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# The All-Photonics Network Enables the Next-Generation Digital Economy

The IOWN Global Forum  
advances photonic networks



Commissioned by:



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# Executive summary

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Optical networks are the arterial connectivity underpinning all consumer, enterprise, and national digital economies. Optical networks have a vast reach, connecting mobile and residential broadband consumers, enterprises, and governments, both to other users and to a panoply of computing applications. The value of the optical network is the transmission of tremendous bandwidth across the entire globe at a low cost per bit and low latency.

The optical network continues to grow and adapt to many outside pressures including the increasing growth of cloud services and now the emergence of artificial intelligence (AI), which is placing even more demand on the optical core. Sustainable networking and computing have grown in importance across all sectors. The result is that new breakthrough innovations are the path forward for the industry to address these challenges and benefit of all stakeholders.

IOWN (innovative optical and wireless network) Global Forum technology is a transformational concept of evolution from electronics to photonics for networking and computing. It is based on a set of fundamental technologies, methods, and approaches that together make possible a secure, connected, immersive, and sustainable future. The IOWN Global Forum has introduced the concept of the All-Photonics Network (APN). The APN proposes an open environment in which more industry players can participate directly in the photonic layer of the network.

Consumers, enterprises, and governments have a stake in the progress of the APN. The APN needs to expand to support more bandwidth and extend to yet more edges of computing while being highly responsive with minimal latency. To succeed the APN needs to be open, enabling all stakeholders to take advantage of the many innovations from service providers and computing industry participants.

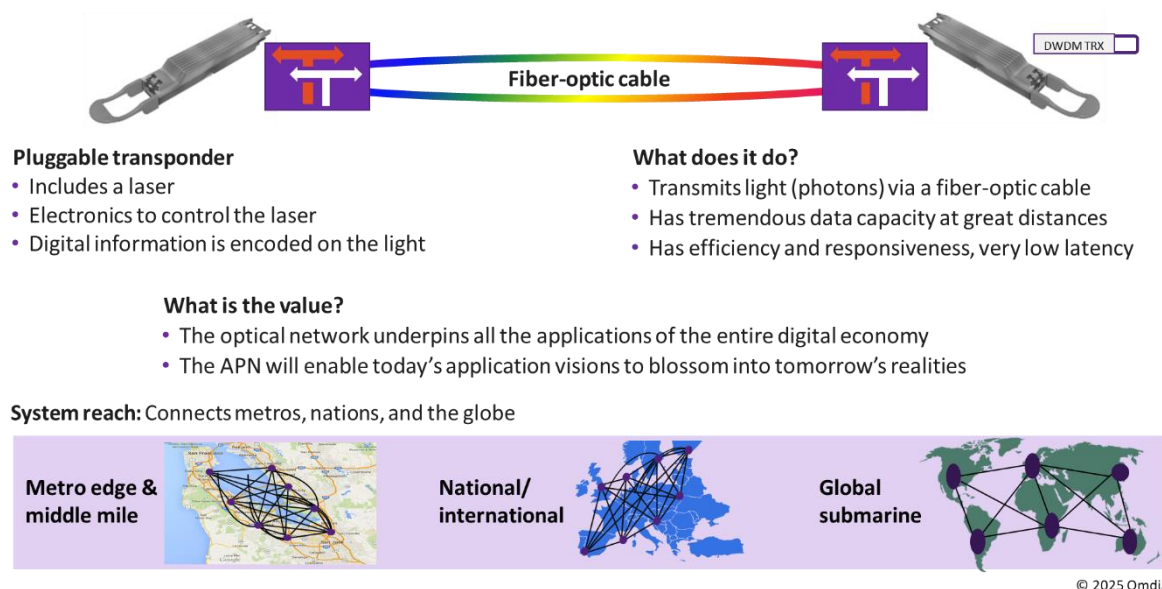
# What is the optical network?

## The digital economy is enabled by light

### How to move vast amounts of data

What are the optical network and the All-Photonics Network? The optical network is today's medium of choice for moving tremendous volumes of data great distances using light. Lasers launch light into fiber-optic cables sending video, data, and information across the fiber-optic route around cities, nations, and the globe. The receiving end can be a user's device or an application housed in a data center. The APN is the next generation of the optical network that is more powerful, capable, and efficient.

Figure 1: What is the All-Photonics (Optical) Network?



Source: Omdia

## The optical network supports access networks

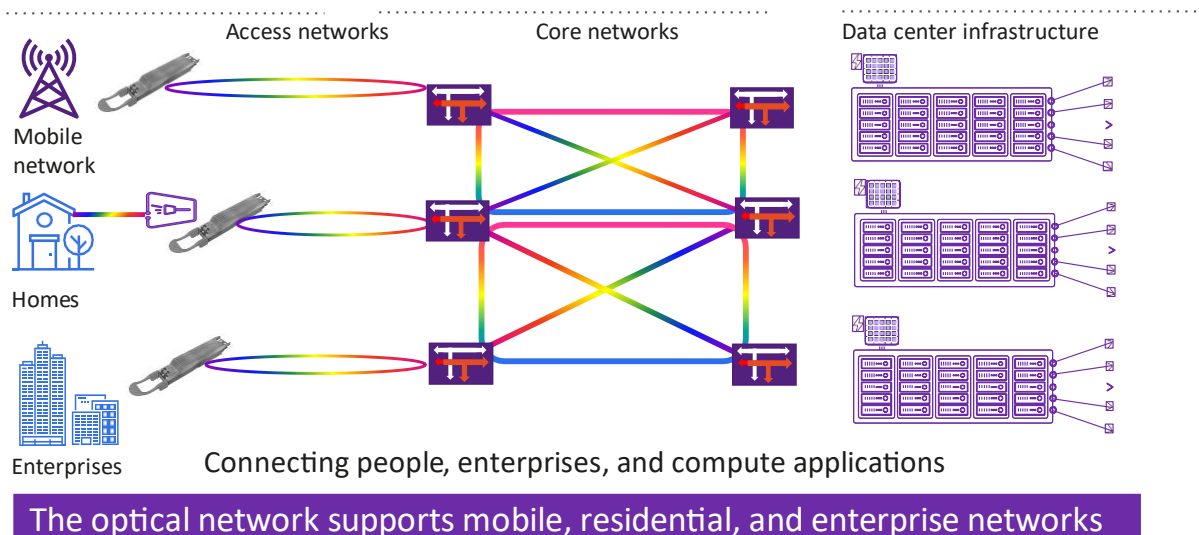
### Access networks

Access networks of all types are ultimately supported by an optical network core. The mobile access network connects mobile phones to the radio access network towers. From that point, modernized

networks interconnect the radio tower back to the network core via fiber optics. A fiber-optic transponder is installed at the radio site. The “mobile call” is now carried over the fiber-optic network toward its destination. Similarly, the network traffic originating from home Wi-Fi networks also makes its way onto the optical core.

Enterprise sites also leverage the optical core. Smaller branch office sites typically connect at more modest bandwidth levels. Larger headquarters sites and private data centers connect into the optical core at much higher data rates.

**Figure 2: The optical network supports many access networks**



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Source: Omdia

## Connectivity to compute applications resident in data centers

Increasing volumes of traffic are traveling between end users and data centers supporting the myriad of infotainment services applications. The optical network aggregates the tendrils of traffic into very-high-capacity “pipes” to hand off to the applications housed in the data centers. In addition, enterprises are making more and more use of cloud services, increasing the information technology traffic between enterprise clients and the cloud data center locations.

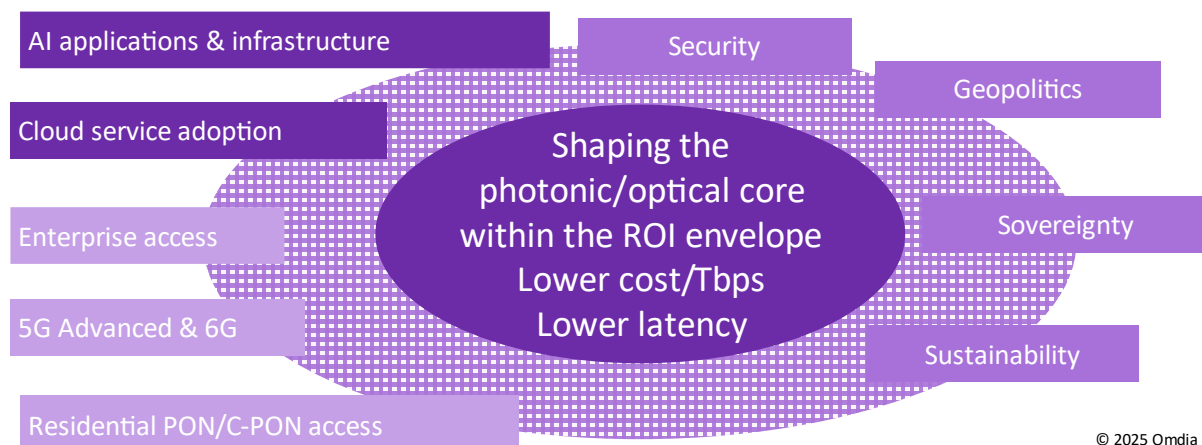
# Pressures on optical networks

## Bandwidth growth pressure

The global optical network is constantly growing, evolving, and reacting to a multitude of pressures including AI, which is fueling a vast infrastructure and ecosystem building boom. The optical network will have to keep pace with new routes to new sites, extending network capillarity to connect more client sites and provide greater overall capacity.

As enterprises shifted IT systems from in-house to the cloud, the cloud services ecosystem reached \$300bn in 2024, increasing pressure on the optical network to keep pace.

Figure 3: Pressures on optical networks



Source: Omdia

## Security, sovereignty, and geopolitical pressure

Networks are crucial to the overall digital economy but can be vulnerable. Building diverse routes mitigates network vulnerability, and new routes are evaluated and built to minimize geopolitical risk. Routes are being built around known geographical choke points and avoiding geopolitical rivals. New, diverse, and secure routes can help a nation to preserve sovereign integrity.

## Sustainability pressure

Sustainability has risen to the top of the agenda for consumers, enterprises, and governments. The objective is to minimize the ecological footprint of new technological initiatives and the increasing pace of technology adoption, especially with the coming AI computing demands.

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# Next-generation requirements

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The activation of the AI economy is bringing the next-generation requirements for optical networks into focus:

- **Even greater bandwidth:** supports the massive data movement for AI
- **Enhanced optical capillarity:** extending the optical network onramps directly to more enterprise, consumer, and government endpoints
- **Lower latency:** equates to faster response times to meet advanced application requirements
- **Lower power consumption per bit:** to meet sustainability goals
- **Cloud-like agility:** to match bandwidth supply to service utilization
- **Greater network robustness and security:** within a geopolitically turbulent world

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# The value of APN

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## APN attributes

The All-Photonics Network will extend the photonic realm more comprehensively throughout the community, bringing greater, secure, and sustainable bandwidth with agility and responsiveness. The new capabilities will unlock new value for the stakeholder community.

## Enhanced personal values

People's quality of life will be improved via the realization and implementation of the APN.

Human connections will be enhanced by the creation of more immersive environments with no perceptible time delay.

Healthcare delivery, in great need of modernization, will be via self-diagnostic tools and will provide instant results that can be shared with physicians in real time, opening up new opportunities for access to healthcare. Today's telehealth can become more ubiquitous and available in areas that digital technologies still cannot reach.

## Enhanced business values

Business processes will be improved, enabling the preservation of resources for the future.

Agriculture will be modernized with precision farming leveraging the digital twin and the APN. There will be more utilization of sensors to gather data on soil, air, and hydrological conditions. Farmers will be able to optimize agricultural inputs to optimize yields.

Manufacturing will be improved with the digital twin connected via the APN. New business models will be possible for manufacturing companies, which will be able to instantly scale production up or down depending on demand. A more effective supply chain can be created through the use of low-latency communications.

## Enhanced societal values

Societies will be revitalized.

Education can be delivered worldwide in all languages. Skills can be more universally taught. Virtual reality can enable hands-on learning for a multitude of vocations.

Safer environments can be developed with more early warning systems. During an emergency, alerts and signals can send people to shelter, directing them along the way, and sensors, wearables, and sophisticated detection tools can help rescuers locate people.



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# Implementing the APN

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## Why now?

The time is right for the APN. Historically, it faced a number of technology, network management, standards, and organizational inhibitors. Thanks to constant industry innovation, the industry inhibitors have been melting away. New enabling technologies have come to the fore. The Forum does have more steps to take to transition from the compelling plan to the full implementation.

## From APN inhibitors ...

Many APN concepts have been in the industry lexicon for many years. Technologies have evolved and daunting impediments are fading:

- Historically, optical transponders were quite large, consuming too much space to be practical.
- Historically, the optical pluggable transponders could not transmit over long distances.
- The edge had to endure expensive solutions that were priced for core applications.
- Wavelength switching—the ability to route optical paths—was not practical.
- Communications service providers (CSPs) were constrained by vendor choice.
- Standards for the APN did not exist.

## ... To APN enablers

- Optical pluggables have greatly reduced in size, enabling deployment in more configurations.
- High-performance optical pluggables can now transmit data over thousands of kilometers.
- Cost-optimized optical edge network elements can deliver high-end optical performance at access network economics.
- Optical switching devices have come to market, enabling light path switching.
- The industry's push toward a standardized, open environment enables several vendors to interoperate, giving CSPs more operational flexibility

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## Remaining challenges to overcome

Work is ongoing at the Forum to bring APN from concept to full realization. The Forum continues to advocate and guide the industry on several topics. Technological progress has advanced to an impressive state. Industry efforts continue:

- Organizations may need to restructure internal groups to maximize APN benefits.
- The APN promise is greater openness, but this new openness may require the creation of new business models.
- The bandwidth supply must evolve from a static to a temporal model.
- Further network management work will be required to support an open multi-vendor, multilayer, and multi-operator model.
- Standards initiatives need to evolve to support the open APN model.

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# Impact of APN for stakeholders

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## Consumer stakeholders

More and more of the physical economy has shifted in whole or in part to digital. Digital interactions are faster, and consumers have heightened performance expectations for all the digital assets they use, whether they use them for recreation, education, information, or vocation. The APN will deliver enhanced performance for the consumers' next set of advanced digital applications.

## Enterprise stakeholders

Enterprises have enthusiastically embraced cloud services, and they are experimenting with and operationalizing artificial intelligence. Both cloud and AI are creating new traffic flows that did not exist just a short while ago. Enterprises must always drive business value, deliver return on investment, and maintain security. The APN will be a fundamental enabler of the enterprise's business goals.

## Government stakeholders

Governments have many priorities: taking care of their citizens, growing the economy, and providing security and defense. They need to maintain their sovereignty, which does require vigilance. Healthcare is always an imperative, and the populace needs to develop. Raising national competitiveness is another foundational goal. Governments need to manage their affairs, raise revenue, and fund programs and initiatives.

The APN supports all stakeholders and use cases. It needs to grow and evolve to support more bandwidth and to extend to yet more edges. It needs to be even more responsive with minimal latency. The APN needs to be open, enabling all stakeholders to take advantage of innovation from many service providers and industry innovations.

# Appendix

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## Further reading

[A Blueprint for Modern IP Transport Networks in the AI Era](#) (February 2025)

[Big Catalyst Required for Commercialization of Multicore Fiber in the Communications Market](#) (February 2025)

[Event Recap: Supercomputing SC24–November 2024](#) (November 2024)

[Market Landscape: Demystifying Artificial Intelligence Concepts for Everyday Use](#) (November 2024)

[Microwave Network Equipment Spreadsheet – 3Q24 \(Share Only\)](#) (February 2025)

[Mobile Optical Pluggables Alliance: Update](#) (January 2025)

[Total Optical Components Forecast Spreadsheet – 2024](#) (December 2024)

[Worldwide CSP Networked Edge TAM and Forecast – 2024](#) (November 2024)

[2025 Trends to Watch: Coherent Optics and Advanced Fiber Technologies](#) (November 2024)

[2025 Trends to Watch: Datacom Optical Components](#) (February 2025)

[2025 Trends to Watch: Networked Edge](#) (November 2024)

[2025 Trends to Watch: Optical Networks](#) (November 2024)

[2025 Trends to Watch: Service Provider Routing and Switching](#) (September 2024)

[“Lumen, Microsoft, and Corning are building the next-generation global AI network”](#) (August 2024)

[“Marvell, growing the AI TAM, announces 1.6Tbps coherent-lite DSP for 20km data center interconnect”](#) (December 2024)

[“Multicore fiber being commercialized for an undersea network is an example of how such solutions may be of benefit to terrestrial networks”](#) (December 2024)

[“Relativity Networks leaves stealth mode to bring hollow-core fiber cables to market: a good gambit, but a steep road ahead”](#) (February 2025)

[“Taiwanese Semiconductor Manufacturing Corporation has its eye on the prize of optical I/O for AI”](#) (February 2025)

Ian Redpath, (September 13, 2024) “AI-ready metro optical network,” Omdia, available at <https://omdia.tech.informa.com/commissioned-research/articles/ai-ready-metro-optical-network>

Ian Redpath (September 27, 2024) “Analyst Insights: The AI Middle Mile and Federated Wavelengths,” MEF, available at [www.mef.net/edge-view-blog/analyst-insights-the-ai-middle-mile-and-federated-wavelengths/](http://www.mef.net/edge-view-blog/analyst-insights-the-ai-middle-mile-and-federated-wavelengths/)

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