

F R O S T & S U L L I V A N

2024

TECHNOLOGY
INNOVATION LEADER

*IN THE NORTH
AMERICAN NETWORK
INTERCONNECTION
INDUSTRY*

LUMEN

F R O S T & S U L L I V A N

BEST
2024 PRACTICES
AWARD

Best Practices Criteria for World-Class Performance

Frost & Sullivan applies a rigorous analytical process to evaluate multiple nominees for each award category before determining the final award recipient. The process involves a detailed evaluation of best practices criteria across two dimensions for each nominated company. Lumen Technologies excels in many of the criteria in the network interconnection space.

AWARD CRITERIA	
<i>Technology Leverage</i>	<i>Business Impact</i>
Commitment to Innovation	Financial Performance
Commitment to Creativity	Customer Acquisition
Stage Gate Efficiency	Operational Efficiency
Commercialization Success	Growth Potential
Application Diversity	Human Capital

Commitment to Innovation

Connectivity is critical to support today’s fast-paced technological advancements. Enterprises are rapidly adopting virtualized technologies and software-defined network processes to improve business outcomes, and these technologies are latency-sensitive and require high-bandwidth connectivity.

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- Amrit Singh
Senior Industry Analyst

Furthermore, secure high-bandwidth connectivity is essential to address the growing cyber threat landscape. Secure high-speed connectivity becomes paramount when interconnecting different colocation facilities and data centers that transmit enormous amounts of data daily.

Businesses require interconnections (defined as private dedicated connections) to exchange traffic between 2 networks or locations, such as between business locations, different companies, data centers to hyperscalers, and content providers to

the data center. However, physical interconnects must be configured one by one, for each connection point. They take time to set up, are expensive to maintain, and do not provide the flexibility to scale quickly, which are significant hindrances to cloud hyperscalers and other businesses that require network

agility to support accelerating data volumes.

Lumen Technologies (Lumen), formerly CenturyLink (it rebranded in 2020), is a global telecommunications company headquartered in Monroe, Louisiana that offers a range of network products and solutions that meet the requirements of all vertical types and business sizes. In June 2023, Lumen launched an industry-first solution to solve the challenges the industry is facing. ExaSwitch is an optical ecosystem that automates, scales, and manages high-volume interconnects, mainly from content providers, hyperscalers, and large enterprises. It can manage high-bandwidth interconnections of 100 Gbps and 400 Gbps, with each node able to scale up to 25 Tbps.

ExaSwitch operators install optical hardware at customers' edge locations, which are connected to ExaSwitch locations using fiber connections. Customers can provision ExaSwitch through an online portal, providing the ability to scale on-demand within minutes and eliminating the time-consuming manual process. Adding an interconnect is a tiring process as it goes through paperwork, and the customer has to wait for a technician to map a physical interconnect. ExaSwitch eliminates the more expensive and difficult-to-maintain physical interconnections, freeing customers from the burden of procuring, maintaining, and managing specialized data center equipment. ExaSwitch also reduces the recurring optical interconnection fee, resulting in significant savings. In addition, eliminating hardware dependence significantly lowers carbon footprint, adding to enterprises' sustainability initiatives.

Lumen partners with large Internet and cloud providers, including Google, Microsoft, and another large Cloud Provider, to route the traffic between them as part of the ExaSwitch ecosystem. ExaSwitch enables easy, cost-efficient, and quick interconnection to geographically distributed network partners, providing enhanced connectivity and on-demand scalability to support the growing volumes of data in the cloud. In future, Lumen plans to add new partners to strengthen the ExaSwitch ecosystem. Frost & Sullivan applauds Lumen's ExaSwitch as a cost-efficient technology innovation that simplifies the interconnection process, serving entire metro regions irrespective of participants' physical edge locations.

Commercialization Success

Wavelength services are primarily used by hyperscalers, content providers, and large enterprises that require high-bandwidth connectivity to connect to data centers and colocations. In Frost & Sullivan's 2023 market analysis, Lumen is the leader in the North American wavelength services market, based on its revenue leadership and distinctive features to enhance the customer ownership experience, such as the Topology Viewer tool. Lumen's wavelength customers include large content providers, financial companies, and software companies that exchange enormous amounts of data between data centers. These customers can benefit from the market-leading wavelength-based ExaSwitch platform to interconnect to data centers across metro locations and scale with growing business needs through a self-service portal. In future, Lumen should aim to attract large wavelength customers to become part of the ExaSwitch ecosystem.

While ExaSwitch is a new offering, its commercialization success is assured because Lumen built the service in partnership with the largest cloud providers, Google, Microsoft, and AWS. These organizations use the service to connect across their own data center networks and with customers.

Commitment to Creativity

As part of the digitalization initiative, businesses increasingly embrace cloud-based services to enhance their business operations and support software-defined network processes. In [Frost & Sullivan's 2023 Global Network Services survey](#), 53% of respondents indicated that a hybrid, multi-cloud strategy is essential to achieving their digitalization goals. Security, high bandwidth, low latency, and flexibility to use multiple connectivity protocols are top of mind for businesses while connecting to cloud services. Unlike many of its peers, Lumen's cloud connect solution delivers on all these aspects, providing virtualized networking to connect to leading public and private cloud providers. The company has extensive reach as its wavelength, multiprotocol label switching (MPLS), and Ethernet services are available globally, providing businesses with different choices for cloud services. Furthermore, Lumen partners with major cloud providers, including Amazon, Google, Microsoft, IBM, and Oracle, to offer cloud connect services,

"To power its ExaSwitch offering, Lumen leverages its ultra-low-loss fiber network comprising more than 65,000 route miles, delivering 400G capability on wavelength networks in North America. The company has 240+ points of presence in 70 North American markets, with extensive coverage of Tier I and II markets."

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providing customers with varied choices. These partners are specific candidates for the ExaSwitch platform.

ExaSwitch powers Lumen's cloud connect services. The company provides faster cloud connectivity through ExaSwitch, benefiting customers who require high capacity and private cloud connectivity, which it offers to customers' edge locations without the need for third-party colocation facilities. ExaSwitch also powers Lumen's network-as-a-service, providing on-demand optical connections across its vast

wavelength network.

Frost & Sullivan applauds ExaSwitch for providing a unique and strong foundation for Lumen's existing services, strengthening its position in the network services space, and demonstrating the company's creativity to leverage technology advancements.

Growth Potential

ExaSwitch is the first optical ecosystem to automate, scale and manage high-value interconnects. It dynamically routes traffic helping service providers, content providers and the largest of enterprises to automate, scale and manage high-value interconnect services without third-party intervention. This capability enables connections within minutes, reducing the time it takes to deploy capacity by automating provisioning and removing manual processes like truck rolls. Lumen's growth potential facilitated by its extensive network footprint, which is one of the largest in the industry. The company is a prominent network service provider in North America, with an extensive fiber footprint, and it continues to invest in building higher-capacity fiber routes. Lumen is present in 150,000 on-net buildings, with about 400,000 route miles of fiber optic worldwide that deliver the industry's highest commercially available connectivity speeds of up to 400 Gbps. The company serves all sizes of businesses in more than 60 countries, offering varied products and services. Its strong global presence strengthens and grows its customer base, mainly businesses with globally distributed locations. To power its ExaSwitch offering,

Lumen leverages its ultra-low-loss fiber network comprising more than 65,000 route miles, delivering 400G capability on wavelength networks in North America. The company has 240+ points of presence in 70 North American markets, with extensive coverage of Tier I and II markets.

Application Diversity

Customer portals have become a must-have feature in the network services industry. Customers prefer to manage their services through a dedicated portal that provides services such as usage monitoring, performance tracking, site management, traffic flow and congestion, billing services, service alerts, and troubleshooting. These capabilities improve service delivery and enhance the customer ownership experience. Lumen's self-service portals across its network service portfolio offer distinctive features. For instance, the company's Topology Viewer, an innovative tool that it offers with its wavelength services, allows customers to view, design, and quote wavelength services based on the available fiber routes. It enables customers to strategize their network planning. Unlike some competitors that use a generic, all-services approach to user interfaces, Lumen offers different self-service portals for each service. This enables the company to provide exclusive capabilities for each service, enhancing the customer experience. ExaSwitch can also be managed through online portals, allowing customers to automate and scale on-demand, based on their business requirements. In addition, ExaSwitch provides faster provisioning through API-based dynamic optical switching to route traffic between colocations, eliminating third-party involvement and setting up connections in minutes.

Customer Acquisition

Businesses prefer to engage with a managed service provider for all their network service needs. In [Frost & Sullivan's 2023 Global Network survey](#) comprising more than 1,300 respondents, 86% of respondents indicated a managed service provider as the most preferred partner for their network service needs. Businesses look for one-stop-shop service providers where they can purchase all the required network services, as it is easier to manage network services than to purchase different services from different providers. Lumen offers a diverse network services portfolio to accommodate businesses' current and future network service needs. The company provides dedicated Internet access, Ethernet, wavelength services, MPLS, SD-WAN, SASE, Internet on demand, DDoS, security with Black Lotus Labs, managed and professional services, and other network services. Furthermore, Lumen partners with key market participants to attract new customers; for instance, it partners with major cloud service providers, including Microsoft, Google, and another large Cloud Provider, to provide cloud connect services. The same cloud service providers are the key partners for the ExaSwitch platform; therefore, it is easier for an existing cloud connect customer to become a participant in the ExaSwitch ecosystem. When choosing a service provider, businesses primarily select a provider with a global presence, a longtime participant, a company that offers a full suite of network services, and a participant that has the experience to deliver complex projects nationally and internationally. Lumen fulfills all these characteristics to be a one-stop shop, which helps it retain existing customers and attract new ones.

Conclusion

Lumen's ExaSwitch is a revolutionary approach for the network interconnections industry. It provides automation, on-demand scalability and management of high-volume interconnects. Service providers, content providers, and large enterprises are the key beneficiaries of ExaSwitch, as they exchange enormous amounts of traffic between data center locations. ExaSwitch is a wavelength-based solution that eliminates physical interconnections, resulting in significant cost savings and reducing carbon emissions. Furthermore, existing network services support the ExaSwitch offering as businesses prefer to engage with providers that meet their current and future network service needs.

With its strong overall performance, Lumen Technologies earns Frost & Sullivan's 2024 North American Technology Innovation Leadership Award in the network interconnection industry.

What You Need to Know about the Technology Innovation Leadership Recognition

Frost & Sullivan's Technology Innovation Leadership Award recognizes the company that has introduced the best underlying technology for achieving remarkable product and customer success while driving future business value.

Best Practices Award Analysis

For the Technology Innovation Leadership Award, Frost & Sullivan analysts independently evaluated the criteria listed below.

Technology Leverage

Commitment to Innovation: Continuous emerging technology adoption and creation enables new product development and enhances product performance

Commitment to Creativity: Company leverages technology advancements to push the limits of form and function in the pursuit of white space innovation

Stage Gate Efficiency: Technology adoption enhances the stage gate process for launching new products and solutions

Commercialization Success: Company displays a proven track record of taking new technologies to market with a high success rate

Application Diversity: Company develops and/or integrates technology that serves multiple applications and multiple environments

Business Impact

Financial Performance: Strong overall financial performance is achieved in terms of revenues, revenue growth, operating margin, and other key financial metrics

Customer Acquisition: Customer-facing processes support efficient and consistent new customer acquisition while enhancing customer retention

Operational Efficiency: Company staff performs assigned tasks productively, quickly, and to a high-quality standard

Growth Potential: Growth is fostered by a strong customer focus that strengthens the brand and reinforces customer loyalty

Human Capital: Commitment to quality and to customers characterize the company culture, which in turn enhances employee morale and retention

About Frost & Sullivan

Frost & Sullivan is the Growth Pipeline Company™. We power our clients to a future shaped by growth. Our Growth Pipeline as a Service™ provides the CEO and the CEO's growth team with a continuous and rigorous platform of growth opportunities, ensuring long-term success. To achieve positive outcomes, our team leverages over 60 years of experience, coaching organizations of all types and sizes across 6 continents with our proven best practices. To power your Growth Pipeline future, visit Frost & Sullivan at <http://www.frost.com>.

The Growth Pipeline Engine™

Frost & Sullivan's proprietary model to systematically create ongoing growth opportunities and strategies for our clients is fuelled by the Innovation Generator™.

[Learn more.](#)

Key Impacts:

- **Growth Pipeline:** Continuous Flow of Growth Opportunities
- **Growth Strategies:** Proven Best Practices
- **Innovation Culture:** Optimized Customer Experience
- **ROI & Margin:** Implementation Excellence
- **Transformational Growth:** Industry Leadership



The Innovation Generator™

Our 6 analytical perspectives are crucial in capturing the broadest range of innovative growth opportunities, most of which occur at the points of these perspectives.

Analytical Perspectives:

- **Mega Trend (MT)**
- **Business Model (BM)**
- **Technology (TE)**
- **Industries (IN)**
- **Customer (CU)**
- **Geographies (GE)**

