WHITE PAPER

The Importance of Military Satellite Communication

Introduction

Military satellites support communications, intelligence, navigation, and other defense- and intelligence-related applications that are fundamental to national security. Their importance is underscored in the FY2020 National Security Space (NSS) budget request, which included $14.1 billion for satellites, launches, and the establishment of the U.S. Space Force.[1] The Space Force will unify command and control of all DoD satellites to provide "continuous global coverage, low vulnerability, and autonomous operations."[2]

Ground stations play a critical role in these efforts; they not only provide command and control over the satellites, they also distribute data from the satellites to users using LANs and WANs. With more satellites to manage at higher bandwidth capacity, and more traffic to distribute to more end-users, ground stations need to improve performance, security, resiliency, and operational excellence.

Network operations today

Ground stations use LANs and WANs to distribute mission-critical voice, video, data, and other traffic to customers and other systems that may reside on premises or at remote facilities and data centers.

These complex networks consist of a broad mix of heterogeneous systems and technologies—from legacy TDM systems supporting C2 systems to modern IP/MPLS elements—that must interoperate with each other and connect with end-users, agencies, and allies and partners throughout DoD and beyond.

These networks are also managed and maintained by disparate systems and operational procedures, making inventory, service design and activation, and service assurance challenging. Highly skilled technicians must utilize various vendor-specific CLIs and management systems to run the network, using slow, expensive, and error-prone manual intervention that add OPEX and delay and limit scale.

For example, to add a new customer, technicians must first gather and correlate data from multiple statically configured inventory systems to identify available resources. They then manually design the service path, considering any unique security, availability, and latency requirements. Configuring the network elements and attached resources is also a fragmented effort, and increasingly difficult given the adoption of virtual appliances and cloud-hosted resources. In aggregate, these processes can take weeks to complete and test, consuming valuable and expensive technical resources.

These same processes delay service restoration when issues arise. Techs must manually gather and correlate alarm, alert, and event data from a variety of different network and service monitoring tools to isolate the issue before they can even begin to resolve it.

To meet evolving mission requirements, ground stations must adopt more automated, software-centric networks that avoid over-reliance on manual intervention, allowing Space Force operators to quickly respond to anticipated and unforecasted requirements and maintain performance, security, and reliability under all network conditions.

Introducing Blue Planet®

Blue Planet, a division of Ciena, offers a comprehensive, open software suite that enables highly programmable closed-loop lifecycle management automation to foster operational excellence.

Importantly for Space Force, Blue Planet provides open, standards-based interoperability across their entire service and network ecosystem. Blue Planet uses published open REST APIs to integrate with modern BSS/OSS, ITSM, and SDN controllers, and native protocols to communicate with proprietary systems and elements. This approach extends Blue Planet to any IT environment and network infrastructure, enabling automated discovery, orchestration, and assurance across complex multi-vendor/multi-tech ecosystems.

Blue Planet federates data from pre-existing inventory systems and synchronizes it with actual network data to create an accurate single 'source of truth' for all resources. Blue Planet also offers advanced catalog-driven service order management and orchestration that enable rapid, accurate zero-touch service activation end to end across network vendors, layers, and both physical and virtual elements.

Blue Planet provides intent-based Network Configuration and Change Management (NCCM) that eliminates the errors associated with CLI-driven configuration changes and 'stare and compare' compliance audits. It automates pre- and post- change validation checks and can roll back configurations to a prior known working state if the post-validation check fails[3].

Blue Planet also streamlines troubleshooting and remediation via state-of-the-art AIOps assurance capabilities that unify and correlate alarm, fault, event, and performance data from the entire network, providing technicians with the information they need to rapidly isolate and address problems.

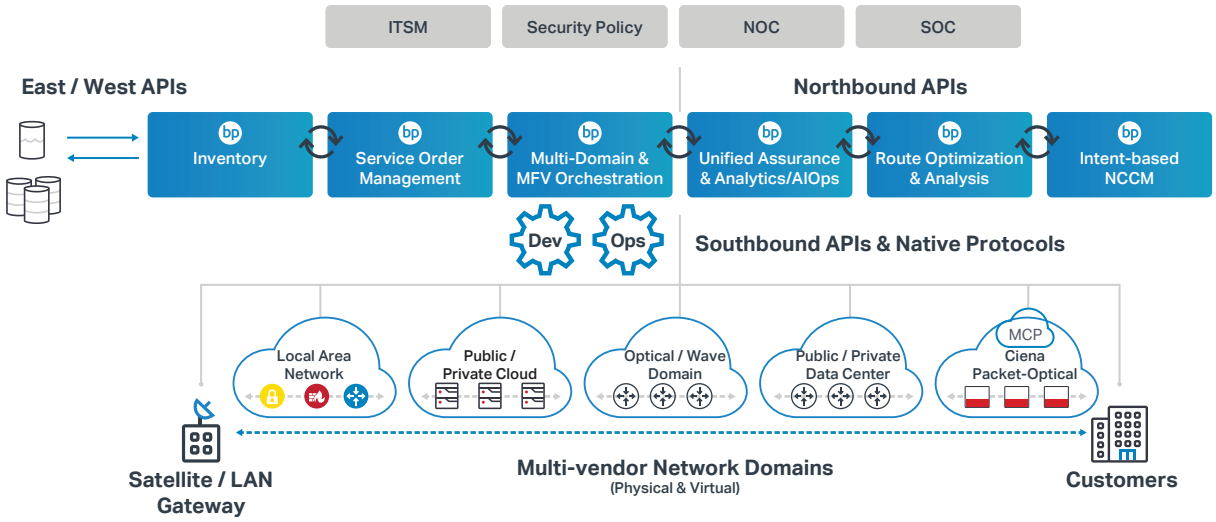

Figure 1. NEED CAPTION

The Blue Planet Intelligent Automation portfolio

With accurate inventory data, dynamic service activation, and automated recovery, Blue Planet modernizes ground station operations to improve performance, security, and resiliency, at scale.

Blue Planet for ground station network automation

Blue Planet eliminates the silos that exist between IT and the network, and uses automated discovery, orchestration, NCCM, and AIOps Assurance to overcome the limitations of error-prone manual operations.

Using intent-based NCCM automation, technicians simply define configuration policies; Blue Planet discovers the devices and verifies their configuration network-wide, and in real time. Valid configurations can be dynamically applied to non-compliant devices, or flagged for manual remediation, and the system keeps a record of all network and configuration changes for forensic and compliance purposes.

Similarly, Blue Planet can help automate service design and activation to extend the network to new customer and partner sites—without the need to manually gather inventory data, use off-line design tools, or manually configure elements[4]. Space Force technicians simply specify the service endpoints, select the bandwidth rate, QoS, and protection scheme, and activate the service or select a time/date for service activation (and termination) using sophisticated Blue Planet calendaring features. Blue Planet's intent-based orchestration automates service fulfillment end to end across multi-vendor/multi-technology networks, including fiber networks supporting optical and wave services, enabling service activation in mere minutes, not months, without manual intervention.

At the same time, Blue Planet AIOps Assurance correlates data from multiple sources (such as network elements, controllers, monitoring tools, ITSM, etc.) to help technicians rapidly identify root-cause issues. Blue Planet provides comprehensive service visualization, as well as a playback option that allows technicians to 'see' what was occurring on a device before, during, and after alarms were triggered; it also analyzes historic data and applies machine learning techniques to enable in-depth network health monitoring.

The AlgoSec 2019 Cloud Security survey finds that the two main causes of network outage in 2018 were human error in managing devices and in configuration changes.

Network misconfiguration risks

by Avivi Siman-Tov

According to the Uptime Institute, up to 75% of data center failures are caused by human error.

The biggest risk to uptime?
Your staff

by Andy Patrizio,

Together, AIOps and orchestration enable dynamic, policy-driven bandwidth adjustment in response to demand and can even execute policy-based closed-loop remediation. Technicians can also use Blue Planet to reroute services in support of planned maintenance windows or to optimize network resource utilization while avoiding the risks associated with manual intervention. Throughout these and all other automated procedures, Blue Planet gives technicians visibility into—and control over—all actions.

To avoid downtime due to fiber Loss of Signal (LOS) conditions, Blue Planet's Preemptive Network Maintenance (PMN) solution uses advanced analytics and Machine Learning, combined with policy and orchestration, to detect and avoid optical signal degradations before they affect service. The solution also provides technicians with device and port details, probable time to failure and impacted services, and guidance on how to address the root-cause issue.

Blue Planet can also integrate with satellite-aware systems to enable unified satellite and network C2 that increases resiliency in contested environments.

Ciena and LinQuest, a satellite-focused system engineering company, demonstrated unified satellite and terrestrial network C2 using LinQuest LYNX™--a satellite-aware service manager that receives inputs from multiple satellite control systems and can issue scheduling requests back to the satellite controllers and Blue Planet.

The demo dynamically reassigned resources in response to mission needs. Lynx managed the satellite controllers and gateways; Blue Planet controlled the network: rerouting traffic, adjusting bandwidth, and switching traffic between a military SATCOM asset to a commercial one.

With its open API support, Blue Planet can integrate with any satellite-aware service management solution, giving Space Force the ability to restore traffic from compromised satellite systems on commercial systems, and reconfigure ground network resources to accommodate shifts to different satellite constellations and gateways. Additionally, Space Force can use the solution to adjust terrestrial network resources to meet changes in traffic demand and restore terrestrial traffic via satellite.

Summary

Space Force ground stations are being challenged to manage ever more satellites, bandwidth, mission-critical applications, and services while concurrently managing complex LANs, WANs, and fiber-based terrestrial/submarine networks that span the globe. Using outdated operational processes and proprietary tools is impractical. Modern software-centric automation is the answer.

The Blue Planet Intelligent Automation portfolio can help Space Force automate operations across their complex heterogeneous networks. Blue Planet automation speeds service activation by up to 75 percent while decreasing traditional order-to-service OPEX by up to 90 percent; it also eliminates downtime cause by manual errors and frees up highly skilled technicians. With accurate inventory data, dynamic service activation, and automated recovery, Space Force can use Blue Planet to improve performance, security, and resiliency and achieve operational excellence at scale.

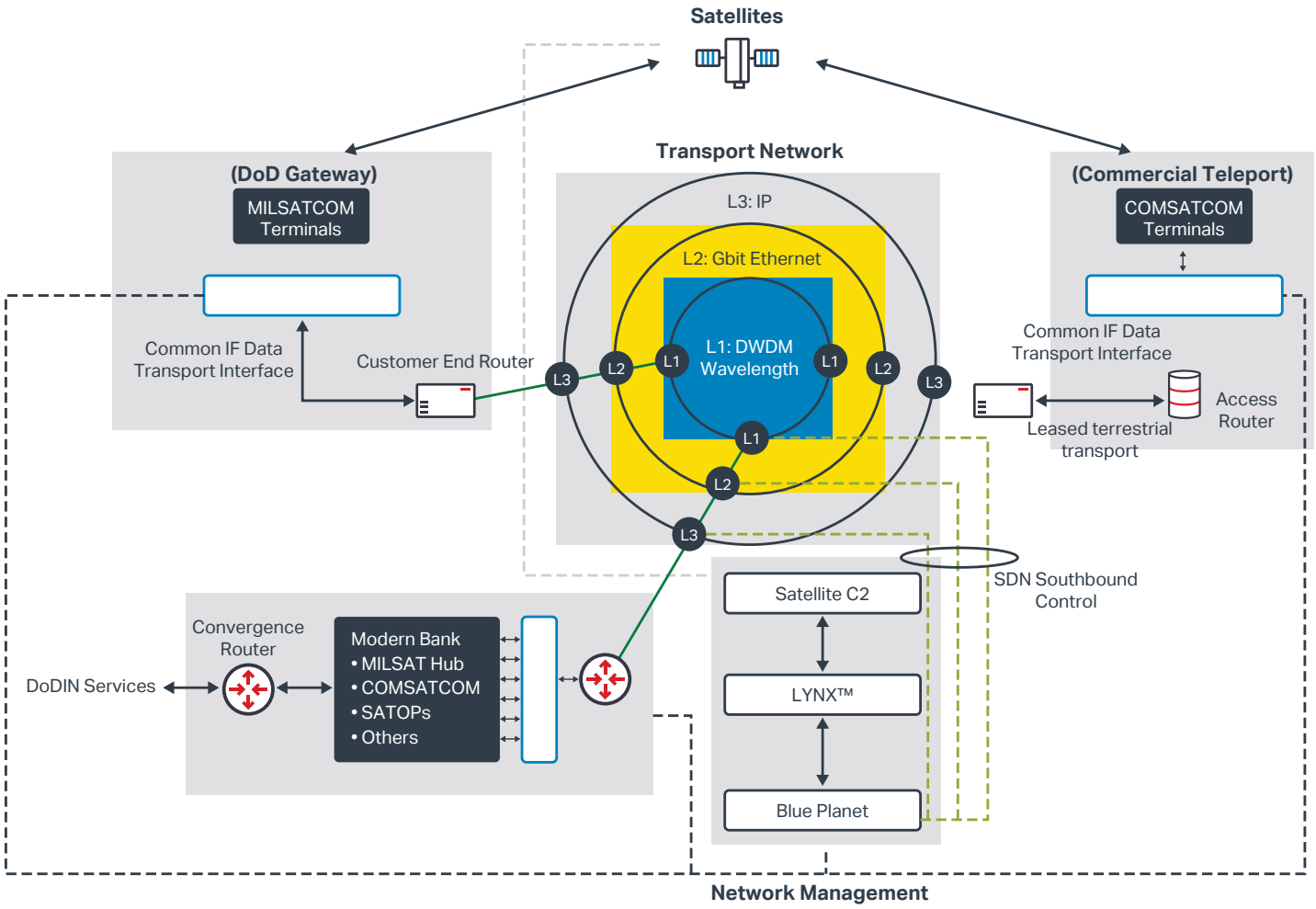

Figure 2. Demo topology: integrated command and control of satellites and network resources[5]

Ciena Government Solutions, Inc. (CGSI)

CGSI is a wholly owned Ciena subsidiary serving the unique networking infrastructure needs of the U.S. federal sector. CGSI leverages Ciena's portfolio to provide comprehensive solutions tailored toward U.S. federal, civilian, defense, and research and education networks.

1. FY2020 National Security Space Budget Request: An Overview, (see https://fas.org/sgp/crs/natsec/IF11244.pdf) published by the Congressional Research Service This request is 14% more than the FY2019-enacted amount, and excludes funding for National Geospatial-Intelligence Agency (NGA) and National Reconnaissance Office (NRO).
2. United States Space Force Fact Sheet https://www.spaceforce.mil/About-Us/About-Space-Force
3. Configuration errors are a major cause of network downtime. One noteworthy incident: In 2017, a Cloudflare engineer mistyped a network configuration command and mistakenly shut down a transatlantic fiber cable. See https://cloudscene.com/news/2017/07/datacenterdowntime/
4. Windstream uses Blue Planet to automate SD-WAN controller and Edge router configuration, which eliminates 300 alpha-numeric manual entries and 1.25 hours of manual intervention per customer site. See https://inform.tmforum.org/casestudy/windstream-uses-intelligent-automation-to-cut-provisioning-time-by-80/
5. The "Extension of SDN Networks to the Satellite Domain; Integration of an SDN Enabled WAN Network with C2 of Multiple Satellite Constellations" demo was co-delivered by Ciena Corp. and LinQuest Corp. at OFC 2018.