Distributed, Disrupted, Disconnected, and Denied (D4)

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ABSTRACT

Military requirements for combined Joint All Domain Command and Control (c-JADC2) missions are driven by the need for interoperability among different networking architectures that (will) exist in the proliferated Low Earth Orbit (pLEO). BBN and SpiderOak have teamed up to develop Distributed, Disrupted, Disconnected, and Denied (D4) Secure pLEO Cloud which facilitates such interoperability. D4Secure Cloud will use the Software Defined Networking (SDN) framework and Network Function Virtualization concept to enable new applications in pLEO to provide a secure, reliable, and resilient environment to enable new space-based and space transport-based application support to users.

1. PROBLEM STATEMENT

Recent trends in space networking have been driven by the United States Government's desire for a simple, "just works", networking solution. However, interoperability among different networking architectures that (will) exist in the proliferated Low Earth Orbit (pLEO), and the need to connect to multi-domain networks for combined Joint All Domain Command and Control (c-JADC2) missions remain critical to meet military requirements. To this end, we are building the BBN and SpiderOak (the BBN team called here onwards) Distributed, Disrupted, Disconnected, and Denied (D4) Secure pLEO Cloud. The BBN team's D4Secure Cloud will use the Software Defined Networking (SDN) framework and Network Function Virtualization concept to enable new applications in pLEO to provide a secure, reliable, and resilient environment to enable new space-based and space transport-based application support to users.

2. NETWORK FUNCTION VIRTUALIZATION

The focus of the BBN team's D4Secure Cloud allows new deployments and connectivity to existing deployments from different tactical domains of operation, including air, ground, ship-based, and underwater. D4Secure Cloud will provide a strong level of confidence to customers that our solution can interoperate with existing multi-domain systems because the interfaces are based on proven open commercial standards that are already successfully deployed throughout the tactical and commercial world. Additionally, our solution will not be tied to a particular mission, platform, service, application, router, switch, or modem type and can be adapted to the needs of the customer by packaging only the services they require. The D4Secure Cloud is able to handle distributed, disrupted, disconnected, and denied operating conditions by building on backward-compatible extensions of the SDN concepts using secure network virtualized services.

3. ENCRYPTION

Fundamental to the BBN team's D4Secure is SpiderOak's purpose-built fully decentralized software approach for secure and verifiably trusted C2, comms, data of distributed, disaggregated architectures not in continuous contact with each other, such as Space Systems and distributed tactical sensors and unmanned systems. The most vulnerable aspect of this connectivity is the link segment connecting all of these distributed systems together and, as such, a means of providing this security in a fully decentralized system without servers or data centers enables not only secure connectivity and resilience of the all multi-domain C2 and Data Transport, but protects the systems themselves by preventing cyber intrusions through the data at rest or in transit. Also, the D4Secure system serves as a distributed record of data from initial digitization to end-user/Warfighter to prevent spoofing or adversarial AI injections into the data stream.

4. APPLICATION

D4Secure specifically serves Space Domain Awareness needs extremely well in in order to securely bring data from the globally disparate, disaggregated space sensor network that is made up of the DoD Space Sensor Network but also other USG sensors such as missile defense and civil as well as commercial and allied sensor data for a holistic real-time aggregated awareness of the space domain at all times.

5. ADDITIONAL INFORMATION

Due to the sensitive nature of this research, further technical details are available upon request by contacting the authors directly. This public abstract omits protected information. The full paper contains the details of our innovative solutions, novel techniques and prototype user application specifics that could not be included here. To learn more and discuss access to the comprehensive work, interested parties are encouraged to contact Mr. Syed Naqvi at Syed.Naqvi@rtx.com