CISCO
The bridge to possible

Cisco Solutions to Bridge the Digital Divide

Transform the middle mile with Cisco Routed Optical Networking

Benefits

- Improved capital efficiencies

- Lower operational costs

- Faster time to service

- Fewer components

- Network simplification

- Network automation

- Federal funding available

The challenge

The United States is currently experiencing a broadband gap driven by lack of availability and affordability. During the pandemic, more than 10 million US households were without broadband connectivity. This left over 16 million K–12 students unable to complete their studies during the period that schools went virtual.

Often, broadband services in many of these underserved or unserved areas are described as lacking reliable service, options of providers and plans, and affordable pricing.

States, counties, and municipalities are increasingly committed to bridging this digital divide by adopting new business models, funding, and technologies.

New business models

The Internet Protocol (IP) has enabled the breakup of previously vertically integrated business models of telecommunications operators. It's also allowed new players into the market, including wholesale operators, broadband access providers, and service providers (in both the public and private sectors).

The Open Access Middle Mile (OAMM) is a business model that has increasing relevance in closing the broadband gap. It connects last mile broadband providers, wireless service providers, large enterprises, and community anchor tenants (like governments, schools, and hospitals) to the Internet backbone on nondiscriminatory terms and conditions. OAMMs serve to lower transport costs for last mile

broadband providers.[1] This in turn promotes more investment in last mile access networks by reducing the capital expenditures required to build these services.

[1] Lessons from Open Access, Middle Mile Networks, Benton Institute for Broadband and Society, Dec. 2020.

New funding

With $1B available for middle mile network investment via the Infrastructure Investment and Jobs Act (IIJA) and other funding programs, there is a unique opportunity to bridge the digital divide. And with new business models for open access middle mile, there are more players that can access that funding and invest in this part of the network connecting access to the network backbone.
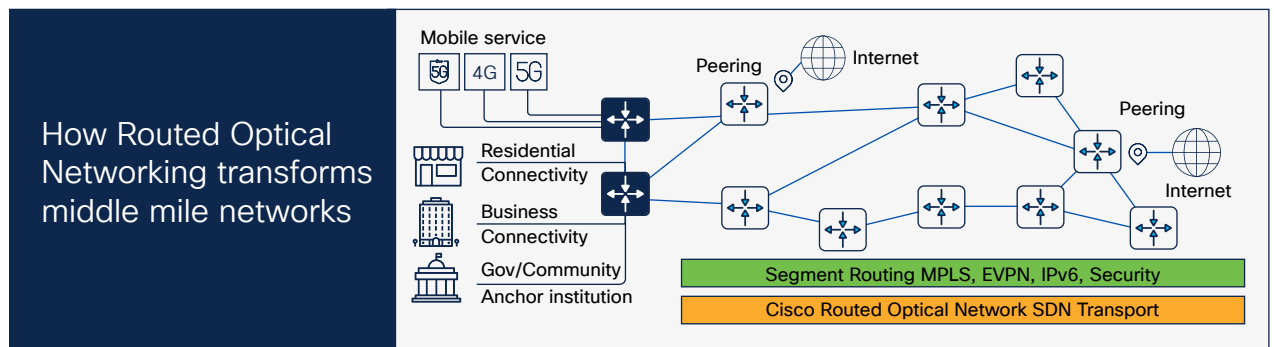

How Routed Optical Networking transforms middle mile networks

Mobile service

5G 4G 5G

Residential Connectivity

Business Connectivity

Gov/Community
Anchor institution

Peering

Internet

Peering

Internet

Segment Routing MPLS, EVPN, IPv6, Security

Cisco Routed Optical Network SDN Transport

Figure 1.   Automated end to end service creation and provisioning

How Cisco Routed Optical Networking adds value

By partnering with Cisco, you can implement Routed Optical Networking to transform your broadband infrastructure, building middle mile networks that add value through:

- **Fewer Components:** Routed Optical Networking reduces the need for expensive transponders in the network. Fewer components reduces power usage, hardware footprint, and hardware cost.

- **Network Simplification:** the convergence of IP and optical layers leads to simplified planning, design, activation, management, troubleshooting, and resolution of network services.

- **Network Automation:** Routed Optical Networking combined with automation reduces errors, improves resiliency, simplifies repair, and accelerates time to service.

New technologies

The economics of middle mile networks are also being transformed by new technologies. Cisco's innovation in Routed Optical Networking simplifies the network by collapsing the routing and optical layers with 400G coherent pluggable optics inserted into high capacity routers. This enables simpler network operations.

ACG Research found that Routing Optical Networking reduces operational costs by up to 57% and initial capital costs by up to 35% when compared to traditional architectures.

Solution overview

Currently, middle mile broadband networks have separate and siloed routing and optical layers that require large volumes of line cards to transmit the traffic between the layers. These layers also have overlapping and redundant resiliency that requires separate management systems. This adds capital and operational cost to the network that impacts broadband's affordability and availability.

How it works

Cisco Routed Optical Networking simplifies the network by merging the routing and optical layers onto a single IP/MPLS network where all switching is done at Layer 3. This results in a higher scale and lower cost network design by using high- density routers, high-capacity pluggable coherent optics, simplified DWDM line systems, and end- to-end automation. For many city and county networks the DWDM will not be needed, made redundant by the pluggable optics.

Four building blocks of Routed Optical Networking

- High-density routers
- High-capacity pluggable optics
- Optical line systems
- Automation software

High-density routers are positioned at the core, edge/aggregation, and access network. The highest density core router is the Cisco 8000 Series, with a capacity of up to 260 Tbps and 648 400G ports. Other core routers include the Network Convergence System (NCS) 5500 Series with a capacity of 154 Tbps, or the carrier-class Aggregation Services Router (ASR) 9000 Series with capacity of up

Why Cisco for broadband

As a global leader in IT, Cisco believes that technology can bring positive change to our communities. That's why we're leveraging our solutions and services to help you connect, secure, and automate their networks to extend connectivity to everyone regardless of geographic or economic limitations.

By leveraging the new generation of Cisco broadband solutions, you can help meet the needs of a growing hybrid workforce, deliver more capacity to rural areas, and bridge the digital divide in underserved communities.

Take your next steps

· Schedule your visit to the Broadband Innovation Center to experience firsthand how Cisco's innovations in broadband are changing the game for networks and subscribers.

· Checkout the State and Local Government Collaborative Planning guide for expert advice and guidance on building a collaborative planning model to expand broadband services in your community.

to 160 Tbps in 80 400G ports. The NCS 540 is positioned for access and provides flexible port interfaces from 1G up to 400G with a capacity of 1 Tbps. The NCS 540 is a hardened device which is suitable for both indoor and outdoor deployments.

With **High-Capacity Pluggable Optics**, the 400G optical modules offload wavelength-division multiplexing functionality to the router and enable high-bandwidth 400G links. These ZR/ZR+ pluggable optical modules are based on the QSFP-DD form factor. These pluggables meet optical standards for interoperability and are compatible with QSFP-DD ports across the Cisco routing portfolio.

Optical Line Systems, like the Cisco NCS 1010 and 2000 Series, serve long-haul and metro networks by providing a simple DWDM network that scales with operational ease.

Cisco's Crosswork **Automation Software** suite is designed for low/no-touch operations. It is multi-vendor and multi-domain, centered on programmatic controls and access to data, and spans both cloud and on-prem tooling. The tools encompass a full-service lifecycle including planning and design, implementation, and ongoing operations and assurance.
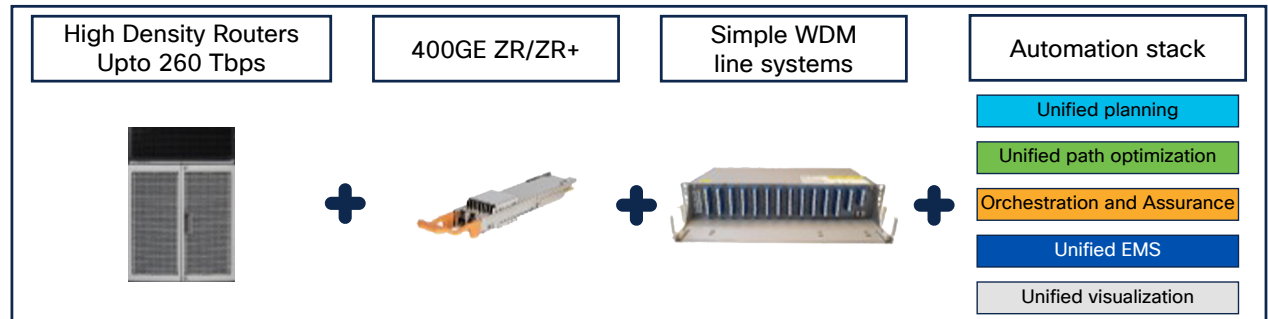
Learn more: Cisco Routed Optical Networking

Figure 2.   Single layer hop-by-hop design

Let's bridge the digital divide together

As a leader in lighting up services for fiber infrastructure in the middle mile and beyond, Cisco is here to help service providers and government agencies plan and implement their broadband projects. Our extensive partnerships with dark fiber suppliers, service providers, and systems integrators support all aspects of middle mile construction and operations.

To join us in creating an inclusive future for all, please visit: cisco.com/go/digitaldivide

Funding opportunities

IIJA Federal grants

The purpose of the **Enabling Middle Mile Broadband Infrastructure Program**, established by the Infrastructure Investment and Jobs Act (IIJA), is twofold:

- Expand and extend infrastructure to reduce the cost of connecting unserved and underserved areas to the backbone of the Internet.

- Promote broadband resiliency through the creation of alternative network connection paths designed to prevent single points of failure on a broadband network.

Entities eligible to apply to the National Telecommunications and Information Administration (NTIA) for middle mile grants include state and local governments, tribal governments, telecommunication and technology companies, electric utilities, nonprofits, and economic development authorities.

Partnerships of two or more of these types of entities are explicitly permitted and encouraged.

Other Federal grants for public agencies

In addition to the IIJA Federal grants, state, local, and tribal governments can apply for:

- IIJA Broadband Equity, Access, and Deployment Program.

- American Recovery Plan Act Capital Projects Fund.

- Coronavirus Aid, Relief, and Economic Security Act.

- Tribal Broadband Connectivity Grant Program.

- Economic Adjustment Assistance.

- Community Development Block Grant.

Other Federal grants and loans for Service Providers

There are also Federal grants and loans for Internet Service Providers (ISPs) to subsidize deployment of middle mile infrastructure:

- USDA Re-Connect.

- Rural Digital Opportunity Fund.

State grants

States offer grants to counties, cities, tribes, non- profits, and service providers through competitive awards funding for middle mile deployment. These programs vary so ask the **Cisco Public Funding Office** about eligibility to apply, allowable uses, matching funds, and application due dates.