

Muse™ 5G Native Domain Orchestration



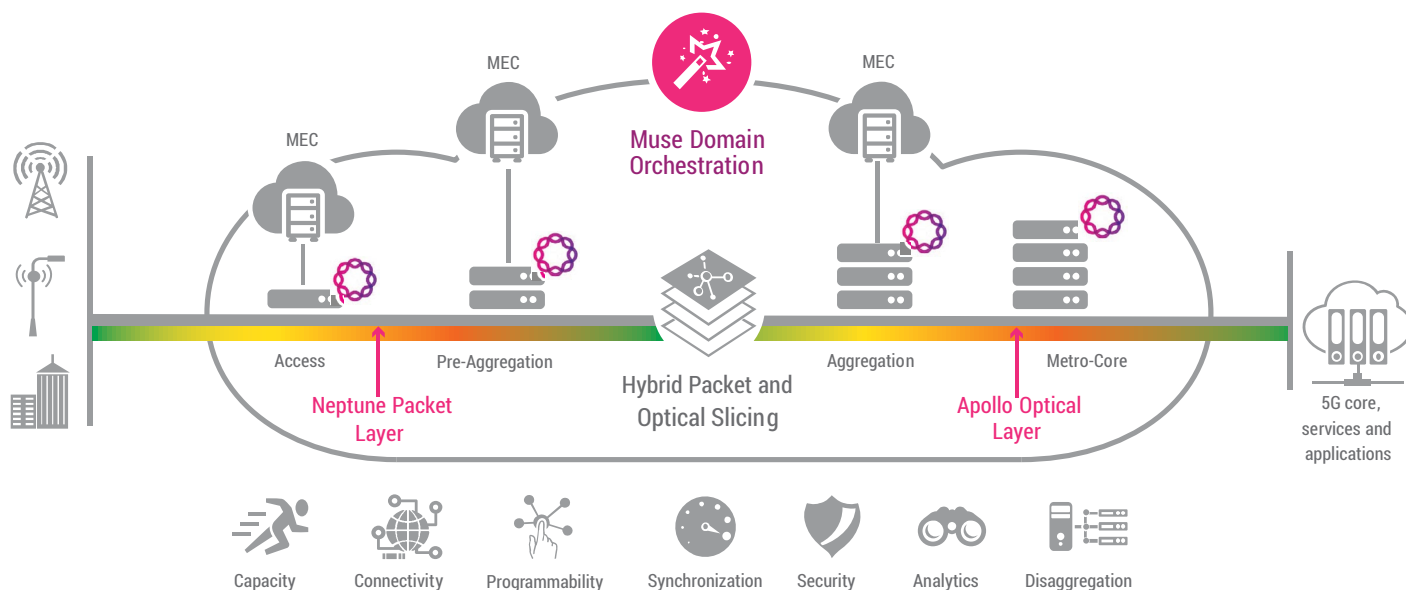
Real-time Management of a Multilayer Hybrid Sliced Network

The emerging 5G environment is creating new challenges for midhaul and backhaul networks. These include new services with different performance requirements, sharing a common infrastructure among different service providers, support for virtual private networks, and heightened requirements for security and service isolation.

It is widely recognized that the only way to meet next gen midhaul-backhaul challenges on a common infrastructure is using network slicing. Ribbon has created a 5G native transport solution that uniquely delivers programmable hybrid network slicing with advanced analytics, and surrounds that with other advanced capabilities. It enables network operators to address the above challenges, and transform their midhaul-backhaul network into a competitive platform for revenue generation that delivers secure, deterministic services.

Muse Domain Orchestration is the mastermind of the solution. Powered by a carrier-grade PaaS, it delivers complete lifecycle management for the underlying packet and optical transport network. Muse enables network operators to programmatically configure and combine hard and soft slicing technologies to create slices appropriate to different sets of 5G-enabled services and customer sub-networks. Then using a rich set of tools, operators can design, provision, and assure a broad array of services on top of the slices.

**5G native solution for delivering secure deterministic services -
Powered by programmable hybrid network slicing and advanced analytics.**



Cloud Native Control for 5G Native Transport

Muse Domain Orchestration is a modular suite of applications that streamline and automate the service and network operation lifecycles to extract the maximum value from Ribbon's packet, optical, and virtualized networking solutions. The applications create and activate new services rapidly and ensure that the network is optimized, available, and running at peak efficiency.

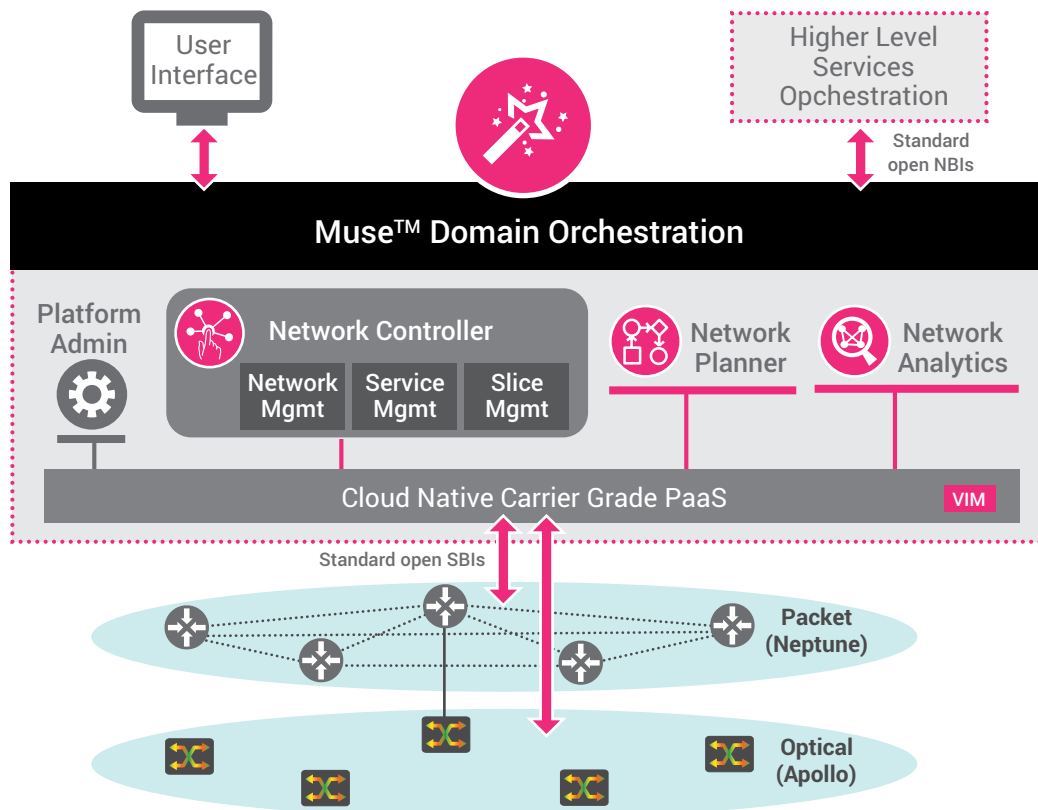
Muse Domain Orchestration applications are built on top of a carrier-grade cloud native PaaS, ensuring scalability and high availability. Through open interfaces on the PaaS, Muse makes it easy to incorporate applications and associated value from other sources. Muse Network Controller is the central application, delivering three major sets of functionality:

- **Network Management** oversees the lifecycle of network elements (nodes, links, etc.) for all topology layers, including maintenance, optimization, and efficient allocation of network resources.
- **Service Management** creates, modifies, and manages all types of services using smart Path Computation Elements (PCE) and policy-based assurance.
- **Slice Management** defines and provides continuous management of multilayer network slice instances, including slice definition, fulfillment, assurance, maintenance, and optimization.

Muse Network Controller works closely with the two other Muse Domain Orchestration applications:

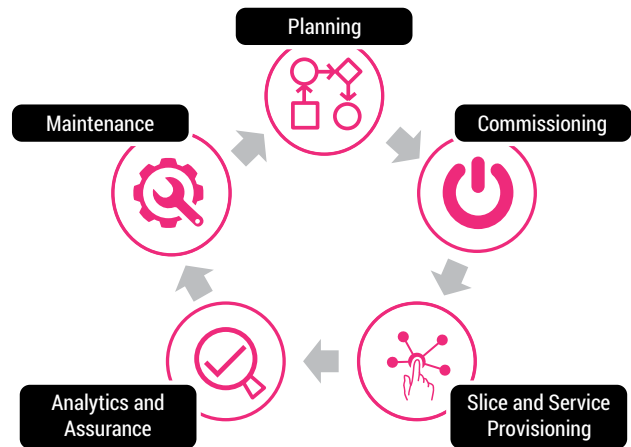
- **Network Planner** designs multilayer optimized packet and optical networks that maximize service delivery capabilities and availability, using a minimum set of network resources.
- **Network Analytics** continuously guides network planners on how to optimize a network's ability to sustain failures and assure Service Level Agreements (SLAs).

All Muse Domain Orchestration applications are controllable via an intuitive Muse GUI or through standard and open northbound interfaces that can be exercised by OSS or higher-level orchestrators.



Complete 5G Transport Lifecycle Management

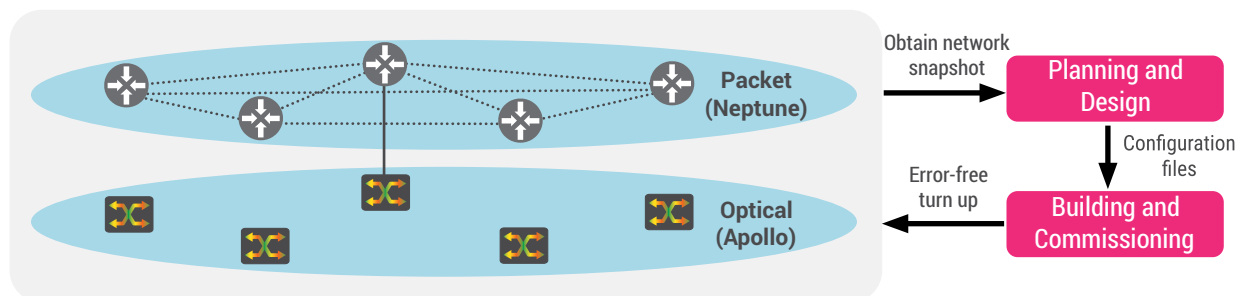
Muse 5G Domain Orchestration ensures that the midhaul-backhaul network, powered by the Neptune packet network and Apollo optical network product lines, is ideally configured and continuously tuned for the 5G services environment. Providing complete lifecycle management, it oversees that an optimal network infrastructure is in place and runs smoothly to support services. Muse balances between automation that removes unneeded human involvement, while allowing human operators to step in anytime to make override decisions. This facilitates network modernization, enabling the addition of automated processes and other advanced capabilities steadily over a period of years.



Building Optimal 5G Transport - Planning through Commissioning

Muse provides next-generation planning for multilayer optimized packet and optical networks that maximize service delivery capabilities and availability, using a minimum set of network resources, for either greenfield or brownfield networks. In the case of brownfield networks, Muse works on actual configuration data it uploads from the network. Starting with a service demand matrix, state-of-the-art algorithms optimize on user-selectable factors including cost, latency, and OSNR, and can telescope-in to plan selected portions of the network critically. Sophisticated simulation testing analyzes design robustness, such as how to handle CIRs in the event of failures.

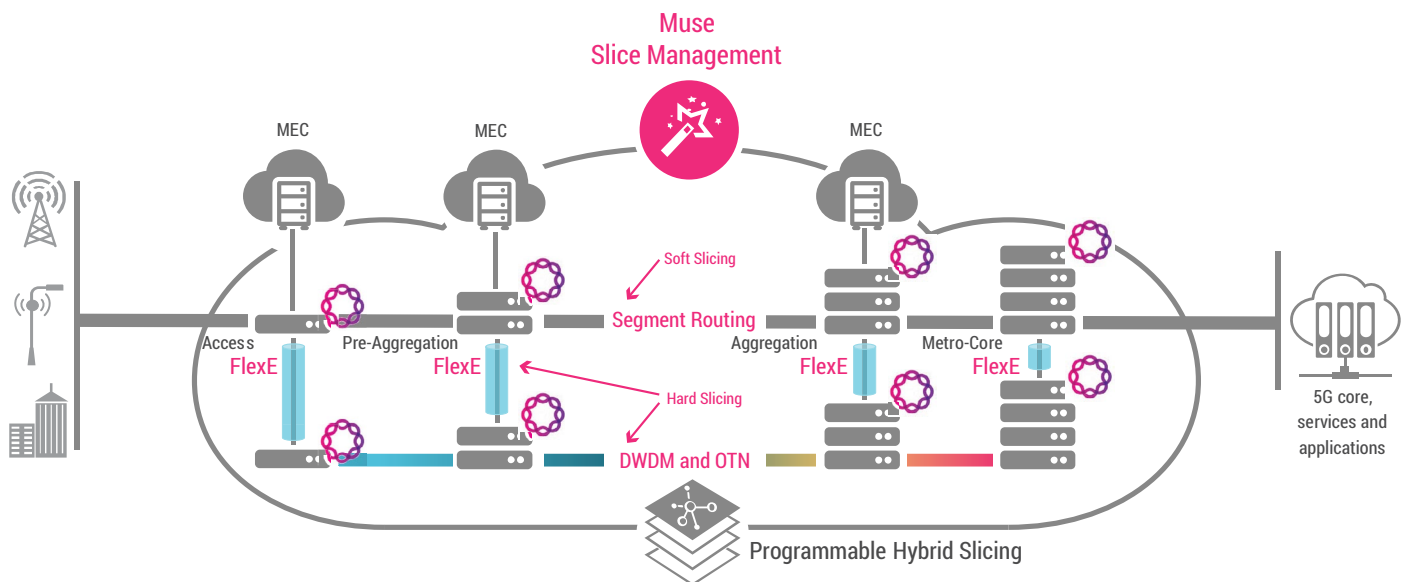
In the same way that Muse uploads data from the network for a real-time snapshot on which to create plans, it remains in lockstep for building the network. It creates detailed files for site installations, and downloads initial configurations directly to the equipment for error-free plug-and-play turn up.



Monetizing 5G Transport – Slice and Service Provisioning

5G is ushering in a new era in communications, supporting multiple service classes with associated performance guarantees, for the first time. The challenge is organizing a common physical network to deliver different combinations of high-bandwidth, low-latency, and high-availability services simultaneously. Network slicing, which assigns network resource pools dynamically to different services, is widely regarded as the most efficient means to achieve this goal.

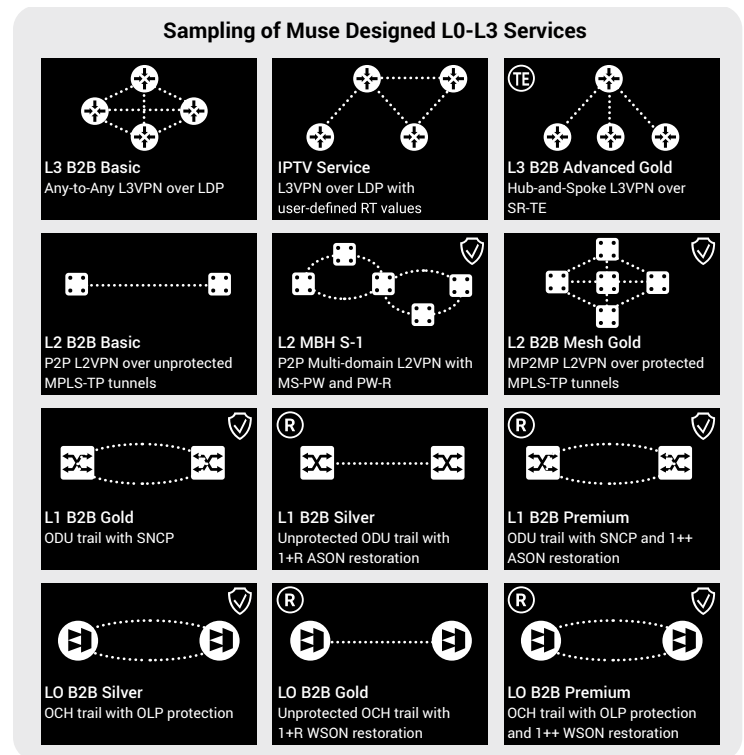
Ribbon's 5G native solution delivers a unique network slicing solution that combines hard and soft slicing across multiple network layers. Hard slicing dedicates resources such as FlexE time slots, ODU channels, and wavelengths. Soft slicing shares resources to set up L2 and L3 VPNs, and segment-routed topologies.



Muse™ 5G Native Domain Orchestration

Muse Domain Orchestration provides sophisticated tools to design and assign resources to multilayer network slices, and then design and create services to run on top of these slices. It enables network operators and service providers to tailor specific performance and availability guarantees for each slice and service individually, while extracting maximum throughput from a common network for the entire complex mix of slices and services, as a whole.

Ready-to-use templates can be applied to individual customers, slices, and services, and new templates can be designed from scratch. The templates combine powerful abstraction capabilities to create wide-ranging “connectivity configurations”, with different performance and reliability parameters, with real-time control of underlying network resources to provision them. CRUD controls are available to update and modify slices and services, as needed, to respond to evolving customer needs.








Ensuring Smooth Running – Analytics, Assurance and Maintenance

A 5G transport network that shares resources among multiple users is complex by definition. It is necessary to “stay on top” of the network so that small changes do not affect services. Muse Domain Orchestration accomplishes this by monitoring the status and performance of the network continuously, from traffic flows and resource utilization, to warnings and alarms. It then makes necessary adjustments to the network’s configuration proactively to ensure it is always running at peak efficiency. Various capabilities include:

- Using modeling to stress test the network topology to determine how services are impacted under multiple failure scenarios, such as individual card failures, fiber breaks, entire site failures, and more. It then advises how to maintain SLAs through applying protection and dynamic restoration architectures.
- Measuring KPIs against historical trends, to identify and address degradations early on, before they become significant. KPIs range from packet network utilization to packet Connectivity Fault Management (e.g. delays, loss), to changes in optical link OSNR levels.
- Sectionalizing faults rapidly when hard failures do occur, such as using OTDR to identify fiber breaks rapidly to within a few meters, and then linking this with GPS capabilities to dispatch repair personnel

In cases where tuning the network can no longer maintain necessary performance, Muse Domain Orchestration re-initiates a planning cycle to make necessary upgrades to the network, closing the lifecycle loop.

Delivering Optimum 5G Native Transport

5G Transport Challenge	Muse 5G Domain Orchestration Solution
 Seamless planning to implementation	Iterative planning for greenfield and brownfield networks allows creating a customized balance between performance and investment. Plug-and-play features ensure rapid and error-free installation and turn up.
 Optimally sharing a common infrastructure for multiple slices and services	Creates and manages "hybrid slices" that combine hard slicing resources like FlexE slots and ODU channels, with soft slicing VPN and segment routed packet resources.
 Fast time to market and service differentiation	Template driven processes rapidly define and provision services; including tools to design new templates from scratch suited to specific network capabilities and customer needs.
 Smooth network operation	Continuous network and service monitoring identifies degradations before they become service affecting. Dynamic restoration recovers from outages using shared resources.
 Living in a multivendor 5G ecosystem	Standard and open NBIs and SBIs enable integration with higher level orchestration and other network equipment.

About Ribbon

Ribbon Communications (Nasdaq: RBBN) delivers communications software, 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 innovative, end-to-end solutions portfolio delivers unparalleled scale, performance, and agility, including core to edge software-centric solutions, cloud-native offers, leading-edge security and analytics tools, along with IP and optical networking solutions for 5G. We maintain a keen focus on our commitments to Environmental, Social and Governance (ESG) matters, offering an annual Sustainability Report to our stakeholders. To learn more about Ribbon visit rbbn.com.

Contact Us

Contact us to learn more about Ribbon solutions.