



Future-Proof, Risk-Free, Network Modernization

Critical Infrastructure (CI) Network Operators are under increasing pressure to support new services, reduce carbon emission, improve security, provide automation, and increase safety. Achieving this requires transition to a modernized, secure communications network that supports both packet and optical transport seamlessly.

Ribbon offers a seamless integrated packet and optical transport solution, providing a highly reliable, secure, future proof communications solution optimized for critical industries. Ribbon's unique Elastic MPLS functionality provides integrated support for: MPLS-TP, the proven best-choice packet transport for OT services; and IP/MPLS, the preferred packet transport for IT services. In addition, Ribbon's holistic security suite incorporates state-of-the-art OT protection measures, giving operators extra confidence in the security of their network. Also, field hardened, proven processes allow easy and safe migration of legacy services and interfaces to Ribbon's futureproof packet platform.

Risk-Free Modernization

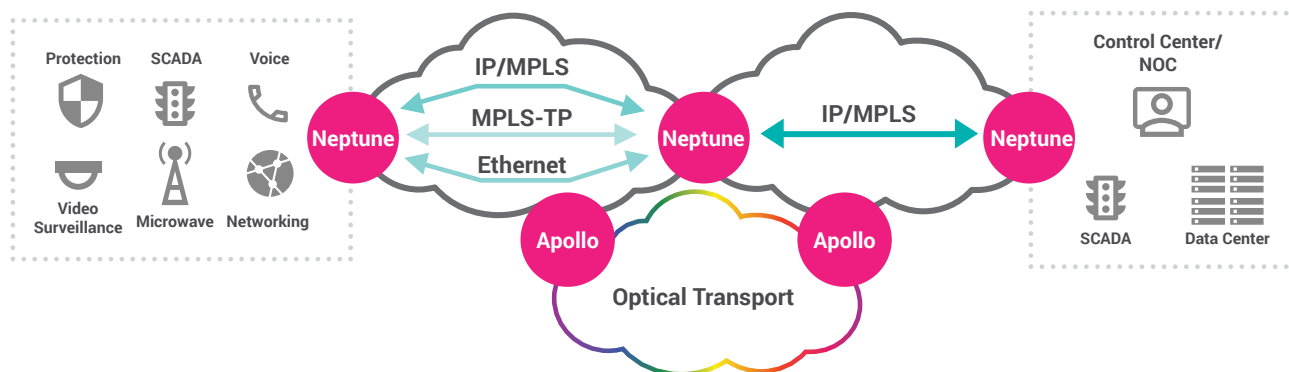
Tailored, field-proven,
and future-proof

Optimized for CI

Compact, hardened, regulation-
compliant solution

Secure OT

With state-of-the-art
options



Future-Proof, Risk-Free Network Modernization

For over five decades, Ribbon has been providing communications solutions for hundreds of CI networks, including power utilities, railways, highways, airports, oil, gas, water, government, and defense infrastructures. These solutions leverage the experience accumulated over many years from these critical infrastructure customers. The acquired expertise has helped us optimize our industry-leading Elastic Services Platform, to offer an optimal solution that meets the unique needs of critical infrastructure network operators.



The critical industries sector spans many strategic industries and operations, including:

- **Energy:** Distribution and transmission businesses
- **Transportation:** Highways, railways, and airports
- **Utilities:** Oil, gas, and water
- **Public sector:** Government and defense institutions, and more recently, smart cities and smart municipalities.

While the specific needs of each critical industry in each country are unique, there are a number of drivers that are common across the board. The four key drivers for modernization are:

Critical Industries Must Transition to Packet-Based Networks

Aging Networks

- End-of-life SDH/TDM/ATM vs network expansion, population growth, and new services
- High maintenance costs
- Need for convergence

Internet of Things

- Always-connected sensors
- SCADA
- Automation and control
- Smart devices



Regulation

- Compliance to standards
- Carbon emission reduction
- Improved service availability and customer satisfaction

Security and Safety

- Control automation
- Safety recommendation
- Video surveillance
- Cyber and physical security

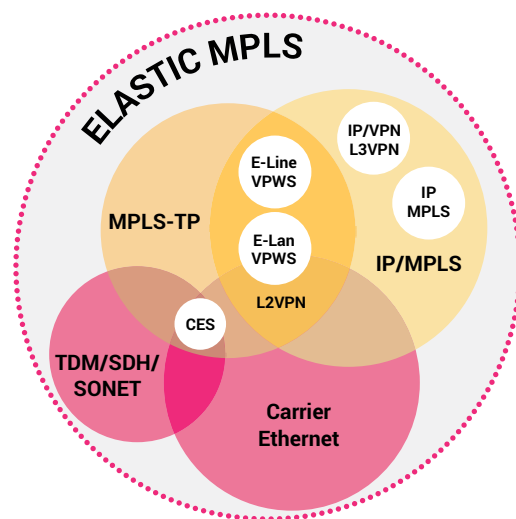
Risk-Free Modernization

Ribbon has a suite of field proven, products and processes enabling critical infrastructure operators to migrate confidently from their existing network to the modernized packet network, which they need today and for the future.

Ribbon's unique Elastic MPLS capabilities give the operator total flexibility in the migration approach they select.

Elastic MPLS supports TDM, MPLS-TP, and IP/MPLS.

When ready, the TDM services are mapped flawlessly onto the packet network using circuit emulation (CES). This is accomplished via MPLS-TP, which provides the determinism and OAM not possible with IP/MPLS, but mandatory for many of the OT services. Where operators want to support non-mission-critical services or want to converge their IT and OT networks, Elastic MPLS supports both IP/MPLS and MPLS-TP on the same platform, with stitching provided between the two different MPLS domains. In addition, the seamless integration between the Neptune-based packet network and the Apollo-based optical network allows legacy TDM services to be mapped directly onto an OTN-based optical transport network. This freedom allows operators to choose the migration approach and time-frame that best meets their own operational needs.



Evolving the network as services continue to develop is straightforward, with the agility provided by Elastic MPLS and the programmability provided by SDN and NFV.



NPT-1010D
Highly Compact
Din-Rail MPLS Switch

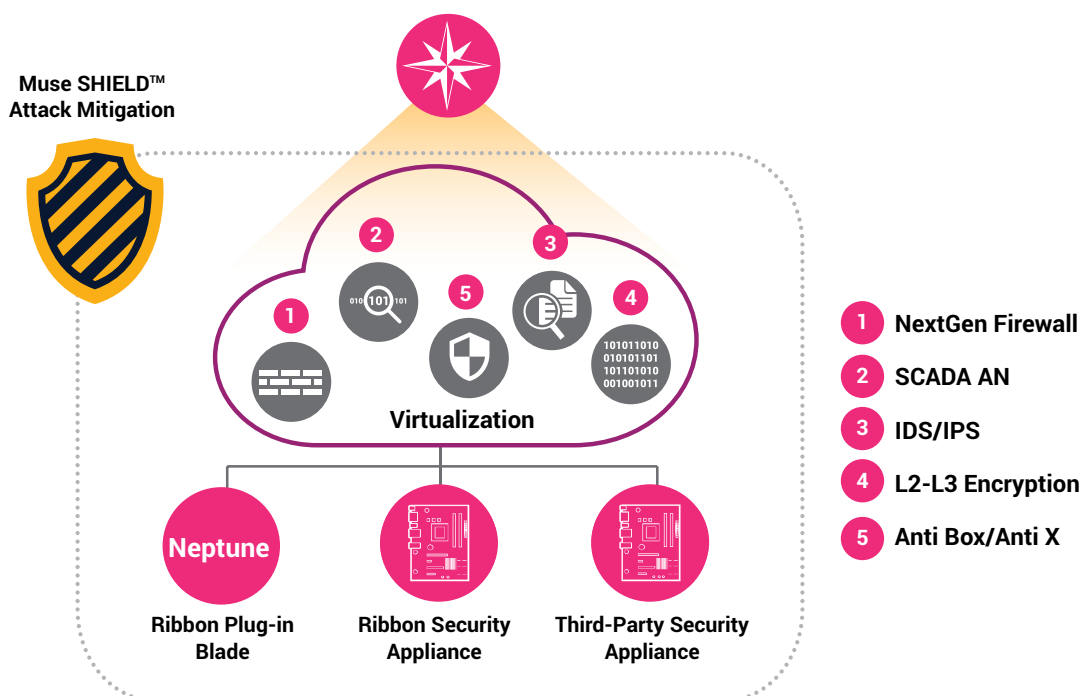
Optimized for Critical Infrastructures

Ribbon offers a suite of environmentally-hardened, compact, high-density, low power consumption products, complying with strict regulations and standards (e.g. IEC 61850, IEEE 1613, EN 50121). These products are optimized to meet the needs of the critical communication infrastructures used by the energy, utility, and transportation industries.

Ribbon enhances this product set with a management suite of advanced software tools that simplify operations of the network and provide the analytics needed to ensure that the network is always running at maximum efficiency. In addition, this software suite provides full end-to-end management, by integrating 3rd-party management devices existing within the Field Area Network.

Secure OT

Critical infrastructures are a prime target for cyber-attacks. Proper protection is a particularly complex challenge. You must defend Operational Technologies (OT), and be able to discern tangible threats from a multitude of reported events. Ribbon's Muse Cyber Security Suite provides a comprehensive cyber security solution for critical infrastructures to address these challenges. Neptune™ uses the Mercury™ NFV platform to host the Muse Shield software, which incorporates industry-leading SCADA anomaly detection, a Secure Gateway, and Encryption to detect and prevent OT cyber-attacks well before they can cause harm.



Scada Anomaly Detection identifies attacks on the SCADA network in the following ways:

- **Maps the SCADA network** so that existing, zero-day vulnerabilities are detected.
- **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 and ranks them by severity.

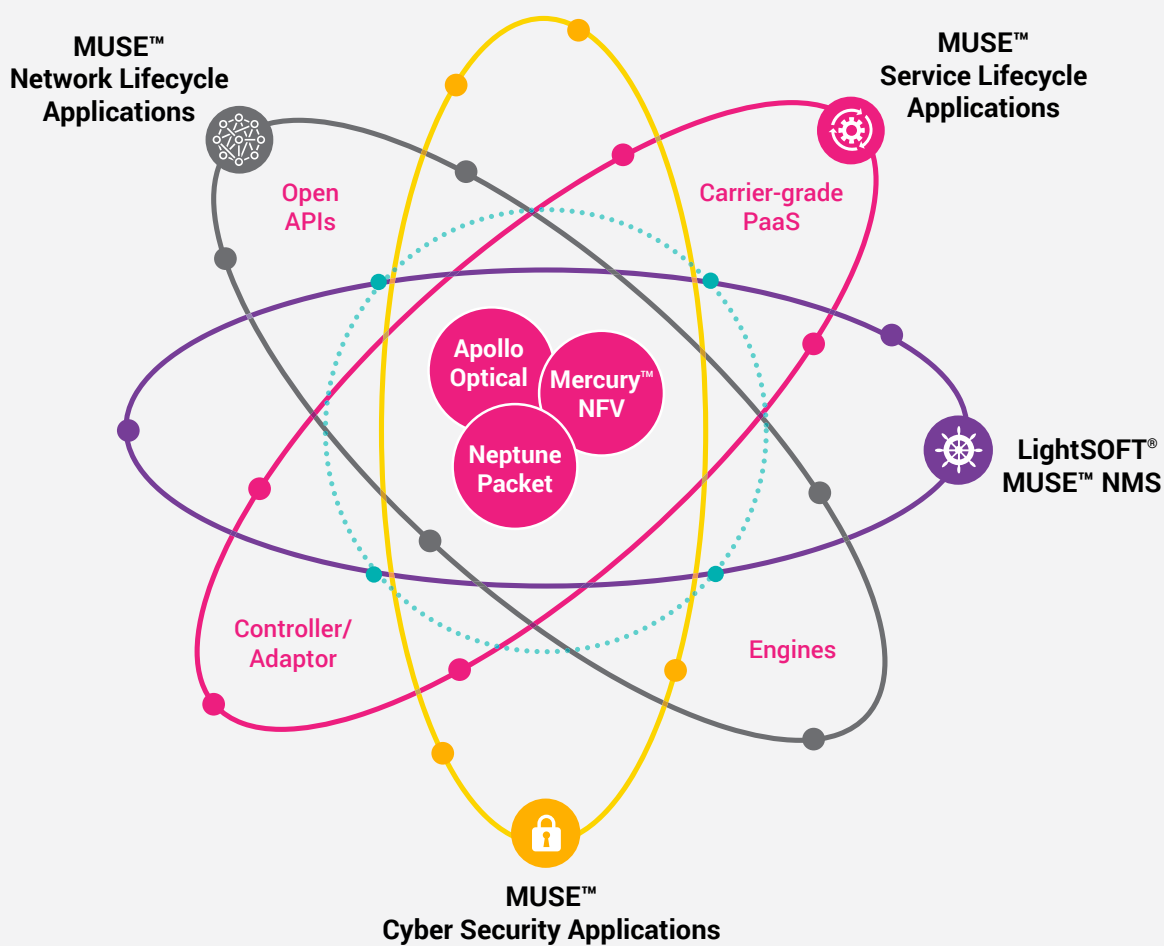
Secure Gateway: A multilayer suite including a NextGen-Firewall, Application Control, as well as IPS and Network-Antivirus. The Secure Gateway segregates the various OT LANs. This way, attacks cannot propagate to other locations in the network and lateral movement is blocked.

Encrypted Communications: L2/L3 encryption protects data flows between a pair of SHIELDS.

In addition, Neptune and Apollo provide encryption at every layer, with Apollo providing per-service optical encryption, and Neptune providing MACSEC and IPSEC.

ELASTIC Services Platform

Ribbon's ELASTIC Services Platform is a set of interworking hardware and software solutions. Network hardware platforms are controlled and supported by Ribbon's Muse software suite..



Ribbon's ELASTIC Services Platform for Critical Industries

Neptune

Powered by Elastic MPLS for Risk-Free Transition to Packet

The Neptune product family offers cost-optimized packet transport. It provides support for modern packet services, as well as for legacy TDM/SDH services and low-rate mission-critical services like SCADA. When it makes sense, the legacy services are migrated to the packet layer using Neptune's circuit emulation capabilities. Elastic MPLS is at the heart of the Elastic Services Platform solution and allows Neptune to provide a complete multiservice platform to support the Operational Technology (OT) and Information Technology (IT) services over the most appropriate transport technology. Mission-critical OT, like SCADA, requires the static, deterministic behavior that MPLS-TP provides. On the other hand, IP/MPLS and segment routing provide optimized support for IT services, like voice, video, and non-mission-critical networking. Both IT and OT traffic can be supported on the same or on different platforms if air-gap security is required. The key benefits that Neptune provides for critical infrastructure network operators are:

- MPLS-TP for mission-critical OT services
- Mission-critical service availability with advanced redundancy and protection schemes
- Support of legacy TDM/SDH interfaces
- Flexible SCADA support (TDM and Packet)
- Layer 2 and Layer 3 encryption
- NFVi for best-of-breed point-of-access security applications
- Unrivaled multiservice support, ready for future business evolution

Apollo

Optimized Optical Transport for Critical Industries

The Apollo product line provides state-of-the-art transparent and flexible DWDM transport with integrated OTN and packet switching capabilities. Apollo's modular architecture enables solutions that extend from the access network, to the metro core, to regional longhaul spans in point-to-point, ring, and mesh architectures. Apollo combines high-performance, low-latency OTN transport and OTN switching with software-configurable optical routing for maximum efficiency. Apollo has unique integrated intelligence features to make network administration and maintenance simple and insightful. The key benefits Apollo provides for critical infrastructure network operators are:

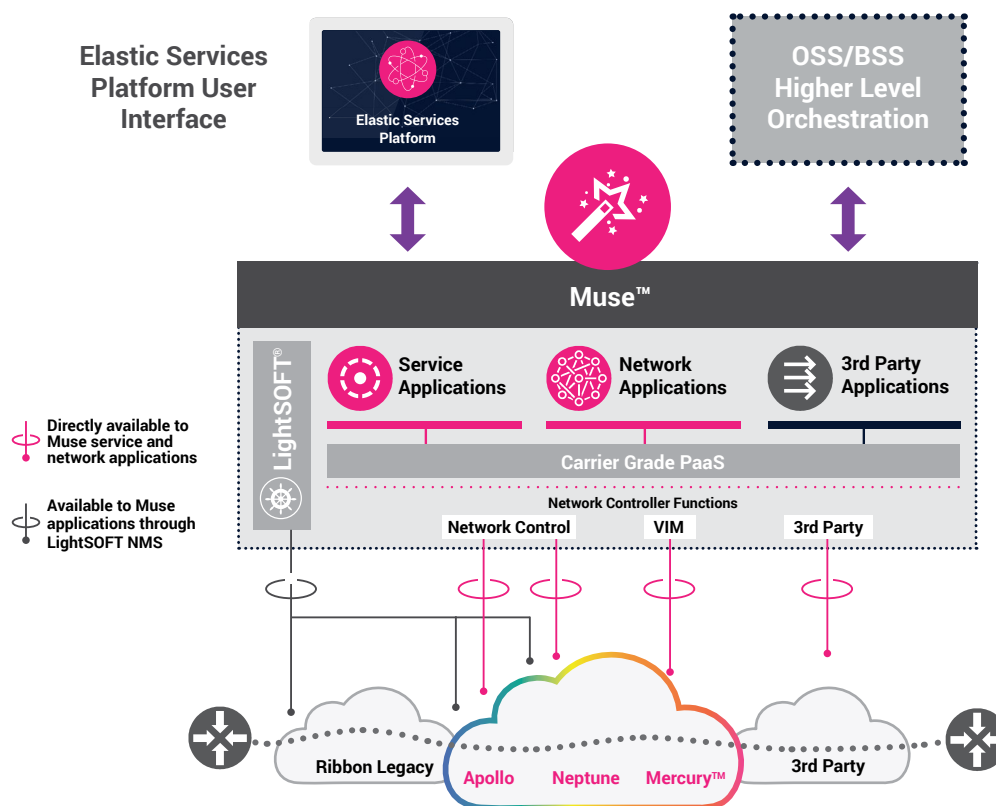
- Flexible optical infrastructure, including ADMs, ROADMs, muxponders, and amplifiers
- Seamless integration with the packet layer
- Optical encryption, per service
- LightPULSE™ integrated OSNR reporting and OTDR capabilities for the fiber network, allowing easy detection of network degradation or failure and rapid repair
- Ready-for-future business evolution with WDM, scalable from 10 Gbps to 1 Tbps.

Muse™ Software Suite

Advanced Operations Software

The Muse suite is Ribbon's holistic software offering, leveraging the best of industry-leading management systems and applications. Muse delivers real-time control over a secure network infrastructure and automates the service and network operation lifecycles. The key benefits Muse provides for critical infrastructure network operators are:

- **Service life cycle applications:** that use intelligence and automation to enhance the management of services over their complete lifecycle.
- **Network lifecycle applications:** ensuring the network infrastructure is in place, optimized, and running smoothly.
- **LightPULSE™:** uses OTDR and OSNR to detect and locate fiber degradation and failure.
- **LightSOFT®:** provides multilayer, intuitive network management, allowing CI network operators to manage their networks in real time.
- **LightINSIGHT™:** a LightSOFT™ application that ensures the network is operating at maximum availability, utilization, and efficiency.
- **Muse 3rd-party NE Controller:** provides management of third-party network elements.
- **Standard interfaces:** facilitate integration into wider ecosystems.



Risk-Free Modernization

Your Challenges

Our Solutions

To modernize and digitize the network, while assuring mission-critical SLAs (Service Level Agreements)

A risk-free evolution path that gives critical infrastructure network operators confidence for modernizing their networks, including:

- Field-hardened, proven migration processes
- Elastic MPLS, allowing legacy, current, and future transport mechanisms to be supported from a single platform
- Seamless integration of packet and optical transport
- MPLS-TP for providing the deterministic packet transport and advanced OAM required for mission-critical (OT) services, like tele-protection and SCADA
- IP/MPLS to support non-mission-critical and IT services
- Optical transport with OTN for high-bandwidth services, like HD video and DCI
- Multiple field-proven migration paths for legacy TDM and SDH networks

A platform with extended network lifetime

Designed for a 15-year deployment lifetime as standard, with:

- Elastic MPLS support for seamless introduction of new technologies, such as segment routing as they become viable for CIs
- Utelco-ready mobile and IoT backhaul, business services, and Carrier-of-Carrier services
- Future-proof SDN (Software Defined Networks) already available
- Easily-added new functionality with Mercury NFV (Network Function Virtualization)

Solutions Optimized for Critical Industries

Your Challenges

Our Solutions

Platforms optimized for the CI environment

Extensive multiservice capabilities for supporting OT and IT services include:

- Pay-as-you-grow architecture with unique in-service expansion units, scalable cross-connects, and in-service upgradable packet fabrics
- Compact form factor with high density and low power consumption
- Environmentally hardened
- Power over Ethernet interfaces to power external devices
- Support of utility-grade mission-critical services
- Compliance with strict regulations and standards (e.g. IEC 61850, IEEE 1613, EN 50121).
- Advanced software tools with automation, analytics, assurance, planning, maintenance, and monitoring to simplify operations of the network

Secure Operations Technology (OT)

Your Challenges

Our Solutions

Meet security regulations and standards as they evolve

Tailored, holistic security:

- Muse cyber security suite is compliant with security regulations and standards (e.g. NERC-CIP, BSI, ENISA, etc)

Point-of-access security for OT

Muse cyber security suite uses the Mercury NFVi capability embedded in Neptune™ to provide comprehensive protection for OT at the point-of-access, with secure gateway functionality including SCADA-aware firewall and other tools

Zero-day attacks

Distributed SCADA Anomaly Detection

Protection from man-in-the-middle attacks

Neptune and Apollo provide encryption at every layer, with per-service optical encryption, and Layer 2/Layer 3 encryption

Neptune provides packet transport protection with:

- MACSEC support, fully compliant with IEEE802.1AE, IEEE 802.1AEbn-2011, IEEE 802.1AEbw-2013, IEEE
- 802.1X-2010 (MKA protocol)
- IPSEC

Contact Us

Contact us to learn more about Ribbon solutions.