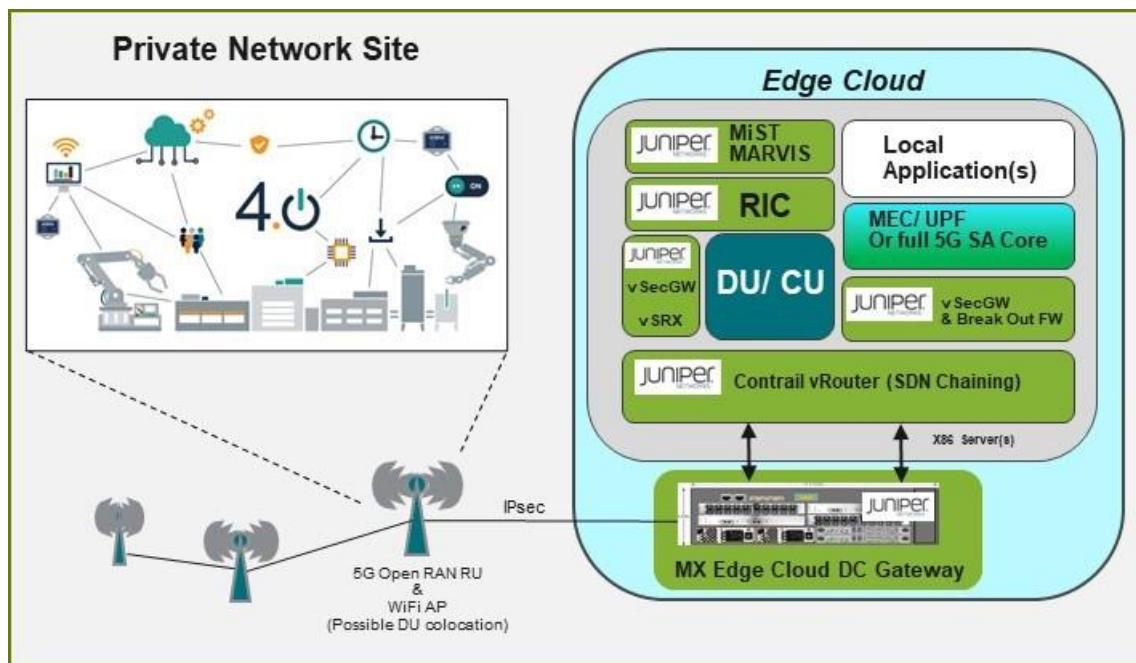
As can be seen from the green building blocks in the diagram, Juniper proposes to integrate 5G SA Core / MEC and ORAN components with routing, switching, security and cloud capabilities to deliver a private network that can be used to assess the benefit of using 5G as the connectivity solution for a variety of applications.

Juniper is working to deliver a 5G ORAN and Edge Cloud solution with an ecosystem of suitable ORAN and 5G Core Partners. In the ecosystem below, we have combined telco

cloud, transport, and security solution portfolios together with automation and service integration and O-RAN components; O-CU, O-DU and O-RU. Juniper's aim is to build an attractive and open ecosystem to deliver the promise of the O-RAN; openness, disaggregation, agility, and cost effectiveness. Juniper also recommends deployment of a Radio Intelligent Controller (RIC). The proposed solution consists of the following elements:

- O-Cloud – The O-Cloud networking requires a solution that is able to support Container, VMs and bare metal workloads across the O-RAN and 5G SA Core CNF workloads, applications, and security systems. The right collaboration between government and industry can deliver a full CaaS in the edge cloud.

- O-DU, O-CU and O-RU to cover the 5G SA massive MIMO use case for the urban cell sites as well as for 5G SA indoor solutions.

- O-CU covering the 5G SA use cases for outdoor small cells and 5G rural coverage small macrocells.

- O-DU for 5G SA for outdoor small cells and 5G rural coverage small macrocells.

- O-RU for the higher power outdoor solutions

- RIC (Radio Intelligent Controller) solution (Non-RT and Near-RT). RT = Real Time.

As stated, this ecosystem is open and can include multiple ORAN vendors. The following diagram illustrates the proposed E2E architecture:
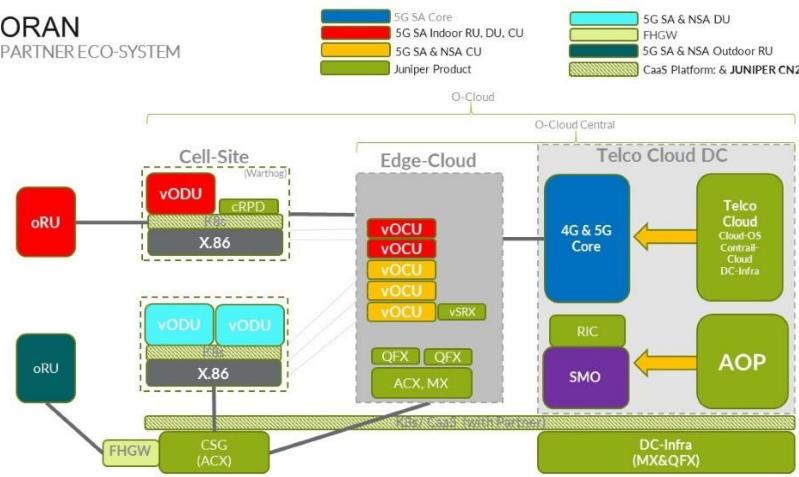
This solution can also be deployed with managed Telco Cloud compute pods:
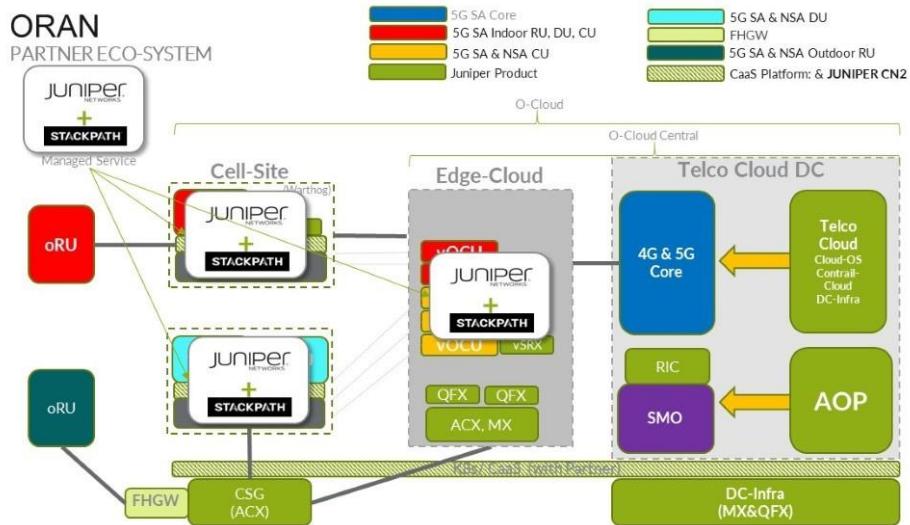
The use cases that involve spectrum sharing between existing DoD systems and the new 5G systems require rapid re-routing of traffic and the rapid re-assignment of spectrum.

The ORAN Radio Intelligent Controller (RIC) allows the management and optimization of 5G ORAN radio systems. While the current use case is the traditional areas of handover, interference, radio frequency (RF) power control, etc., a possible application would be to use the RIC, linked to both the 5G ORAN Radio system and other systems using the spectrum so that the ORAN system's RF power and spectrum use case be dynamically managed when other assets are in the area using the same spectrum with different technologies.

The RIC is a control and application platform for ORAN.
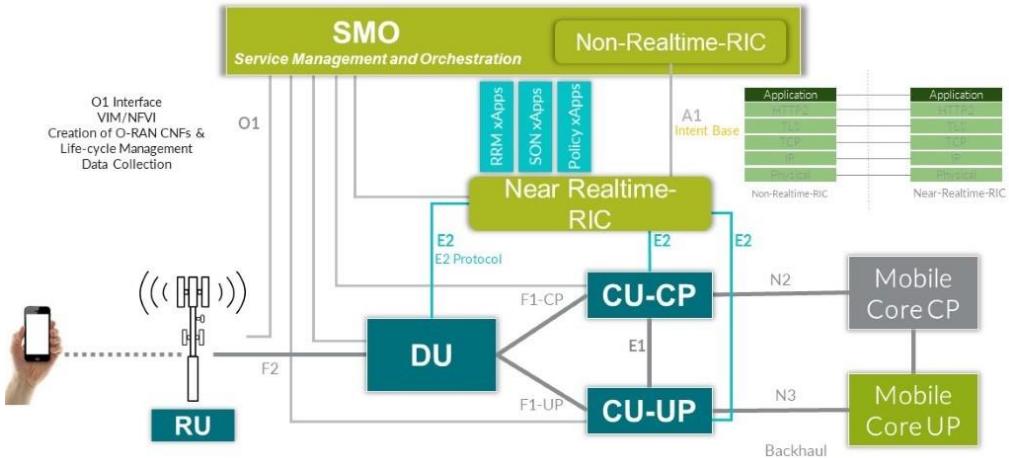
The RIC could host an application that is linked to the other DoD systems and hence can control the RF power and spectrum band being used by the 5G system allowing dynamic sharing.

There is another technology that, when blended with edge cloud, allows the communications from a vehicle to be redirected at the application level between different communications media while maintaining a contiguous communications session. Juniper is a leader in SD-WAN (Software Define-Wide Area Networking), which was originally conceived for enterprise connectivity.

The concept is to provide an SD-WAN spoke in the vehicle and to disaggregate the SD-WAN hub into the edge computing hub sites, allowing connectivity from the vehicle to the hub with low latency via 5G, 4G or Low Earth Orbit (LEO) satellite or other communications system. The link quality and other policies are used to determine which communications medium the vehicle should use at any one time. The concept is illustrated below:
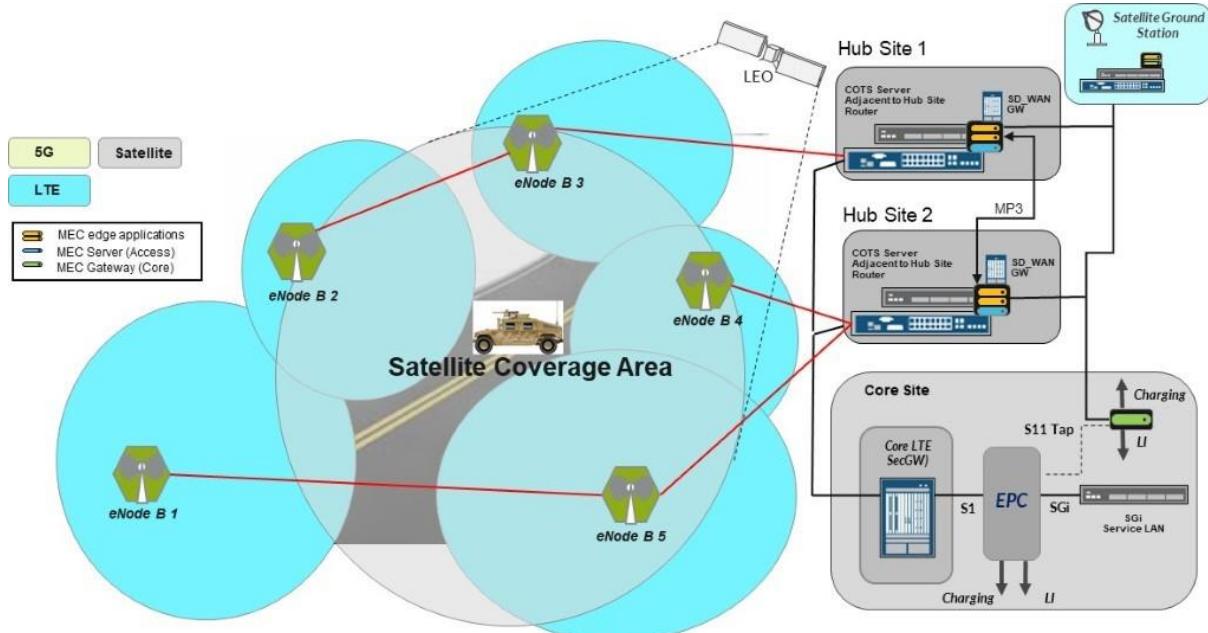
Hence, Juniper believes that a test bed system, using open technologies, can be used to examine the benefits of 5G for military applications both the domestic base environments and in the tactical deployment scenarios.

Juniper would welcome the opportunity to work with the NTIA and US DoD to create these test systems and production solutions. Should you require any further information, please feel free to contact me at (978) 589-0258 or mkokot@juniper.net.

Sincerely,

Mathias Kokot
Vice President
Product Management