ribbon

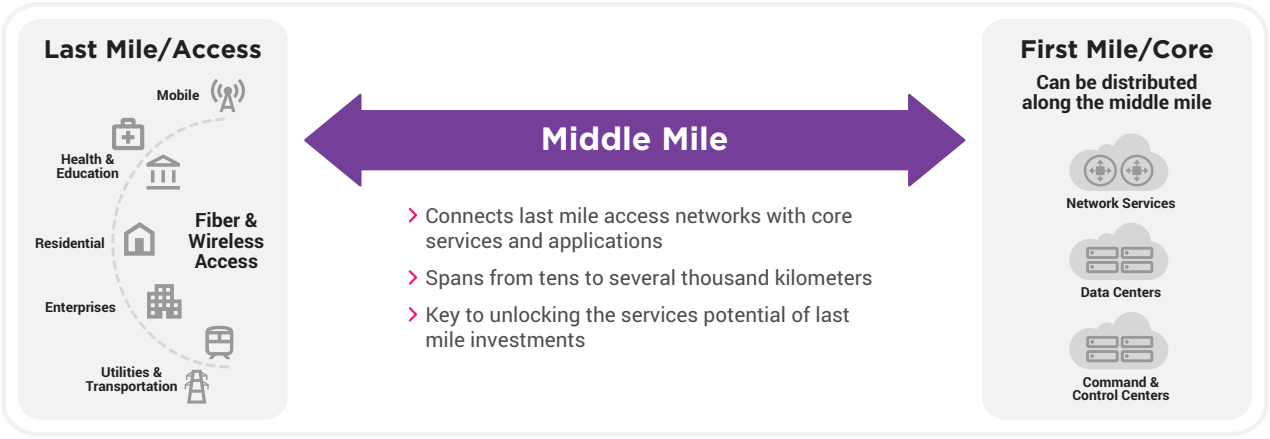
Secure Real-Time Communications

Building the Intelligent Middle Mile

Unlocking the services value of last mile investments while minimizing TCO

Maximizing Middle Mile Profitability

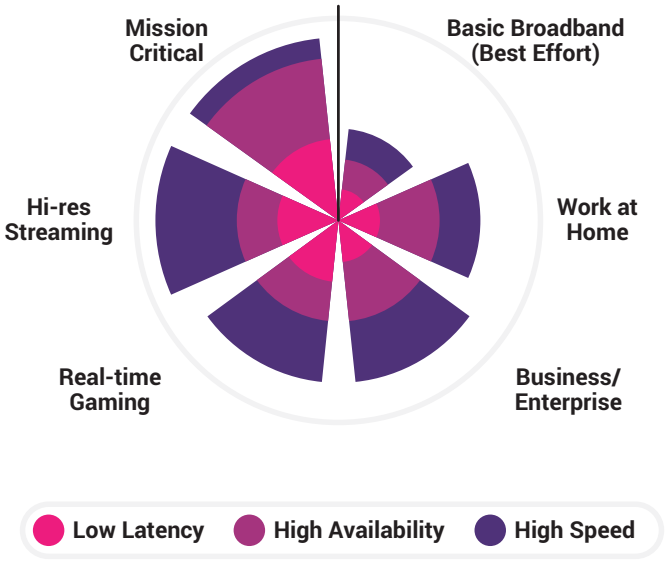
> Middle Mile networks connect last mile access networks with core network services and applications. Spanning from tens of kilometers to several thousands, they are fundamental to service provider and critical infrastructure networks.



Recent investments in fixed and wireless last mile technologies are adding huge increases in broadband capacity to end users, which the right middle mile network can transform into vast new rivers of services traffic. These new services require more than just bandwidth. They require a varied range of guaranteed performance characteristics, such as speed, latency, and availability. At the same time, to maximize profitability, network costs must be kept to a minimum. Let's look at the impact of these service and TCO requirements on the middle mile.

Service Aware
A service-aware middle mile enables service providers to increase revenues through differentiated or tiered service offerings tailored to meet each service's SLA.

Similarly, critical infrastructure networks carry a mix of mission critical traffic, as well as business and consumer traffic. Service-aware, middle mile communication networks are mandatory to guarantee mission critical traffic.



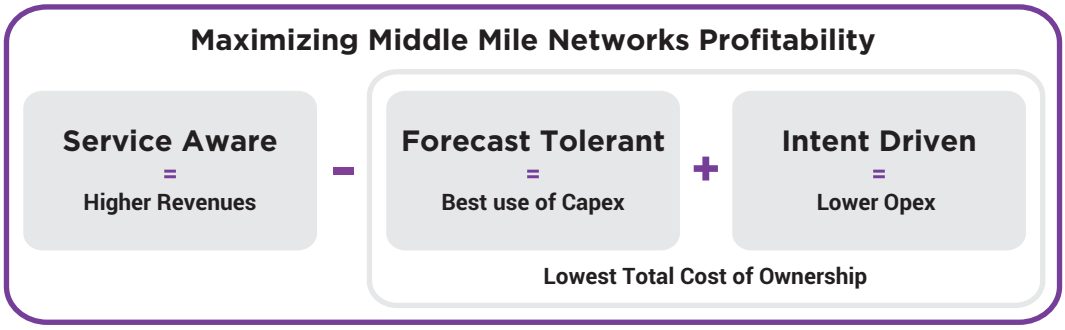
Forecast Tolerant
No two middle mile networks are identical. They must support different access schemes, geographies, business models, and increasingly, connect to distributed core services rather than just at a few central locations. Moreover, service and traffic demands are continually changing, driven by end-user applications, device technologies, and demographics.

These necessitate two things. An ability to construct middle mile networks using a combination of topologies, including rings, chains, stars, meshes and hub-and-spoke. Also essential is an ability to dynamically grow and shift capacity smoothly within its chosen architectural framework, without costly forklift upgrades.

Intent Driven
A middle mile network is a complex system. Achieving operational efficiency and an elevated customer experience requires an intent-driven operations framework that translates goals into actions. This should cover the entire operations lifecycle, from planning and commissioning, to network and service provisioning, to ongoing assurance and maintenance.

To recap, middle mile networks must be **Service Aware** to increase revenues and reduce customer churn.

They must also be **Forecast Tolerant** with fit-for-purpose scalable architecture for best use of Capex, and support **Intent-Driven Operations** for lower Opex and high network availability. Together these abilities ensure lowest total cost of ownership (TCO).



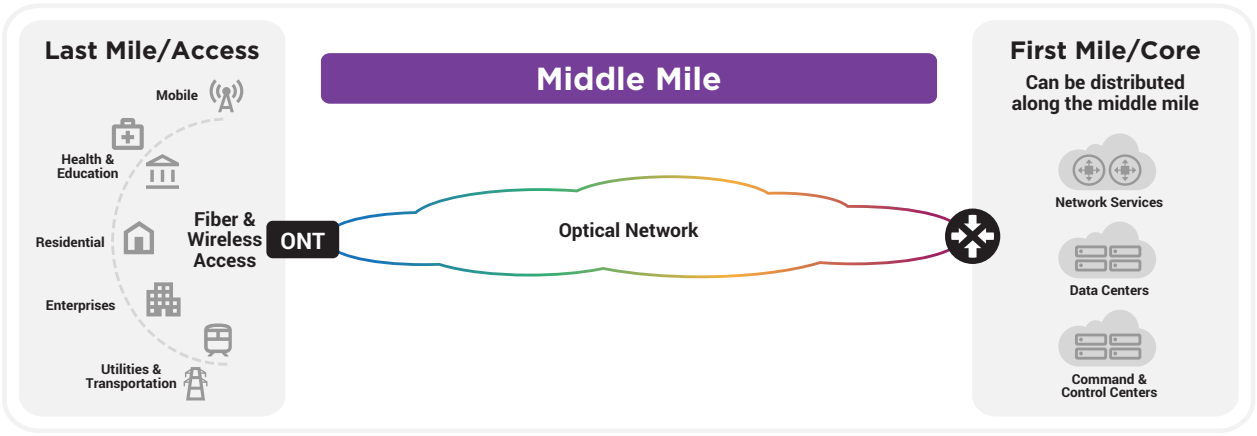
So what is the best way to meet these requirements? Below we analyze three middle mile network approaches.

Raw Bandwidth Middle Mile

The simplest approach to building a middle mile network is to extend last mile bandwidth through fat optical pipes to a centralized core. This appears attractive as a simple single layer approach, but this simplicity creates many shortcomings.

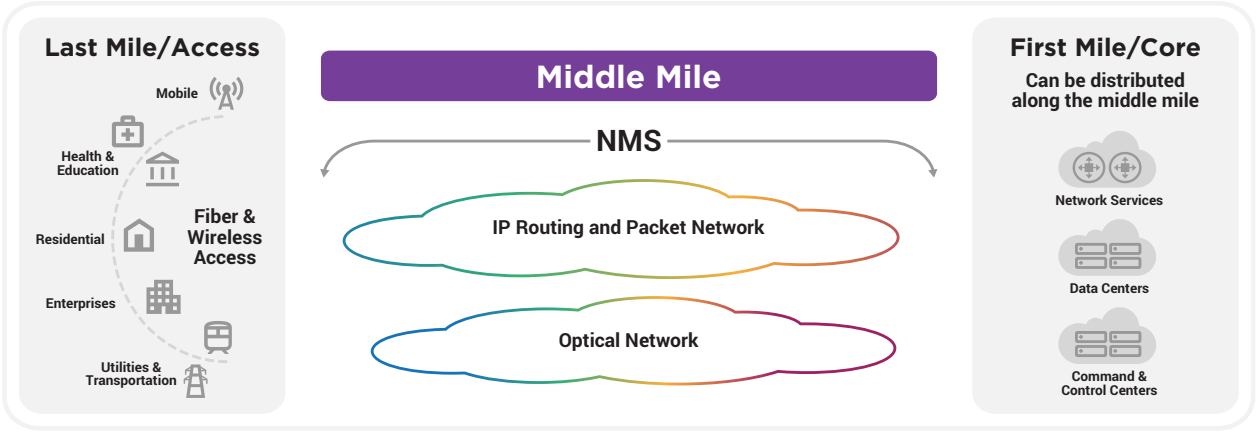
As pure layer 1 transport, it has no mechanism for service awareness. To compensate, a raw bandwidth approach relies on massive over-provisioning to deliver reasonable best effort transport for all services, including ones where end-users expect higher performance. This can negate cost advantages of using a single layer.

Similarly, it does not have the degrees of freedom required to support different topologies or distributed core technologies, and can only scale by adding capacity or more wavelengths on existing routes.



IP Optical Middle Mile

A more modern approach adds an IP routing layer to the optical transport, making the middle mile service aware. The DiffServ model used by routers schedules packets into broad classes of service (QoS). Traffic engineering computes the best path for packets across the network to meet their service requirements, this uses techniques such as PCE, SR-TE and MPLS-TP, and can dedicate routes to support performance guarantees.

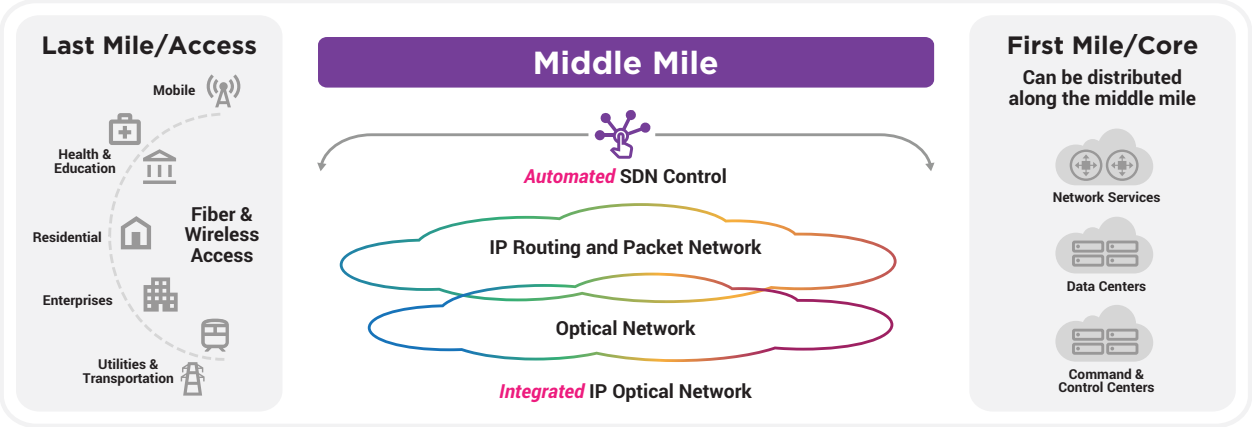


Multiple layers also provide degrees of freedom for topology flexibility, which can be weighted between the IP and the optical transport layers. Similarly, this makes an IP Optical middle mile forecast tolerant. It has the flexibility to shift resources to meet changing service and traffic demands without adding equipment. When this is not sufficient, a variety of equipment enables tuning the network without major changes.

The downside of an IP Optical network is that it adds more complexity. Planning, implementing and managing two layers leads to some duplication of resources and uncoordinated operations, contributing to both added Capex and Opex.

Intelligent "Integrated-Automated IP Optical" Middle Mile

An Intelligent Middle Mile addresses the complexity issue of the IP Optical architecture. It carries over all of its benefits for service awareness and forecast tolerance and flips the switch on the cost negatives. Intelligent automation eliminates complexity by providing full lifecycle management and control of all the IP and Optical network resources.



An intelligent middle mile regards the IP and optical layers as a single multi-layer entity. It makes the most efficient use of resources when planning the network, integrating the IP and Optical Transport layers without bias, for a highly economical first cost. Similarly, it manages the network as a single multi-layer entity, with full visibility how changes in one layer affects the other.

An intelligent middle mile uses automation for several purposes. It manages complexity, such as when provisioning a service or directing restoration across multiple layers, and it streamlines operations to respond rapidly to customer requests and eliminate human operator errors.

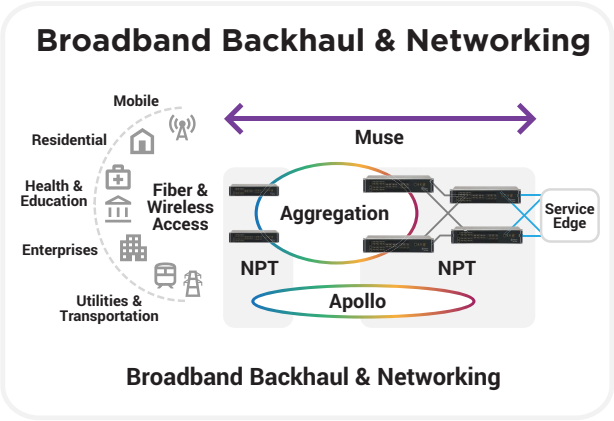
The combination of IP Optical integration and multi-layer operation with automation delivers lowest TCO.

While every network is different, the table below summarizes the essential capabilities of the various architectures to meet middle mile requirements.

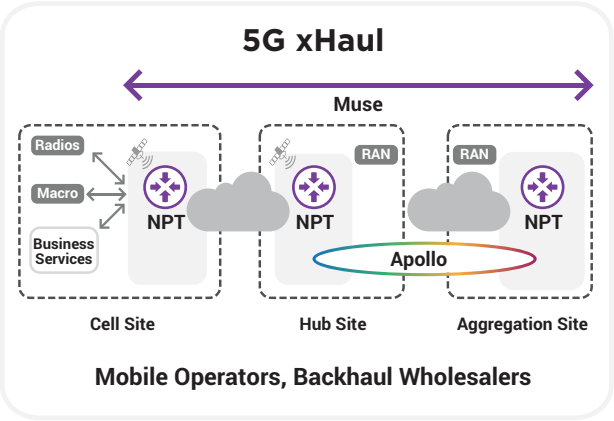
Requirement	Middle Mile Architecture		
	Raw Bandwidth	IP Optical	Intelligent Middle Mile "Optimized-Automated IP Optical"
Service Aware	No	Yes	Yes
Dynamically Configurable	No	Yes	Yes
Intent-Driven Operations	N/A	No	Yes

Ribbon – The Intelligent Middle Mile Experts

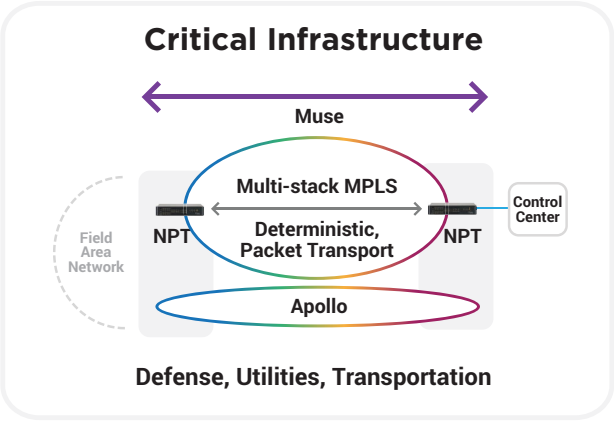
Ribbon has extensive experience in building intelligent middle mile solutions for multiple configurations.



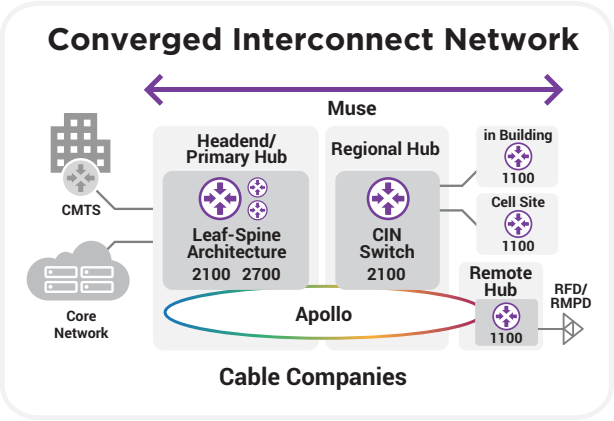
Broadband Backhaul & Networking



Mobile Operators, Backhaul Wholesalers



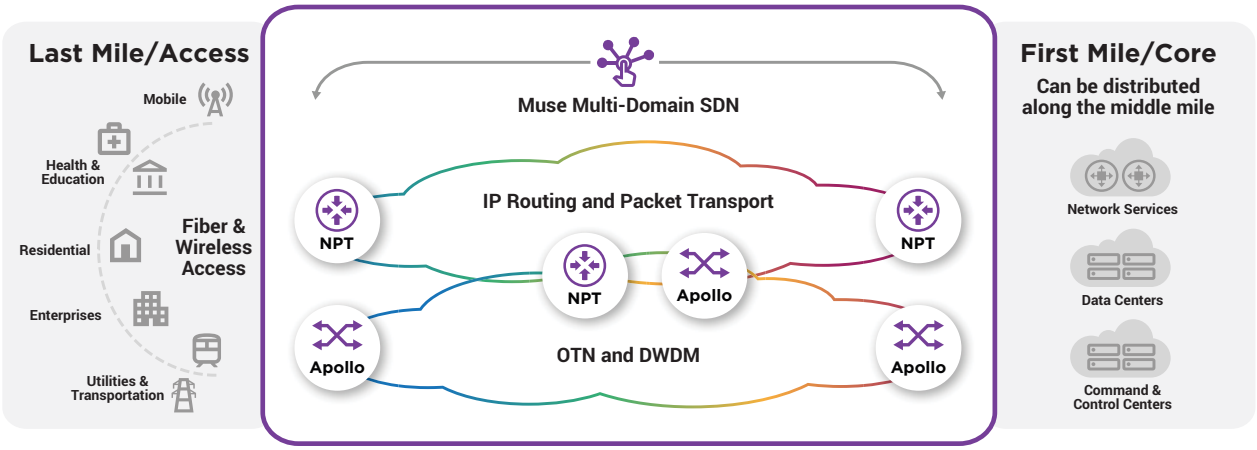
Defense, Utilities, Transportation



Cable Companies

We build our solutions based on three product families:

Muse SDN Domain Orchestrator – Muse achieves service-centric streamlined network operations through intuitive multi-layer IP optical network control, low-code workflow automation and service design tools, and multi-vendor adaptation, within a secure cloud-native deployment.



NPT Service Aware Routers – NPT is optimized for service aware aggregation. It provides operators with the ability to collapse all their services onto a single converged IP network, and the agility to evolve the network as services and customer needs evolve.

NPT is made up of the XDR and AR families. NPT XDR routers with their state-of-the art merchant silicon, 400G interfaces and disaggregated or fully integrated deployment options are optimized for transporting high-performance, high-capacity services. NPT AR routers provide the hardware redundancy and modular architecture required to support mission and business critical services. The IP Wave rNOS provides a common set of industry proven features and capabilities across both the NPT XDR and NPT AR router families.

Apollo Programmable Optical Transport – Built around flexibility and choice, Apollo provides industry-leading 140Gbaud-powered high-performance links to 1.2T, filling up fiber channels to their theoretical limits, as well as 400G ZR+ power-cost optimized links for pay-as-you-grow networks. An erector set of SDN-controlled ROADM and OTN switching modules provide unlimited configurations to route links and the services they carry dynamically from the access to the core. Apollo is easy to deploy and to manage, and open control interfaces enable Apollo to participate in disaggregated, multivendor environments.

Summary

An Intelligent Middle Mile network enables network operators to maximize profitability, by supporting differentiated services that unlock the value of last mile investments, while minimizing TCO through an efficiently built and operated network. Ribbon are experts in building intelligent middle mile solutions that leverage our SDN, IP, and Optical portfolios.

Contact Us Contact us to learn more about how Ribbon can implement your Intelligent Middle Mile

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.