Ribbon Next-Generation Healthcare Network Solutions

High-Capacity, Low-Latency, Resilient IP and Optical Middle Mile for the Digital Era

Digital Transformation is Pushing Incumbent Healthcare Networks to the Brink

Hospitals and healthcare systems are adopting digital technology to enhance patient care, improve outcomes, and boost business results. Digital transformation and cloud-based services are reshaping traffic flows, increasing capacity demands, and creating performance, security, and service quality challenges for healthcare network planners and architects.

A wide variety of bandwidth-hungry and delay-sensitive applications are pushing incumbent healthcare networks to the brink, including:

- **Electronic health/medical record (EHR/EMR) systems** that digitize patient data
- **Next-Gen Picture Archiving and Communication Systems (PACS) systems** for 3D radiology, surgical planning, etc.
- **Unified communications and video conferencing solutions** for improving collaboration
- **Telehealth/telemedicine solutions** for remote consultations and diagnosis
- **IoMT traffic** from smart bedside devices and intelligent medical equipment
- **Cloud-based solutions and services** for clinical and non-clinical applications
- **Computerized Physician Order Entry (CPOE) systems** for automating treatment instructions
- **Data center interconnect (DCI) traffic** for business continuity and disaster recovery (BC/DR)
- **Future applications** like telesurgery
- **High-capacity access connectivity** ranging from fixed connectivity with Fiber and Wireless from 5G and WiFi6

Ribbon Next-Gen Healthcare Network Solution Benefits

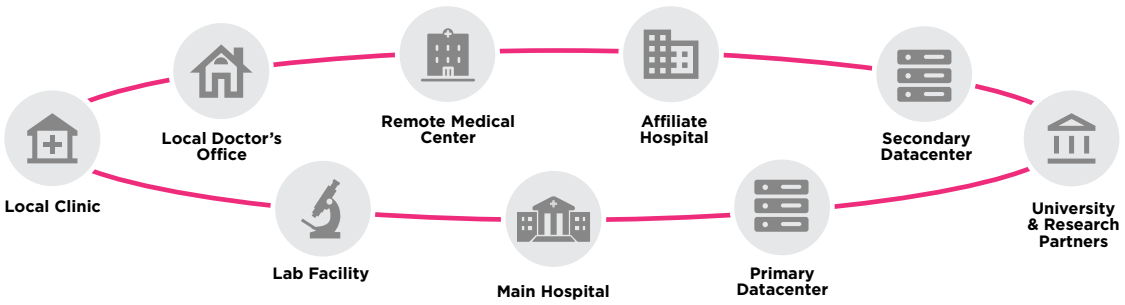
Functional Advantages

- High-capacity connectivity for bandwidth-intensive applications
- Low-latency connectivity for delay-sensitive traffic
- Dependable connectivity for critical applications and services
- Network slicing for meeting SLA and optimal resource allocation among tenants.

Business Advantages

- Improve collaboration and productivity for clinicians, administrators, researchers, and business professionals
- Improve patient care and outcomes
- Minimize network operations expense and complexity
- Monetize investments with shared tenant services

Today's Healthcare Networks Connect a Variety of Sites and Constituents



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Next-Generation Healthcare Network Requirements

Conventional healthcare networks, engineered to support traditional applications and workloads, aren't well suited for the digital era. Healthcare IT organizations must upgrade network infrastructure to meet the increased capacity, performance, and resiliency demands of the digital world.

We already see healthcare having access to high-capacity access connectivity ranging from fixed connectivity provided by fiber through to high-speed wireless connectivity provided by 5G and WiFi6. To make best use of this access capacity, the healthcare industry needs an IP Optical middle-mile able to transport health services and applications to meet their performance requirements. Service-aware packet transport and network slicing are key elements allowing next-generation healthcare networks must provide:

- **High-speed connectivity** to support bandwidth-intensive applications like 3D PACS studies or genomic research
- **Low-latency networking** to support delay-sensitive flows like videoconferencing or telehealth traffic
- **Resilient, high availability connectivity** for mission-critical and life-critical applications
- **Granular traffic engineering capabilities** to enforce different SLAs for different application types
- **Secure communications** to safeguard protected health information (PHI) and comply with HIPAA and other data privacy regulations
- **Network Slicing** to guarantee segregation of life and mission critical services from each other and to guarantee to deliver services to meet their performance requirements

Introducing Ribbon's Intelligent Middle Mile for Next-Generation Healthcare

Ribbon's comprehensive Intelligent Middle Mile for Healthcare provides an optimized IP Optical network optimized to meet the requirements of healthcare networks. It meets stringent network capacity, performance, and resiliency demands while minimizing operations expense and complexity.

Programmable Optical Networking with Apollo

Ribbon's versatile and extensible Apollo optical networking system provides a high-bandwidth foundation for next-generation healthcare networks. The unique capabilities and advantages of Apollo include:

Economical, pay-as-you-grow 10G to multi-100G transport. Apollo supports a variety of optical transmission options to satisfy a range of bandwidth requirements. Standard, pluggable optics make it easy and cost-effective to add capacity as traffic demands increase. Apollo supports all major clients, including Ethernet, Fibre Channel for Storage Area Networks, and TDM for legacy voice connections.

Flexible, survivable backbone network. Ideal for private network deployment, Apollo supports compact ROADMs (reconfigurable optical add/drop multiplexers) that deliver wavelength flexibility and enable dynamic restoration. Combined with protection switching, Apollo ROADMs provide an economical way to ensure continuous availability in the event of equipment or link failures.

Protection against fiber tapping and PHI theft. Fiber-optic cables are susceptible to tapping and data theft. Apollo supports AES-256 optical encryption to prevent tapping and safeguard data privacy without adding latency or impairing application performance.

Seamless migration from existing links. Apollo can transport and manage legacy traffic transparently as an "alien wavelength" alongside Apollo wavelengths to protect and extend previous transmission equipment investments, and enable smooth transitions.

Integrated performance monitoring. Apollo monitors the health of the optical network, providing insights into optical power, OSNR (optical signal-to-noise ratio) and other performance statistics for both native and alien wavelengths, helping network technicians identify and resolve potential problems before they affect service quality and user experience.

Fiber health management. Apollo features integrated OTDR (optical time domain reflectometry) technology that automatically monitors the integrity of the dark fiber underlying the optical network, including all connections and splices. GPS integration helps fiber-provider repair crews save time and avoid guesswork by pinpointing fiber breaks and degradations within a few meters.

Service-Aware IP Routing with NPT

NPT the multiservice flexibility required to aggregate and route a vast array of next-generation healthcare network applications and services, meeting the SLAs of each on service by service basis. The versatile solution can be tailored to meet the specific needs of any healthcare organization. The unique capabilities and advantages of Ribbon's IP routing solutions include:

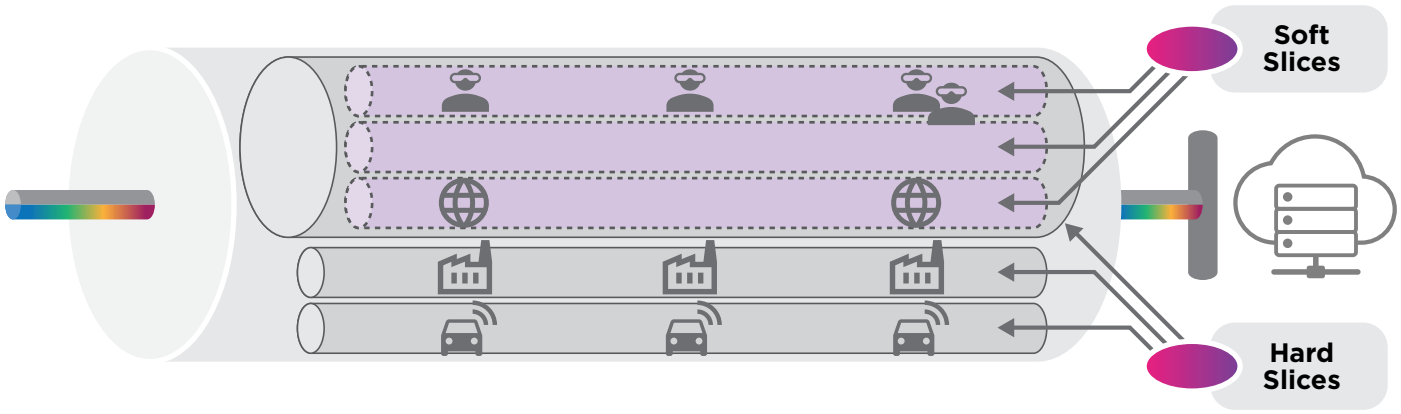
Converged multiservice edge aggregation. NPT aggregates services delivered from any access technology (mobile and fixed) onto a single network. The solution provides a full range of connectivity options and supports a variety of real-time Layer 2 and Layer 3 services including Ethernet Private Line (E-LINE) and Private LAN (E-LAN), Virtual Private LAN Service (VPLS) and IP Virtual Private Network (IP-VPN) services.

Service-aware routing. NPT takes a service-oriented approach to routing, steering traffic over the most appropriate transport technology for any given service. A single integrated network supports a variety of service levels, from a best-effort service with no performance guarantees to an SLA-backed service, engineered to meet the specific latency, availability, bandwidth, or isolation requirements of a mission-critical or life-critical healthcare application.

One network IP optical integration. NPT provides seamless IP-optical operation, with simple passive optical components and a range of optional coherent optical Dense Wavelength Division Multiplexing (DWDM) pluggables integrated into the NPT platform. When the routing takes advantage of a separate optical networking layer, Muse provides multi-layer optimization between the IP and optical layers resulting in a seamlessly integrated end-to-end IP-optical network.

Flexibility and extensibility. NPT is designed to help organizations minimize upfront investments, avoid overprovisioning capacity, and align ongoing expenses with business requirements. A high-density, modular design enables pay-as-you grow scalability. Healthcare IT organizations can enable technologies such as Layer 3 VPNs, E-VPN, Segment Routing Traffic Engineering (SR-TE), Path Computational Element (PCE), and FlexEthernet (FlexE) in software for ultimate flexibility, extensibility, and economics. Neptune makes it easy and cost-effective for organizations to add capacity or introduce new technologies over time as requirements evolve.

Network Slicing. NPT provides a full network hard and soft slicing toolkit. Hard slicing allows services to be totally segregated from each other, while still using the same network. Hard slicing is essential for mission and life critical systems and applications used in healthcare where network performance needs to be absolutely guaranteed. Less critical services still need to be delivered to meet SLAs and KPIs, for these services, soft slices can be created, each soft slice meeting a specified level of performance such as capacity, latency, jitter. Multiple soft slices can be supported by each hard slice. Hard slicing also allows multiple tenants to use the same network, whilst providing strong segregation between each tenant.

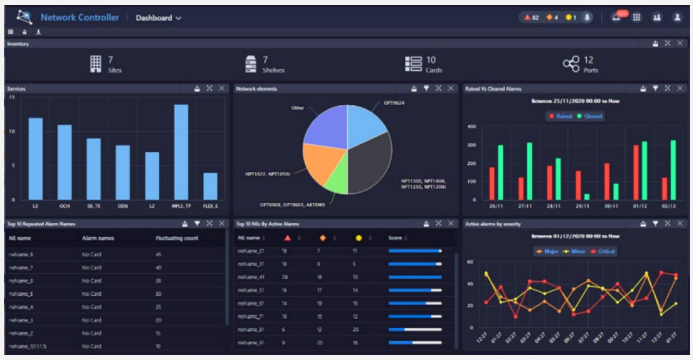


Network Slicing

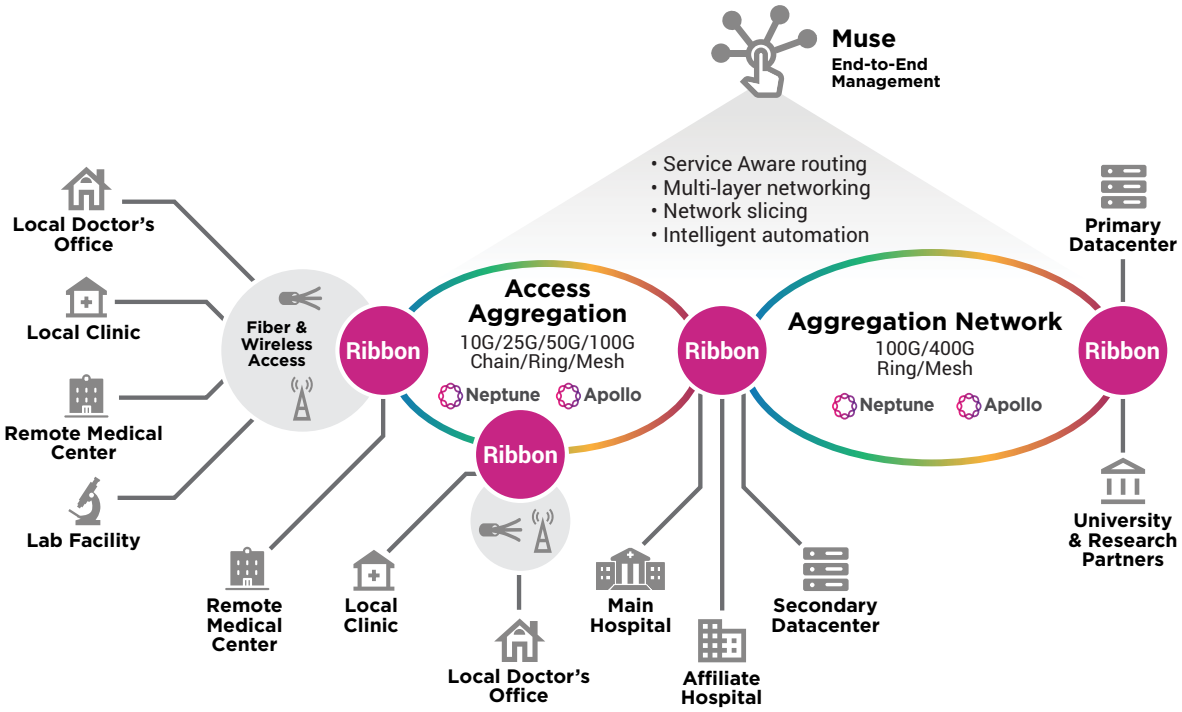
Muse Domain Orchestration

Unifies management and operations for the middle mile network used by healthcare network. The solution includes configurable dashboards that provide at-a-glance visibility into the status of network services and infrastructure. An intuitive browser-based interface makes it easy for healthcare network administrators to provision end-to-end services and links, optimize network performance and service quality, and monitor and maintain network infrastructure.

Muse supports role-based access controls (RBAC) for managing administrative privileges and preventing unauthorized access. The solution encrypts all management traffic using Transport Layer Security (TLS) to ensure data privacy and protect against malicious activity.



Muse Dashboard



Ribbon's Intelligent Middle Mile for Health

Monetize Investments with Shared Tenant Services

Forward-looking healthcare IT organizations are turning to shared tenant services to generate revenues and accelerate investment returns. Budget-constrained IT organizations can turn surplus bandwidth into cash by selling voice, video, or data services to independent medical practices and solo practitioners. Shared tenant services are a great way to monetize assets and make the most of network infrastructure investments.

Conclusion and Next Steps

Traditional healthcare networks, designed to support conventional applications and workloads, aren't well suited for the cloud-centric digital world. Ribbon's intelligent middle mile for healthcare is designed from the ground up to meet the performance requirements, agility, and scalability demands of next generation healthcare networks. .

Ribbon's intelligent middle mile enables next generation healthcare, by providing the agile, service-aware, high capacity network required by today's bandwidth-intensive, delay-sensitive applications.

Challenge	Ribbon Solution
Simple and cost-effective networking	Pay-as-you-grow scalability and software-enabled functionality minimizes upfront investments, and aligns ongoing expenses with evolving business demands. Intuitive admin interface simplifies provisioning and operations.
High-speed connectivity	10G-100G aggregation network and N x 100G/400G backbone support bandwidth-intensive applications.
Low-latency networking	End-to-end optical network with service-aware routing enables granular SLAs to support delay-sensitive application traffic.
Resilient, high-availability connectivity	Redundant configurations, dynamic restoration, and protection switching ensure continuous availability in the event of equipment or link failures.
Supporting life and mission critical services used by healthcare	Network slicing provides a hard and soft slicing toolkit which allows the network to be partitioned to allow the performance of life and mission critical services to be guaranteed.

To learn how Ribbon's intelligent middle mile can help you enable next generation healthcare contact Ribbon today.

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.