ribbon

Accelerate Your Network Transformation

Datacenter Interconnect (DCI) Deployment Options

All Roads lead to Managed Optical Fiber Network (MOFN)

Summary

Organizations, particularly within the Enterprise and Cloud Provider sectors, are increasingly pursuing high-capacity network connectivity solutions (N x 100G/400G) to link their data centers to the cloud, spurred by a rising demand for AI applications. These organizations can explore various deployment strategies for Data Center Interconnect (DCI), which include leasing managed wavelengths from service providers, building their own networks using leased dark fiber, or opting for a hybrid approach called a Managed Optical Fiber Network (MOFN). This paper will examine both the qualitative and financial aspects of these alternatives. Our analysis reveals that organizations expecting network demands of 3 x 100Gs or more will discover that a private MOFN presents distinct benefits compared to other deployment options such as:

- **Lowest Total Cost of Ownership (TCO), based on pricing within the U.S. market**
- **Flexibility in locations where dark fiber is difficult to procure**
- **Where datacenter operators want to outsource the management of their network to a service provider**
- **Where speed to market is key**

Background

Artificial Intelligence (AI) is playing a pivotal role in the transformation of data centers, with IDC predicting an impressive compound annual growth rate (CAGR) of 40.5% for AI data center capacity by 2027. However, the escalating energy requirements of AI workloads present significant challenges, as these workloads are projected to represent 15% to 20% of total energy consumption in data centers. Consequently, the development of new data centers is increasingly being directed towards less populated rural areas, driven by the pursuit of more economical real estate and lower energy costs. By moving operations to these locales, organizations can benefit from land prices that are often significantly lower than those found in urban environments, alongside competitive electricity tariffs and tax incentives aimed at attracting technology firms.

As a result, businesses require dependable connectivity solutions to ensure seamless IP optical interconnectivity between their data centers, commonly referred to as Datacenter Interconnect (DCI). With the expansion of their digital footprint and the adoption of cloud technologies, the demand for high-capacity networking has grown considerably. To effectively link data centers or connect to colocation facilities (colo), organizations need N x 100G/400G DCI connectivity, where N represents the number of individual connections necessary based on specific workloads and performance requirements.

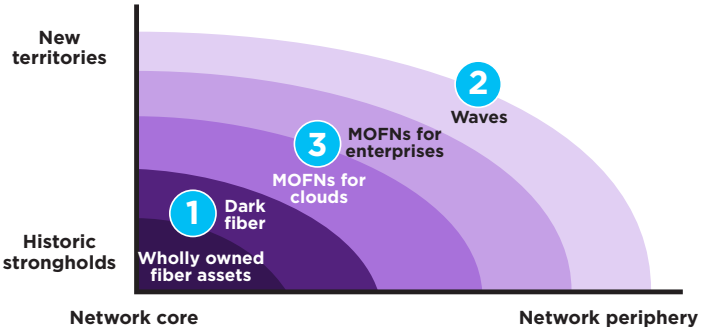


Figure 1: DC Interconnect Network Options
(Source: Omdia)

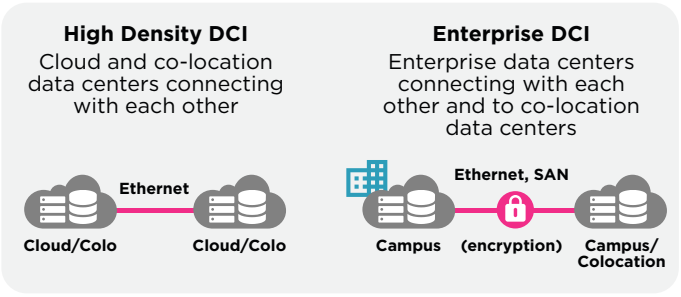


Figure 2: DCI Network Options

Organizations are presented with various DCI options, illustrated in Figures 1 and 2. This paper will delve deeper into the three most prevalent deployment choices.

1) **Private DCI:** In this scenario, the organization owns and manages the network utilizing leased fiber. This method entails a substantial initial capital investment, along with continuing operational costs associated with network management and fiber leasing. Nevertheless, the organization expands the network by integrating client modules that support multiple wavelengths. Consequently, this strategy results in a reduced TCO (total cost of ownership) when compared to option 2.

2) **Managed Waves:** This connectivity solution is a leased service (opex) that leverages shared infrastructure. The service provider retains ownership and management of all equipment, with network operations functioning on 100G/400G wavelengths. As a result, as the customer's network grows, the Total Cost of Ownership (TCO) rises in a linear manner.

3) **Managed Optical Fiber Network (MOFN):** This option can be viewed as a blend of options 1 and 2. It features a managed network that is owned and operated by the service provider, utilizing their fiber infrastructure like option 2, but is exclusively dedicated to the organization, offering scalability comparable to option 1. Furthermore, some service providers provide a customer portal for specific management functions as seen in option 1. This strategy is especially preferred in areas where obtaining dark fiber is difficult, while end users desire the advantages of a private DCI network—such as in India, where companies encounter limitations on building their own private networks.

As shown in Figure 2 – we show 2 DCI options: DCI for enterprises would be a dedicated network interconnecting the main datacenters of an enterprise. DCI for cloud would be targeted at datacenter operators who are interconnecting their datacenters together as well as to cloud datacenters. Both options could be implemented as a MOFN.

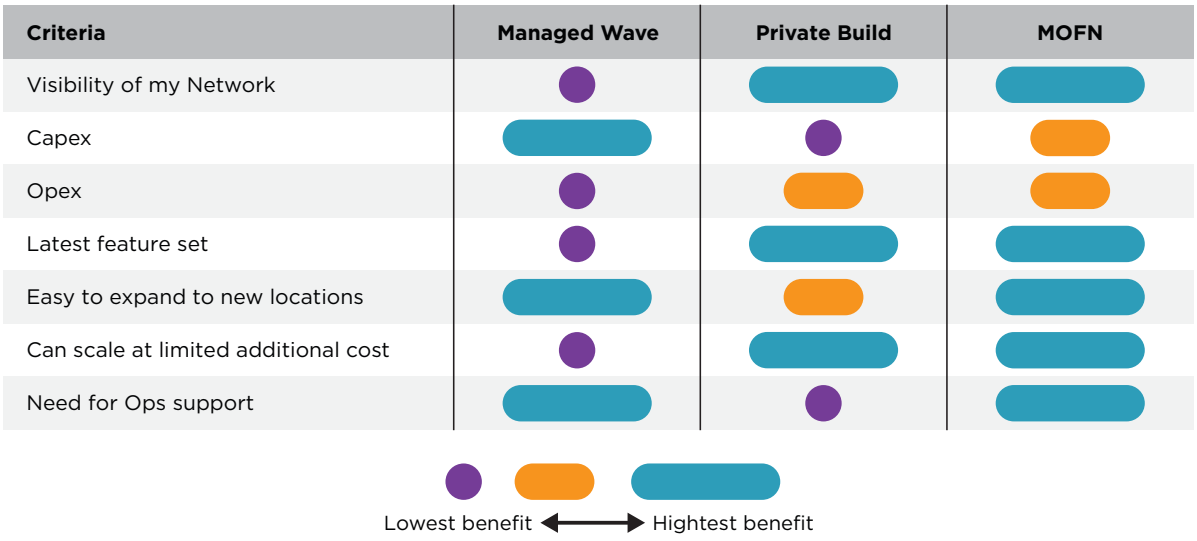


Figure 3: DC Interconnect Options Pros & Cons

Figure 3 compares the qualitative aspects of all three options side by side. The green bars indicate the advantages of each options while the red indicates the disadvantages.

The conclusion of this chart is that the MOFN option offers the best of both the "Managed Wave and Private DCI solutions." MOFN is ideal for circumstances where acquiring dark fiber poses challenges or when an organization prefers to delegate network operations to a service provider.

Economics of DCI Deployment models

In the initial section of this paper, we explored the qualitative elements of DCI alternatives. Ultimately, however, organizations seek a financial assessment that reflects the total cost of ownership (TCO) associated with their DCI options.

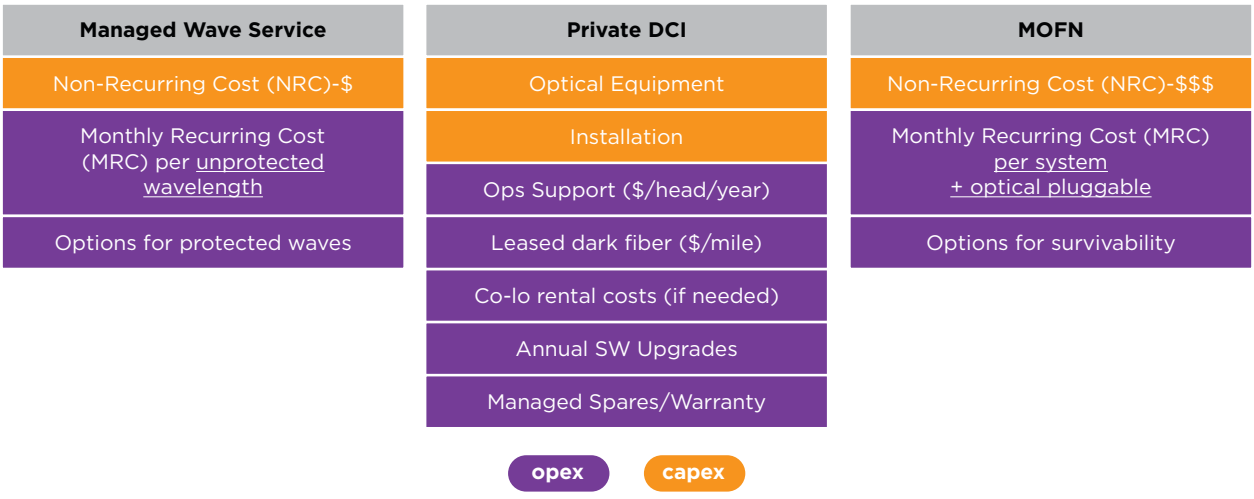


Figure 4: DCI Network Financial Components

Figure 4 depicts the financial components linked to the three DCI options present in this model. Each option consists of a combination of initial capital expenditure (capex) and ongoing operational expenditure (opex).

Some additional notes regarding the financial components of the 3 options:

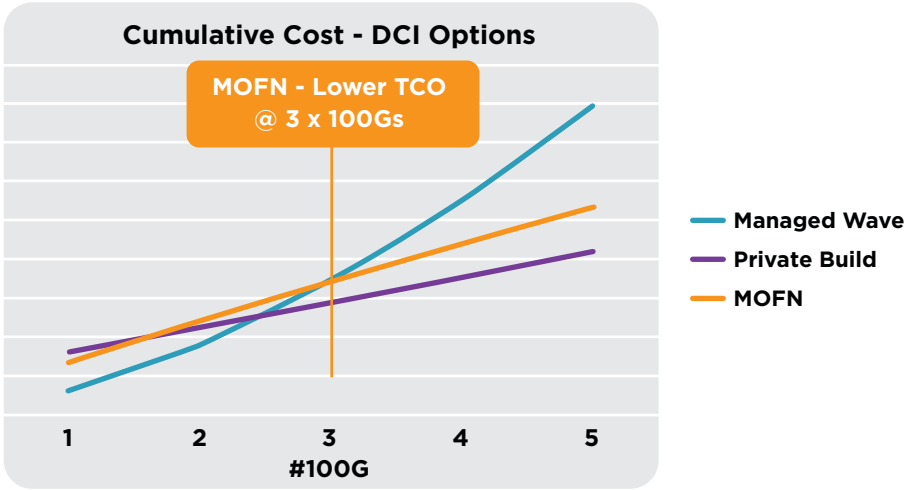
Managed Wave: This follows a straightforward operating expense model with an initial capital expenditure requirement (one-time cost). It is usually priced based on the wavelength, accompanied by a fixed-term contract. The organization does not possess ownership of any equipment.

Private DCI: This involves an initial capital investment; however, there are considerable ongoing operational expenses associated with leased fiber and the costs tied to owning equipment, including spare parts, software upgrades, and operational support. The organization retains ownership of the equipment.

MOFN: This model blends elements from both approaches. Typically, the organization specifies the equipment, resulting in a higher initial cost compared to Managed Wave. While the cost components resemble those of a Private DCI, the overall expense is structured as a monthly payment or operational expenditure. The organization does not retain ownership of any equipment.

We built a financial TCO model using the above cost components and the following assumptions:

- A point-to-point DCI network that grows by 100G increment per year
- Leased fiber in a medium sized US metro and included operating costs for operations support, annual SW upgrades and warranty as a % of initial capex per year for Private DCI
- US based cost assumptions



Based on US pricing

Figure 5: DCI Network Cumulative Cost Comparison

Figure 5 shows the results of our analysis:

- The **Managed Wave** curve, as previously noted, features a minimal initial investment; however, costs increase linearly with the growth in the number of 100Gs, especially after the 3rd 100G
- The **Private Build** curve begins with a higher start-up cost, which accounts for the capital expenditure required to establish the initial network. As time progresses, its costs increase primarily due to ongoing operational expenses, particularly those related to leased fiber. Unlike the managed wave, its cost trajectory is more stable, as there is little additional capital expenditure needed to accommodate extra 100G clients.
- The **MOFN** curve is positioned between the managed wave and private DCI curves. It resembles the Private DCI curve, as it is dedicated to either the enterprise or a cloud provider, but it sits higher than the Private DCI due to its management by the service provider.

In summary, if an enterprise or cloud provider currently utilizes 2 x 100Gs **and anticipates expansion to 3 x 100G soon**, a private DCI or MOFN presents the most economical total cost of ownership (TCO). The MOFN approach is more attractive if dark fiber is difficult to procure and/or the organization doesn't to deal with the management of their network. Managed wave solutions are particularly advantageous at the outset of an organization's DCI journey when they aim to limit capital expenditures and have uncertain future DCI demand.

Ribbon is pleased to tailor these TCO models to fit each customer's unique situation, ensuring they adopt the most suitable deployment model.

What makes Ribbon a compelling choice for organizations seeking a DCI solution?

- Ribbon offers the highest density and lowest power consumption optical transport DCI in the industry, providing up to 25.6T capacity in a 2RU platform while consuming less than 0.07W/G.
- Ribbon's Muse cloud-native multi-layer automation platform provides real-time management of Ribbon's IP and optical networks. DCI operators can directly manage Apollo network elements through APIs, while Muse offers a streamlined version specifically designed for Apollo DCI solutions, empowering organizations to fully leverage their investment. Muse low-code toolkits enable organizations to add workflow automation, ecosystem integration, and other customizations without expensive professional services support.
- Powerful analytics monitor optical performance and fiber health and use trend analysis to identify potential problems before they affect services.

In a world where network and data security has become a daily concern, optical layer encryption is a powerful tool in the fight against unwanted intrusion. Ribbon's cost-effective and flexible Apollo optical networking system adds layer 1 optical encryption that adds no overhead and virtually zero latency easily to any network, enabling datacenter operators to use it for internal purposes or for service providers to provide it as a value-added service for managed wave or MOFN services to their customers.

Managed Optical Fiber Networks (MOFN) represent a collaborative business model that allows datacenter operators to team up with service providers for specialized, high-performance DCI connectivity in areas where they either cannot or prefer not to manage and operate their own DCI networks. This approach has been attracting significant attention as datacenter operators broaden their networks to the edge and look for effective solutions to link their extensive infrastructure in regions where building their own DCI networks is not feasible or desirable.

Why Ribbon for MOFN?

Service providers must have certain key attributes in their solutions to effectively deliver managed DCI services to data center operators. Let's explore a few of them.

1. **External management portal:** This is required to enable datacenter operators to observe the performance of their networks like if it was their private network. Ribbon's Muse Multi-Layer Automation Platform enables service providers to deliver a virtual portal for their DCI customers, enabling them to monitor their network's performance.
2. **Low Code Automation:** This is required to enable organizations to automate desired tasks within their network. Ribbon's Muse Multi-Layer Automation Platform enables service providers to leverage their in-house citizen developers to develop a wide range of applications and reports with built-in drag and drop workflow capabilities for their DCI customers.
3. **Fully modular pluggable optical architecture:** This facilitates easy customization of client and line interfaces to align with DCI customer requirements. Ribbon's 9408 uses industry leading pluggable optics at 400G with full upgradeability to 800G without replacing the chassis at both the client and line sides enabling true plug and play scalability

To learn more about Ribbon's DCI solutions, click here to visit our DCI page.

Key Takeaways

If you are a service provider, you are likely very comfortable positioning managed waves for DCI. Yet as the financial analysis shows, after 3 x 100Gs, a private network over dark fiber becomes more economical and becomes your main competition. Positioning a MOFN as an alternative gives your customers similar benefits to a private network yet keeps them on the service provider's path to managed services.

If you are an enterprise or cloud provider, this analysis confirms that when you are starting out on your DCI journey, managed waves are the most cost effective yet when your bandwidth demand exceeds 3 x 100G, a private network solution becomes more cost effective. If you are not comfortable with pulling together all of the pieces of deploying an optical network, outsourcing to a service provider for a MOFN gives you the best of both worlds.

Indeed, all roads lead to MOFN for datacenter interconnect.

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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.