Always On | Never Fail

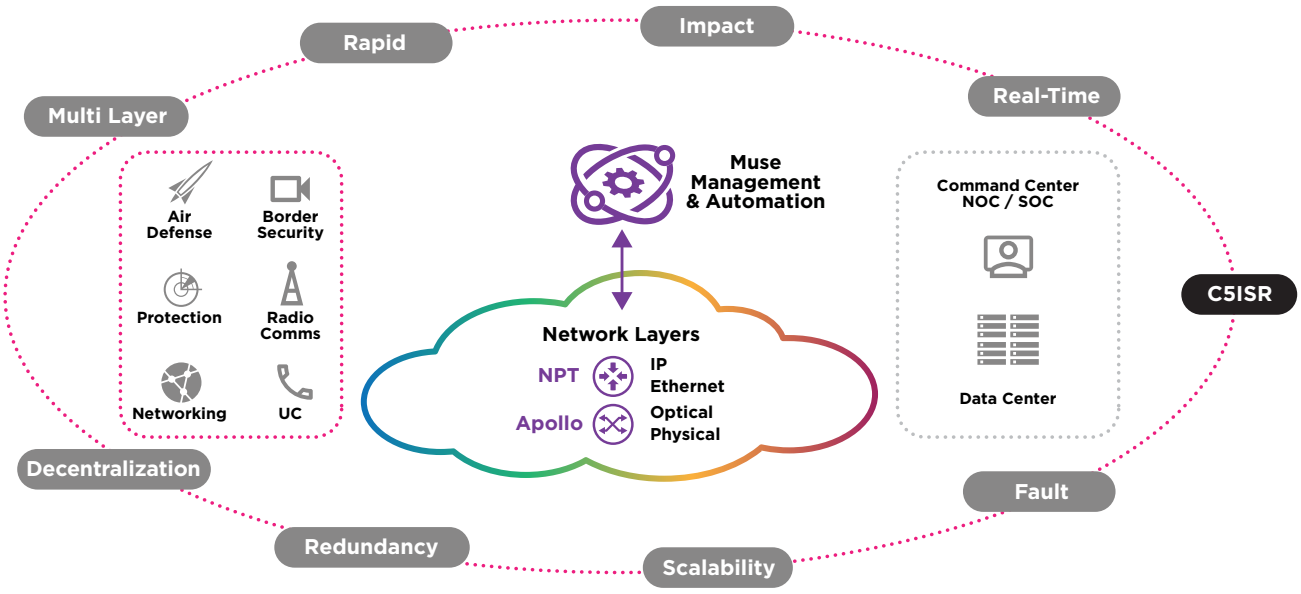
Mission Critical Defense Network Solutions for Defense Forces and HLS Agencies

Secure Turnkey Solutions for Tomorrow's Defense Challenges

Today's battlefield is changing faster than ever. Militaries need to enhance their operational speed and decision-making capabilities, particularly as the time frame between conceptualization and execution continues to diminish. The growing complexity of warfare necessitates the involvement of numerous actors, extensive data, expanding lines of command, and intricate geographical environments. This complexity requires substantial algorithmic support to augment military operations effectively. The utilization of sensors and satellite networks for data collection, transmission, and processing has become vital in integrating land, sea, air, and space domains.

In other words, we now have a digital ecosystem in which Network Centric Warfare is the name of the game. In this ecosystem, effective decision-making requires pooling and analysis of data from a vast array of information sources. The data must be delivered securely, in real-time, to wherever it is required. Network Centric Warfare is about using this data to be the first to know, understand, decide, and act. To meet those needs, Ribbon provides highly- secure, highly-reliable next-generation communication solutions.

Secure Networking	**Multilevel Security**	**Flexible and Future-Proof**	**Tailored & Integrated**
Field-proven Hardware and Software	for Mission-Critical Services	Reconfigurable Multiservice Networks	End-to-End Solutions



ribbon

Reliable High-Bandwidth Connectivity

Decision-making on the modern battlefield requires real-time information to be made available when and where it is required. This data must then be analyzed in real time to allow informed decisions and provide the control of network-dependent weapons such as drones, robots, and unmanned vehicles. A combination of IP, Packet and Optical networking provides both the agility to link the data generated from various data sources to multiple destinations as well as the capacity required to transport bulk data over long distances with ultra-low latency.

Ribbon provides tailor-made, secure, hardened, field-proven defense solutions. These solutions integrate intelligent optical networking with agile IP/Packet connectivity to provide a converged, secure communication network.

- NPT is a multiservice IP/Packet platform supporting both modern devices as well as legacy systems
- Apollo programmable and open optical networks satisfy ever growing demands for secure bandwidth
- The Muse™ software suite allows seamless operation and automation across Apollo and NPT

Ribbon provides a single integrated communications network, able to support video surveillance systems, command and control networks, sensors, radar, and smart IoT devices. Our market leading TDM-to-IP solutions support the integration of legacy TDM-based systems as well as their migration. NPT's unique Multistack MPLS capabilities allow mission-critical and non-mission-critical communications on the same network. MPLS-TP provides the deterministic transport needed for mission-critical applications, and IP/MPLS provides the dynamic IP transport expected for non-mission- critical IT applications.

Always on Networking

Mission Critical Defense networks must be "always-on", with more than five 9s availability. Ribbon has designed its defense solutions with this in mind, and achieves better than transport-grade reliability with 4 levels of resilience:

- **Equipment:** Fully-redundant, hardened Network Elements design, with 1+1 and 1:1 protection of key units and extended temperature range for field installations (-25°C to +70°C).
- **Network:** Fast protection against single and multiple network failures, supporting sub-50ms protection switching:
  - Multiple failure protection in conjunction with Pseudowire
  - Network Disaster restauration via advanced optical protection mechanisms like ASON or WSON
- **Management:** Advanced software with intuitive operations provides rapid fault isolation in the event of network failure or degradation. In addition, Muse Network Insights provides the ability to monitor network performance in real time and helps identify trends over time.
- **System disaster recovery:** Field-proven processes and procedures provide network and management restoration from geographically-dispersed sites in the event of a catastrophic failure.

Flexible and Future-Proof

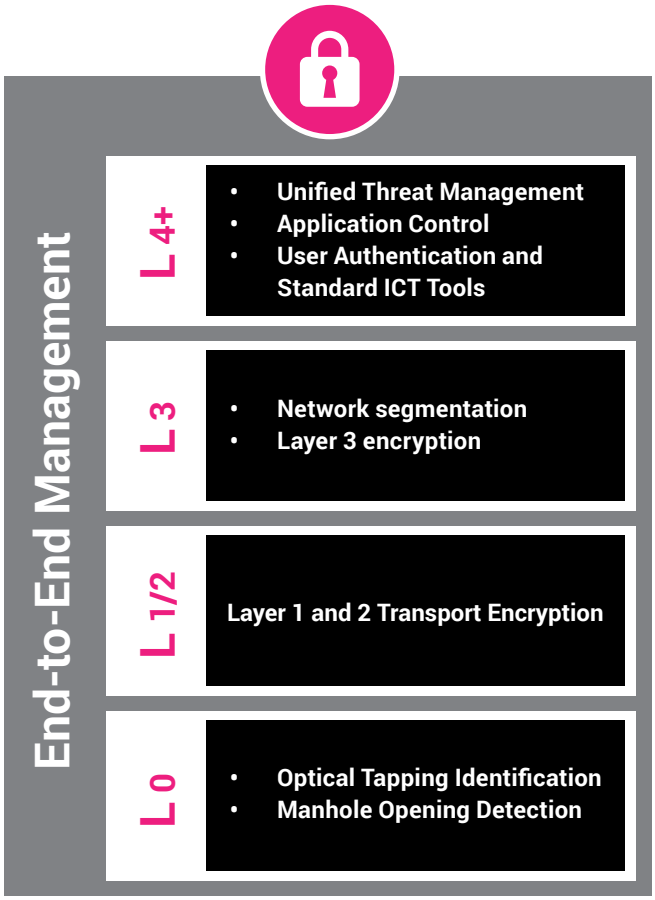
Modernization is never complete, and Ribbon's defense solutions provide the flexibility to scale as the needs evolve:

- **State-of-art optical transport** provides high-performance optical links filling up channels to their theoretical limits, as well as cost-power optimized links. SDN-controlled ROADMs and OTN switches dynamically route links and the services they carry from access to the core.
- **Multiple routing technologies** including IP/MPLS, MPLS-TP, Segment routing, RSVP-TE, Flex Ethernet, supporting multiple services such as Ethernet, Layer 2/3 VPN, EVPN and Circuit Emulation.
- **State of the art operations** with an easily managed, unified, and secure communications solution, improving operational and administrative effectiveness and efficiency.
- **Future-proof agility** with new telecom capabilities added as they become hardened for the battlefield. Examples include Multistack MPLS for introducing new IP/Packet transport techniques, such as Segment Routing, SRv6 and Flexible Ethernet.

Multilayer Security

By definition, defense networks are a prime target for cyber-attacks. The aim of these attacks can be to either take control of the network or to disable communications. Ribbon helps secure the defense communications network and the data that it transports against such attacks with a comprehensive set of multilayer security mechanisms:

- **Intrusion detection:** Uses physical measurements and analytics to identify tampering and physical intrusion.
- **MACsec:** Ensures that only authorized data streams are allowed.
- **L1-L3 Encryption:** Encrypts all the data, including the in-band optical management channels.
- **IPsec:** Used to secure the VPNs.
- **Secured DCN:** Protects the DCN and each site on the DCN. Stops one site from being able to launch an attack on another.
- **Secured access:** Implements authentication with at least two factors.
- **Comprehensive:** Integrated into SIEM/SOC.



Fully Integrated Turnkey Solutions

Ribbon has been providing communications solutions in hundreds of critical infrastructure networks over the past 50 years. Customers include power utilities, rail, highways, airports, oil, gas, water, government, and defense. We are using the experience gained from these customers to optimize our industry-leading solutions to provide a communications network that defense forces and HLS agencies can depend on.

Ribbon understands the need to provide tailored solutions, and our specialists go the extra mile to understand your particular challenges. Ribbon provides solutions to address these challenges incorporating best-in-class Ribbon products, 3rd-party wireless access products, and customized or commercial off-the-shelf equipment. In addition, Ribbon is able to offer extremely rapid network turn-up. We offer complete racks with pre-integrated and tested solutions (power, optics, etc), ready for shipping and deployment.

Extensive experience in multiple networks worldwide has enabled Ribbon to develop field-proven, hardened processes for migration. This means defense forces and HLS agencies can be assured that migrating to a next-generation Ribbon communication network is straightforward.

Holistic Security Suite

Securing the Network

Critical industries are a prime target for cyber-attacks. Data security is a particularly complex matter. It must protect both IT and OT assets and be able to identify tangible threats from amongst the multitude of reported events.
Our solution provides physical layer security, encryption, firewalls, and intrusion detection. It provides the capabilities to identify and tackle potential attacks in several ways:

- Prevents attacks where they occur with distributed attack mitigation.
- Provides Distributed SCADA Anomaly Detection and DPI Deep Packet Inspection, addressing zero-days, advanced cyber-attacks, and delivers the key to identify and isolate such threats.
- Guards the integrity of the SCADA and OT network. The system maintains a complete OT network map and continuously monitors all transactions for abnormal behavior, providing early warnings of any tampering.
- Identifies real threats with advanced correlation and analysis for a clear view of tangible threats.

NPT

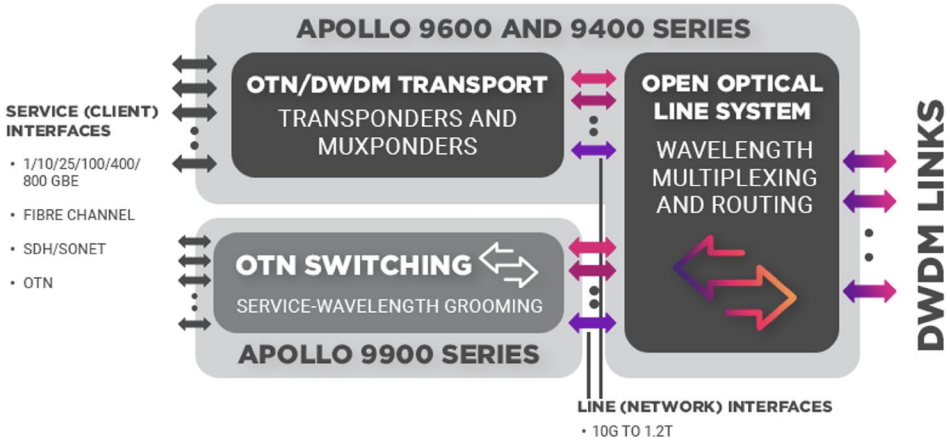
Powered by Multistack MPLS for Future-Proof IP/Packet Transport

NPT is a powerful, flexible, and efficient platform streamlining IP/Packet transport for defense networks. Multistack MPLS is at the heart of NPT, building a multiservice platform to support mission-critical services over the most appropriate transport technology. NPT delivers both deterministic behavior that TDM and MPLS-TP provide, as well as IP/MPLS and Segment Routing to provide optimized support for services like voice, video, and non- mission-critical networking. IPoDWDM is supported as well as classic IP/Optical interworking.

Apollo

Programmable Optical Networks

Apollo is Ribbon's family of OTN/DWDM transport and switching platforms, covering all performance requirements and network topologies. Apollo integrates programmability with a comprehensive set of optical transmission and wavelength management capabilities to offer adaptable optical networking solutions that can evolve with changing traffic demands. Apollo provides capacity-reach optimized links up to 1.2T to maximize spectrum efficiency, as well as 400G/800G ZR+ power-cost optimized links for scalable networks. A modular set of ROADMs and OTN modules enables configurations to route links and transport services across all optical networking applications. All Apollo network elements feature open control interfaces for compatibility with third-party controller environments.



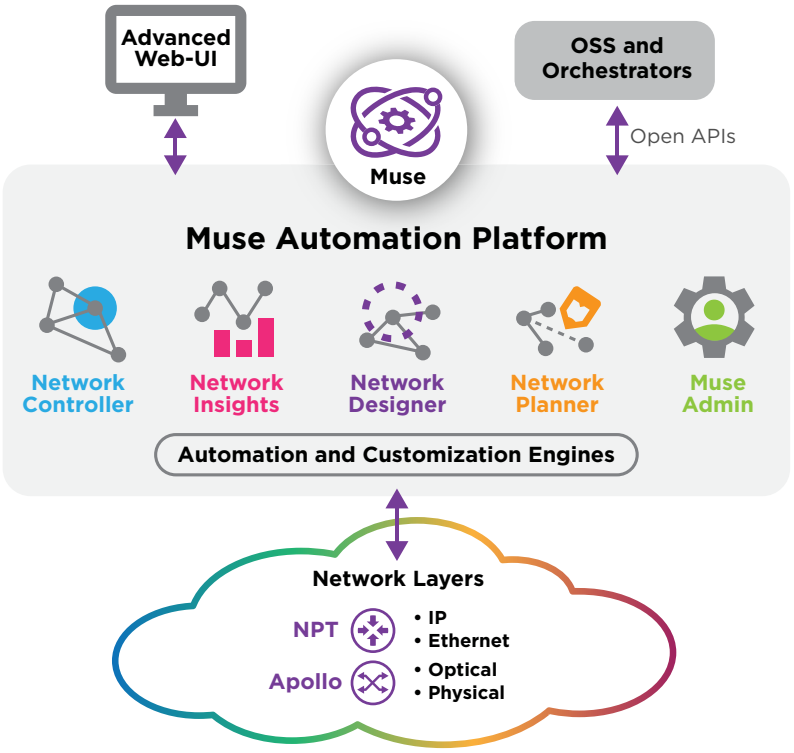
Muse™ Software & Automation Suite

Advanced operations software

Muse delivers real-time control over Ribbon's Mission Critical IP and Optical networks and automates the service and network operation life cycles as required. It also integrates with OSS/BSS or higher level orchestrators via northbound interfaces and can integrate 3rd-party network equipment for multi-layer end-to-end inventory, topology, fault management, and service provisioning.

Muse speeds up services creation and provisioning, assures that services are always on, and reconfigures the network on failures. Muse streamlines network operations, optimizing capital outlays and reducing costs. To this end, Muse integrates network planning with equipment commissioning, continually analyzes and optimizes the use of network resources, and prevents failures before they happen or sectionalizes them quickly when they do occur.

Muse is deployed on a private cloud native infrastructure that can be right-sized for each application and is equipped with low-code toolsets that facilitate adding automation, customization, and multivendor integration to its solutions.



Meeting the Needs of a Modern Defense Network

Your Challenges	Our Solutions
Secure Networking	**Scalable high-capacity IP/Optical solutions:** • Core-to-Door, field proven IP/Packet/Optical solutions • Superb Management-, Planning- and Automation-Tools **Four levels of resilience provide ultra-high availability, making it better than transport grade:** • **Equipment:** Hardened fully redundant network elements, meeting unique defense requirements • **Network:** Optimized architectures and extensive protection schemes tailored to the defense needs • **Management:** Advanced software with intuitive operations for rapid fault isolation, increased availability, maximized utilization, and improved efficiency • **System disaster recovery:** Field-proven processes and procedures keep the network operational
Multilevel Security	**Tailored, holistic cybersecurity and network immunity:** • Comprehensive cyber protection suite integrated into external SIEM/SoC • Intrusion detection with machine-learning analytics • Encryption including the OAM channels • Secure DCN protection of the sites and data centers
Flexible and Future Proof	**Extensive multiservice with Elastic MPLS:** • MPLS-TP for deterministic transport and advanced OAM • IP/MPLS for dynamic L2 and L3 services • Unique support of legacy networks/services and TDM to IP migration • Pay-as-you-grow design, in-service expansion units, and in-service upgradable packet fabrics • Just-in-time introduction of new services/resources
Turnkey Solutions	**Ribbon provides end-to-end solutions with:** • Easy integration for best-of-breed 3rd-party equipment • Single Network Management System • Unique pre-integrated solutions • Field implementation and support • Easy intervention for fast rollout • Knowledge transfer for self-sustainability

About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers secure cloud communications and IP and optical networking solutions to service providers, enterprises and critical infrastructure sectors globally. We engage deeply with our customers, helping them modernize their networks for improved competitive positioning and business outcomes in today's smart, always-on and data-hungry world. Our end-to-end portfolio of communications software and IP Optical networking solutions deliver superior value and innovation by leveraging cloud-native architectures, automation and analytics tools, and leading-edge security. We maintain a keen focus on our commitments to Environmental, Social, and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders.

Contact Us Contact us to learn more about Ribbon solutions.