

# 5G Native Transport



### Providing xhaul for 5G services

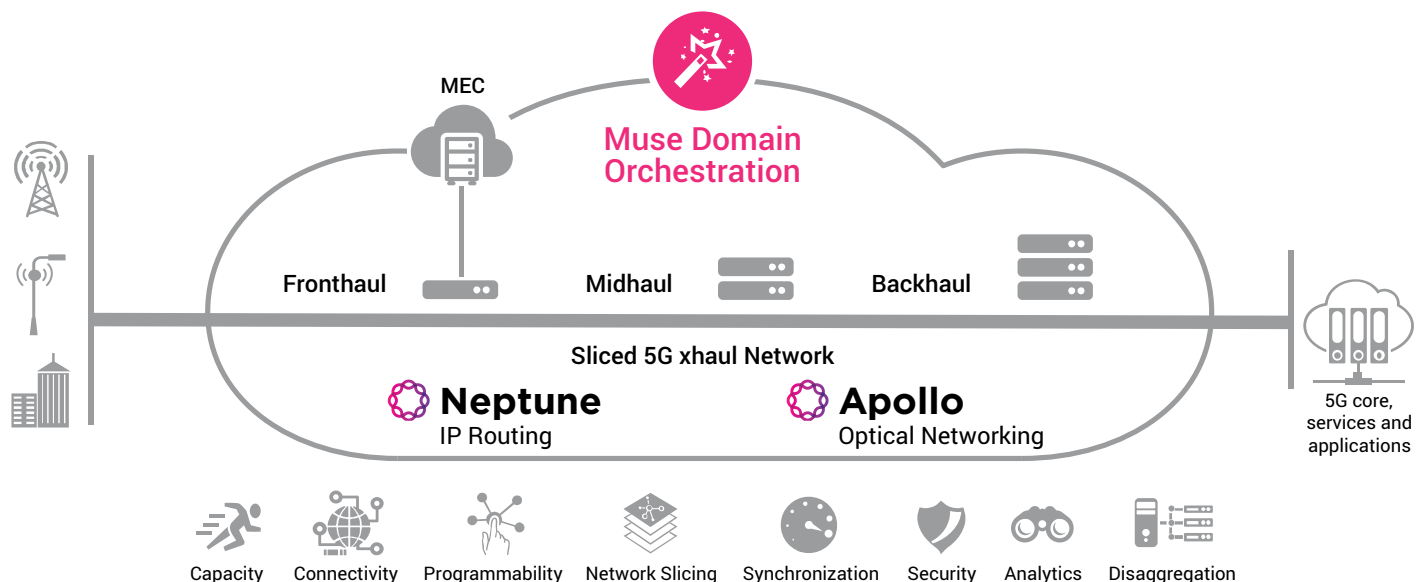
5G technologies will allow mobile network operators to introduce a vast array of new mobile services. Today we already see 5G used to deliver enhanced mobile broadband and services like online mobile gaming, e-health, AR/VR, IoT/IIoT applications and private networks for mission-critical networks, will soon follow. Each of these new services has different policies and performance parameters for latency, latency variation, capacity, reliability, security, and isolation. A new type of transport solution is required to support all of these services on a single physical network. This network must provide deterministic performance to guarantee SLAs, as well as the enhanced security and reliability expected by mission and business critical applications.



As an IP and Optical specialist, Ribbon has developed an industry-leading, 5G native solution for delivering these services. Hybrid network slicing sits at the heart of the solution. Hybrid network slicing provides both soft and hard slicing technologies, allowing MNOs and transport network operators (TNOs) who lease transport to the MNOs, to choose the best combination of slicing technologies for the services and customers they support. Operators then use intelligent operations, incorporating advanced analytics, to design, create, and assure a broad array of services across these slices.

Ribbon's 5G native solution provides network operators with a unique capability to transform their transport network into a competitive revenue-generating platform.

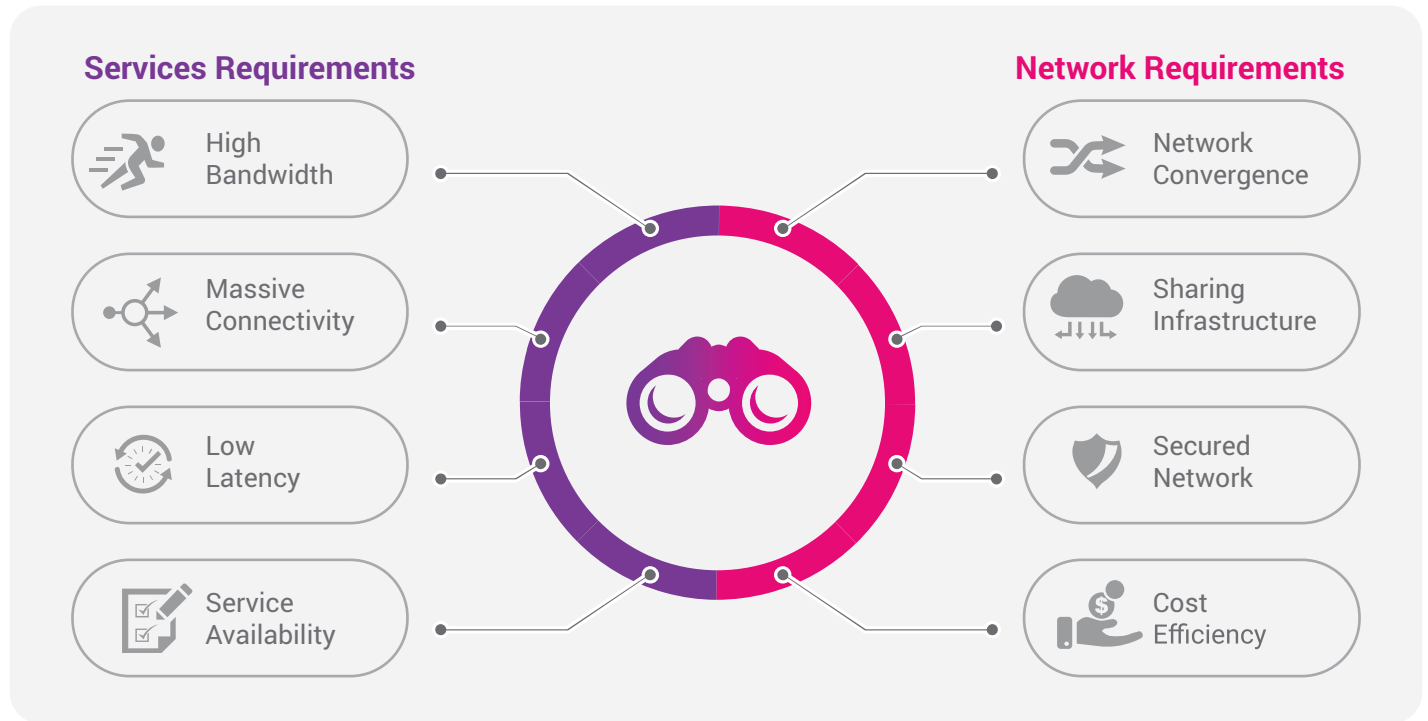
### 5G native solution for delivering secure deterministic services - Powered by programmable hybrid network slicing and advanced analytics





### New xhaul Network Challenges

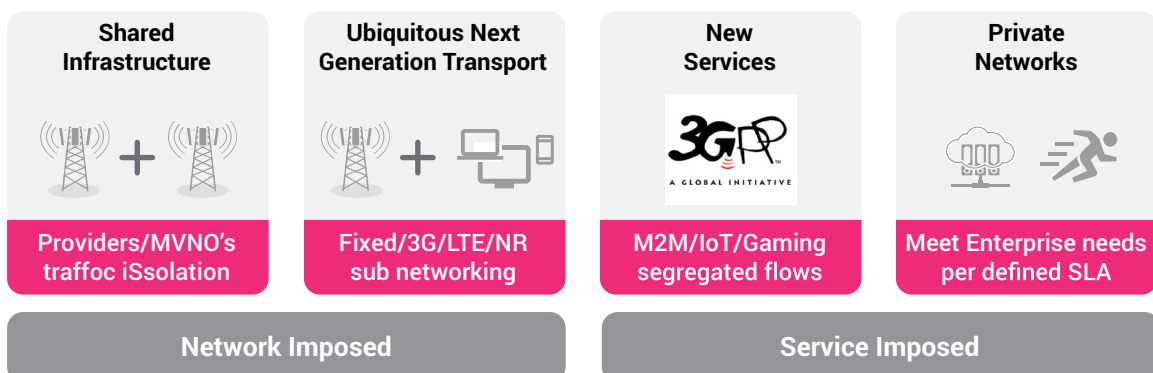
Xhaul networks cover huge geographies, aggregating and connecting traffic from the network edge to a high-density network core. Until now, these networks focused mostly on delivering a level of best effort transport consistent with service expectations, which they largely achieved with a fixed “nailed-up”, one size fits all infrastructure. A newly emerging dynamic environment is, however, creating new challenges for these transport networks.



#### Dynamic 5G Architecture

Traditional mobile networks have been static in nature. Traffic from the radio access network (RAN) is backhauled by “nailed-up” connections to the mobile core and centralized applications. This all changes with 5G, the RAN becomes disaggregated with radio components being geographically located and instantiated where (and when) required. Similarly, the mobile core and the applications become disaggregated and virtualized, instantiated where and when required. For

example applications requiring ultra-low latency will be instantiated in multi-access edge compute (MEC) located close to the end user. The 5G xhaul network must be able support this highly dynamic environment.



## 5G Native Transport

### Shared Infrastructure

The transport network must support multiple MNOs sharing a common transport infrastructure or transport wholesalers leasing transport to multiple MNOs over a common transport network. The 5G xhaul network must support this shared infrastructure while providing the MNOs operational and network isolation.



### Ubiquitous IP Optical network

Many network operators are looking to consolidate all of their new, and legacy, fixed and mobile services onto a single network. The 5g xhaul network must be able to provide this single ubiquitous network while providing isolation between the various networking domains.

### New Services

5G technologies in conjunction with advances in cloud-based computing, robotics, telemetry, and end-user AR/VR interfaces is ushering in a brave new world of mobile services. These span e-gaming, e-sports, e-health, smart cities, smart transportation, enhanced social interactions, private networks and many more. Each of these services imposes vastly different requirements on network in terms of bandwidth, latency, latency variation (jitter), reliability and security. The 5G xhaul network must be able to simultaneously support each of these differing service types.



### Private Network

Mobile networks continue to expand beyond consumer services. LTE currently enables multiple industrial use cases and companies are increasingly adopting 5G into their future network plans. Some enterprises will build their own fully isolated end-to-end private network, others will deploy their own 5G radio resources and lease xhaul capacity, others will use a mix of private and public 5G to meet their service demands. The 5G xhaul network must be flexible enough to support the various operational models and be able to guarantee traffic is fully isolated and protected from other network users.

### New Business Cases

Some MNOs will start exploiting the increased capacity of 5G technologies to compete directly with fixed wireline services delivered today. The 5g xhaul network must support the additional capacity requirements this imposes.

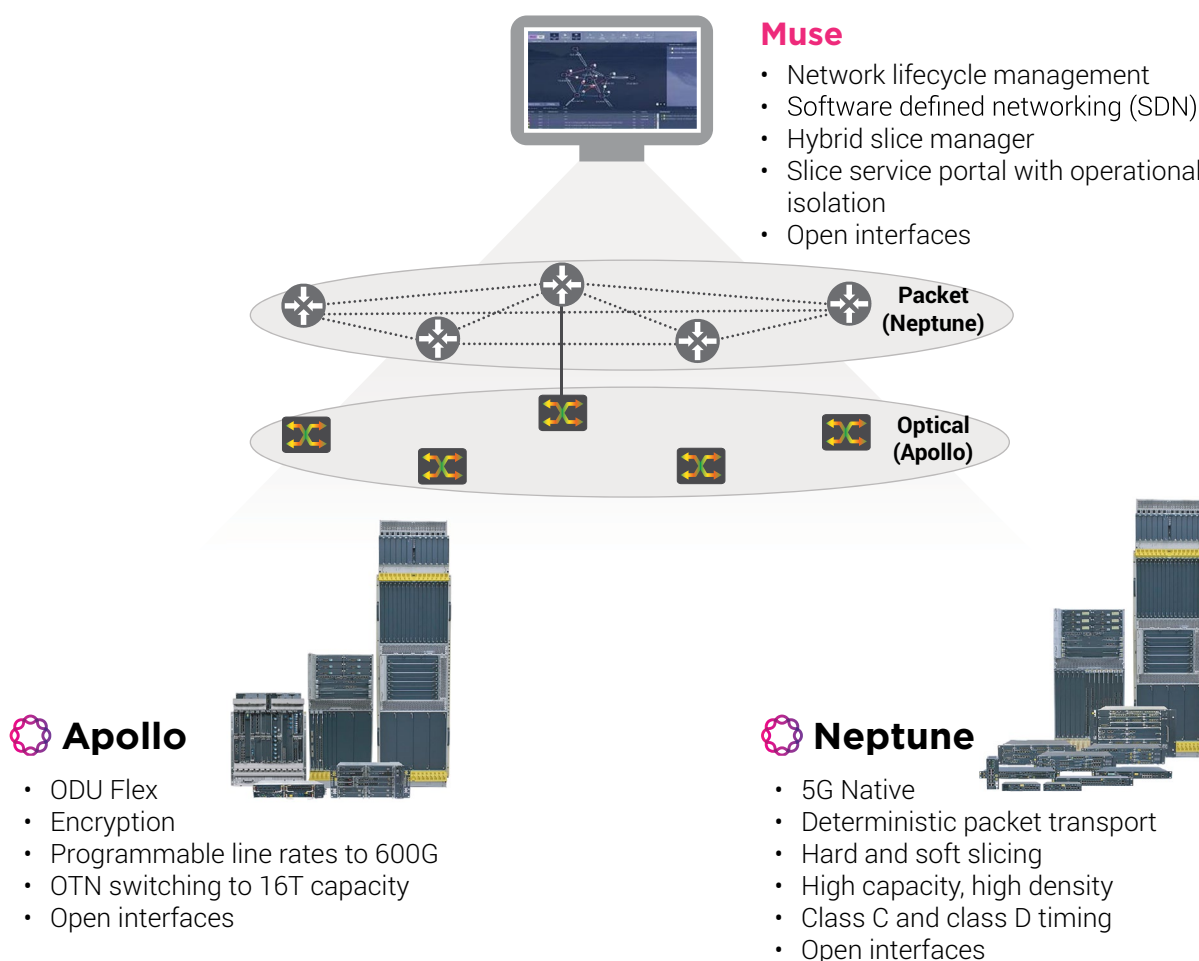


### Security

With malicious cyber-attacks on the increase and governments increasing fines for data breaches, security is a major concern. As the 5G architecture is much more dynamic and complex than previous mobile generations the number threat vectors rises dramatically. The 5G xhaul network must provide holistic security to protect against these threats, for example; the network being attacked for malicious purposes, data being intercepted stolen or changed or data "leaking" (maliciously or not) from one user to another.

### The need for a 5G Native Solution

Ribbon has a seamlessly integrated IP Optical solution which uniquely delivers programmable hybrid network slicing and advanced analytics to meet the needs of 5G xhaul. This 5G native solution provides a competitive platform for transporting secure, deterministic services. Ribbon's solution combines purpose-built IP and optical networking functionality with a cloud native control infrastructure. It is composed of IP routing capabilities provided by Neptune, optical networking provided by Apollo, and the SDN domain orchestration provided by Muse.



#### Network Slicing

Network slicing provides the network isolation required to allow multiple services or customer networks to share a common infrastructure. Our 5G xhaul solution supports a comprehensive set of slicing technologies. In our approach, strict isolation (hard slicing) runs side by side with a more lenient classical service assurance-based packet processing approaches (soft slicing). By using reliable time division-multiplexing concepts for hard slicing, and statistical multiplexing technology for soft slicing, the solution provides the operator with the elasticity they need to choose between strict and lenient slicing approaches, as they need.

## 5G Native Transport

### Programmability

Service definitions, service mixes, and customer networks are constantly changing. Resources assigned to slices, and the parameters governing slice performance (particularly soft slices) must be adjusted continuously to ensure the transport network is performing at peak efficiency. 5G networks require a reliable, dynamic, real-time approach to introducing and assuring new services. Ribbon's 5G Native solution provides open and standards compliant northbound interfaces from its Neptune and Apollo network elements to support real-time management and automation as part of any ecosystem.



Ribbon's Muse domain orchestrator allows network operators to launch new services and drive new revenue streams quickly by providing all the tools required to program and automate management of the packet and optical transport network. A suite of advanced service and network control applications enable simple service creation and lifecycle management, proactive network assurance, network optimization, and automation. Muse uses sophisticated design algorithms to dynamically assign resources to hard and soft slices and tailors performance and availability guarantees for each service individually, while ensuring maximum throughput from the entire network for the complete service mix.



### Advanced Analytics

Advanced automation techniques help operators to address their top business challenges, including reduction of operational costs, simplifying network complexity and monetization of 5G services. Operators must therefore harness machine learning (ML) - based analytics to enhance their current automation capabilities in the following areas:

#### Network optimization of the 5G network:

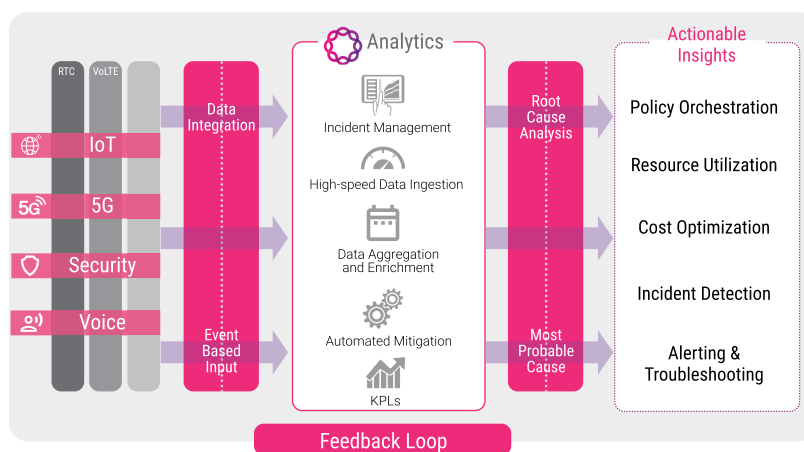
Advanced intelligence-based analytic applications like traffic classification ensure the 5G traffic is optimized and served effectively.

**SDN/NFV:** The learning and predictive capabilities of ML and Deep Learning (DL) models provides service orchestrators with insights on when virtual resources need to be scaled up or down in line with demand.

**Microservices based EPC/5GC:** Automation with advanced insights can be applied to monitor microservices running in container-based environments, to identify and troubleshoot anomalous events.

**Multi-access Edge Computing (MEC):** Autonomous systems allow traffic classification at the network edge, allowing traffic streams requiring real-time processing to be allocated to MEC resources and those not requiring local processing to be allocated to the core for processing.

**Network slicing:** ML and DL models can be trained to perform these functions and to monitor the performance of network slices to determine when an overload or failure is likely to occur. Remedial actions can be triggered by the analytics applications to correct any undesirable or anomalous behavior and assure the quality of services. The Ribbon Analytics portfolio consists of Operations, Security and Monetization applications to deliver numerous use cases for service assurance, security and subscriber growth. Ribbon Analytics leverages Machine Learning (ML) to identify, in real-time, most leading indicators of problems before they occur. With, highly scalable, advanced analytics the application delivers insights, intelligence and outcomes about network outages, service degradation and security threats as the network grows in complexity.



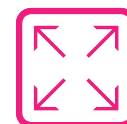


### Enhanced Connectivity

Ribbon's 5G native solution supports the deterministic connectivity required for new 5G services such as gaming, eHealth, private networks and mission critical networks, which need strict performance guarantees, by using PCE, Segment Routing –TE and FlexE to provide the deterministic connectivity required to guarantee the latency, capacity, reliability, service isolation required for these services.

### Massive Capacity

With enhanced mobile broadband, streamed HD videogaming, AR and VR, 5G networks must support huge capacity growth. Capacity demands for a 5G network are about 10 times greater than LTE-based networks. Ribbon's 5G native solution tackles the new capacity with 100GE to the cell site and appropriate multi-rate interfaces, such as 5GE and 25GE. The solution supports capacity scaling from the access ring up to multi-tera platforms for the metro core connectivity, with seamless packet and optical integration, based on our Neptune and Apollo product lines.



### Synchronization

Ribbon's 5G native solution provides the high-accuracy synchronization required by 5G mobile networks to support superfast broadband and positioning services. It supports a GPS receiver, SyncE, ITU-T G.8273.2, ITU-T Class C, and it is designed to support class D when the standard is approved. This allows the solution to support all 5G architecture and deployment scenarios, now and in the future.

### Security

We have discussed above how 5G networks require advanced security. Ribbon's 5G native solution provides a comprehensive and holistic approach, including advanced secured platform mechanisms, strict access to network control, secured management communication, slice isolation, and secured multilayer traffic encryption. This approach and design ensure ultimate network protection against threats.



### Ribbon's 5G Native Solution - Holistic Security



#### Platform Security

UEFI Secured boot  
Chain of trust  
Access control



#### Network Security

FlexE Isolation  
L1 Encryption  
MAC Sec



#### Network Management

Authentication  
Access control  
Secured communication



### Disaggregation

Increasingly, network operators are pursuing disaggregated solutions, where they have the flexibility to assemble networks based on transport and control sub-systems from different vendors. The essential elements of Ribbon's 5G native solution – Neptune packet networking, Apollo optical networking, and Muse SDN domain orchestration – have been developed based on disaggregation design concepts.

Software and hardware decoupling, and hardware disaggregation are available today. Ongoing activities will also deliver a disaggregated cloud native network operating system (NOS), and multi-vendor white box support. Our products are aligned with the open and disaggregated TIP and open ROADM specifications.

### The Opportunity is Now

The 5G tide is rising and will be a watershed event in the telecommunications industry. Companies that start making changes to their networks now to capitalize on 5G opportunities can profit immensely, while companies that choose to “wait and see” can easily find themselves too far behind to catch up.

Ribbon's 5G native solution allows network operators to smoothly transform their transport networks into competitive revenue-generating platforms. Built using seamlessly integrated, intelligent programmable IP Optical networking – it supports all 5G needs for connectivity, capacity, synchronization, analytics and security – ensuring 5G xhaul network will be able to profitably support whatever services are thrown at it today and into the distant future.

**Contact Us**

Contact us to learn more about Ribbon solutions.



## 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](https://rbbn.com).