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# 100G Everywhere for Carriers and Enterprises

Service providers and  
enterprises are rapidly  
adopting 100G and 400G



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# Summary

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## Communications Service Provider (CSP) view: 100G to the network edge

Passive Optical Network (PON), cloud, and 5G continue to catalyze the growth of network-edge bandwidth needs. The industry is well past 1G and 10G and has moved onto 100G for edge applications, which is a deployment priority from now through 2023. The 100G transition at the edge will, in turn, catalyze bandwidth growth in the network core, where 400G has been deployed. The 400G capability will be extended into the aggregation segment of the network to handle the growth of 100G access links.

On the packet side, CSPs recognize the natural shift of key packet functions from core to network edge. The network edge consists of both 5G Radio Access Network (RAN) and enterprise. Packet functions for both applications will be supported in a single optimized form factor, integrated packet optical solution. Latency, service level agreements (SLAs), and security are also top CSP priorities. Extending key packet capabilities such as FlexEthernet (FlexE) to the edge enhances service isolation for improved security. Extending segment routing to the edge enhances SLA performance. Packaging the next-generation optical and packet capabilities into an access-friendly form factor will provide CSPs with a powerful tool for meeting fixed and mobile client needs.

## Enterprise view: 100G and advanced packet functions

Enterprises are also evaluating next-generation optical networks. Many enterprises, via their own rights of way or via procured dark fiber, operate substantial private optical networks. Enterprises surveyed by Omdia highlighted their top motivators, citing security, total cost of ownership (TCO), and latency as key.

Enterprises that do operate their own private optical networks also want to stay on the leading edge of technology adoption and will rapidly adopt access 100G and core 400G capabilities.

Enterprises will migrate network intelligence to the edge to scale their networks and support next-generation services. They are evaluating SRv6 for the next generation of networks. In addition, enterprises are extending Quality of Experience (QoE) capabilities to the IP edge.

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## Architecture and technology directions

CSPs and enterprises are both looking to evolve their architectures and introduce technology solutions that address their growing needs for bandwidth and intelligence. At the same time, new solutions will need to be 'Day 1' rightsized for the network-edge access environment with the flexibility to scale over time.

# CSP view: 100G to the edge

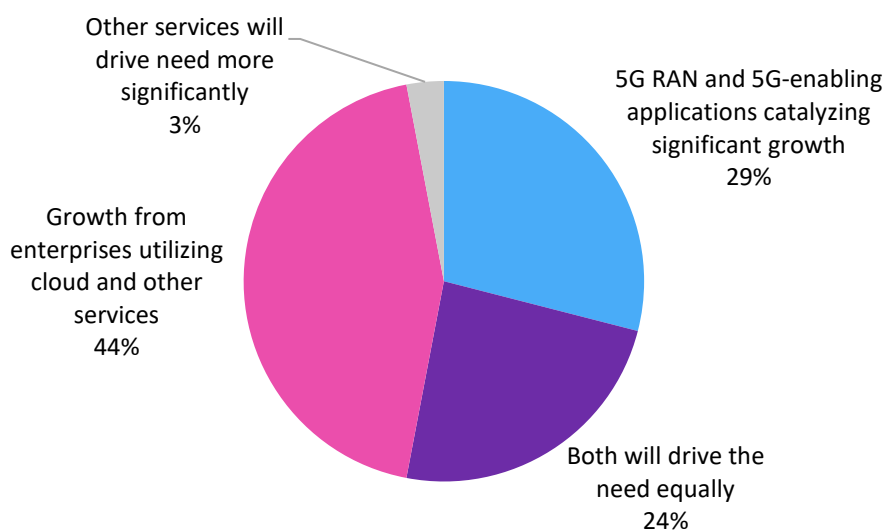
## PON, Cloud, and 5G drive edge bandwidth

The industry has been witnessing several key catalyzing bandwidth trends:

- An enterprise shift to hybrid, multicloud has been underway for more than five years
- PON underwent a rapid growth spurt in response to the massive shift to at-home working
- Deployments of 5G RAN, including fixed wireless access (FWA), are underway worldwide.

Looking ahead, the major access trends will gather momentum. Once the expanded PON-enabled access is deployed, it will be heavily utilized, placing greater traffic loads on optical access, aggregation, and core networks. Enterprises transforming their IT infrastructure to a cloud model are also demanding low latency and secure performance. At present, 5G is at the front end of a decade-long investment cycle. Early versions of 5G are just being deployed, and early 5G-enabled applications are just beginning. The follow-on waves of 5G technology and applications will further drive optical access, aggregation, and core networks. From the CSP perspective, the traffic growth dynamics lead to a very specific access-network upgrade need: transition the network edge to 100G.

Figure 1. What is the most significant driver for 100G in the access segment?



Note: n=112

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Source: Omdia Optical Transmission – CSP survey

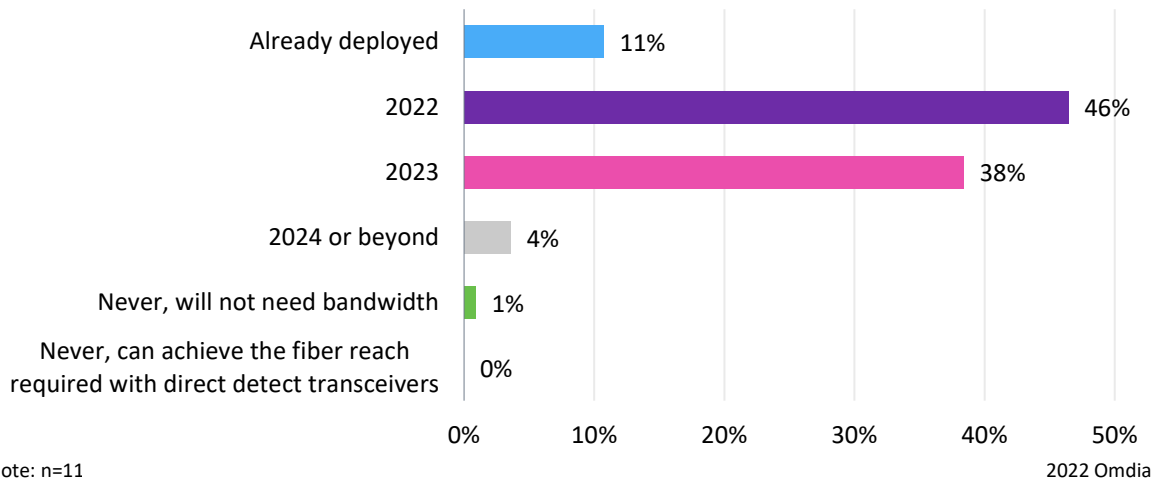
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## Coherent 100G to the edge: A deployment priority

CSPs surveyed by Omdia are looking to rapidly deploy coherent 100G in access and aggregation networks. If they are not already deploying, the majority plan to in the next one to two years.

Figure 2. CSPs expect to rapidly deploy 100G to the network edge by 2023

**When will your company start using 100G coherent in access and aggregation networks including 5G and enterprises?**



Note: n=11

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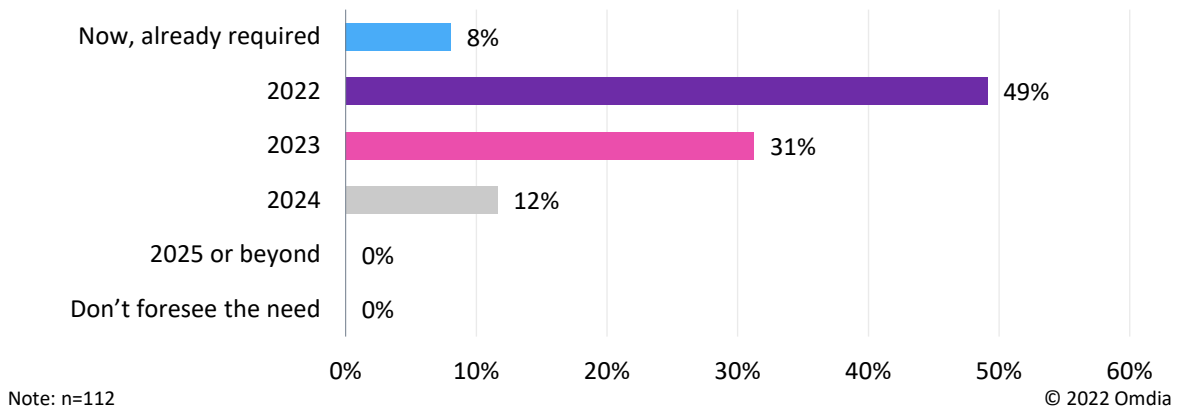
Source: Omdia Optical Transmission – CSP survey

## Edge growth in turn drives aggregation to 400G

The industry has been deploying 400G solutions in the optical core for many years now. With traffic growth at the network edge, the need to deploy 400G into the aggregation portion of the network becomes more acute. CSPs are rapidly moving to 400G in their aggregation networks.

Figure 3. When do you foresee the need for 400G in aggregation networks?

When do you foresee the need for 400G to aggregate and transport multiple lower

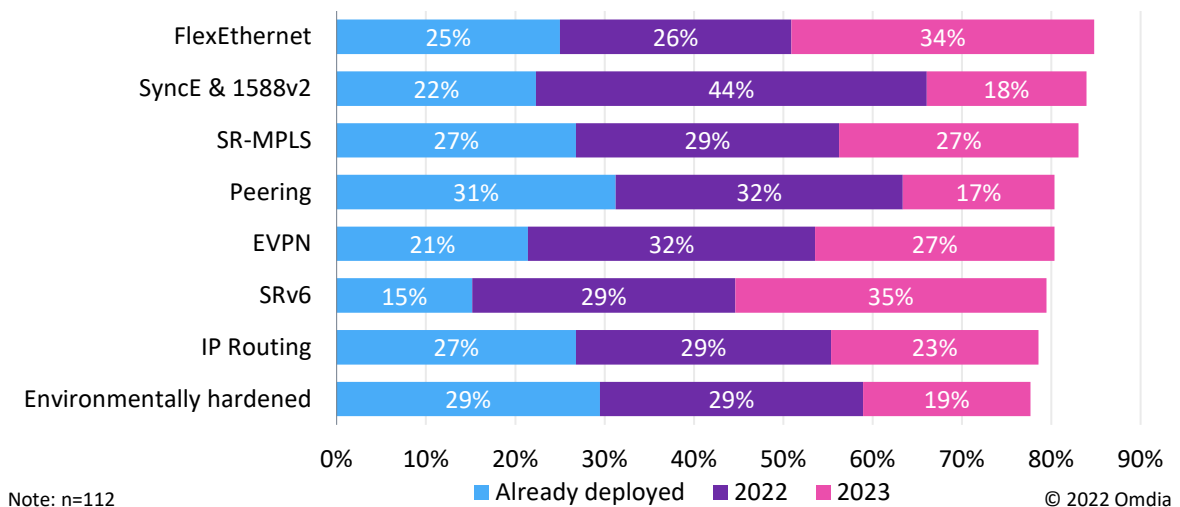


Source: Omdia Optical Transmission – CSP survey

## CSPs deploying key packet functions to the edge

In addition to expanding capacity at the network edge, CSPs are also extending key packet functions to the edge. The survey results shown in Figure 4 were sorted by CSPs’ intentions to deploy by 2023. Key packet capabilities for access deployment will support 5G and enterprise applications.

Figure 4. When do you expect to deploy the following capabilities in access applications?

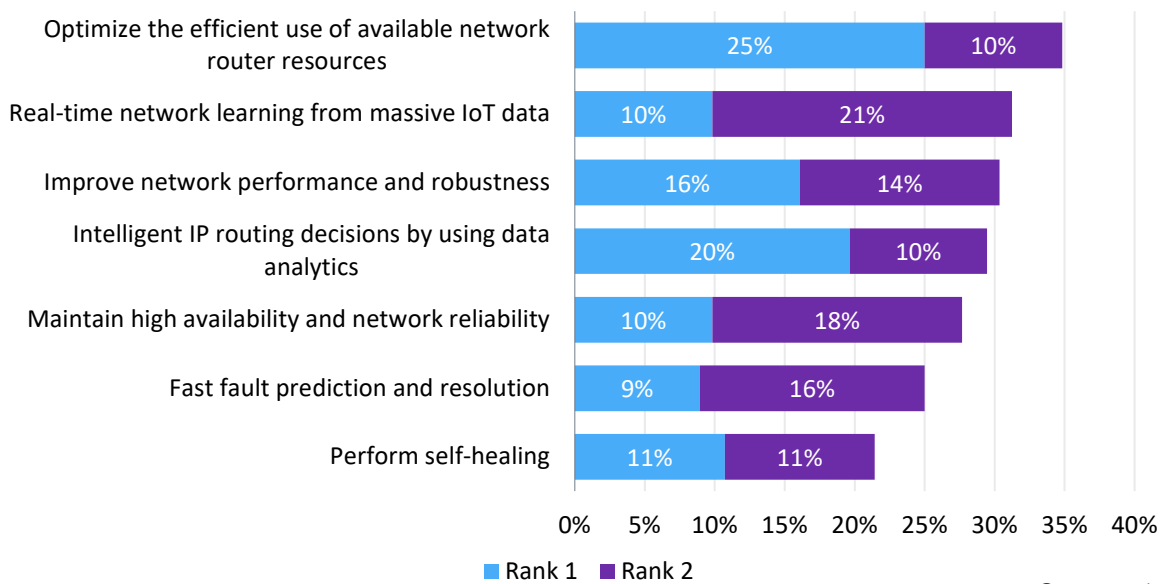


Source: Omdia Optical Transmission – CSP survey

## CSPs are evaluating artificial intelligence capabilities

CSPs are also introducing artificial intelligence (AI) techniques and capabilities into their networks to improve network performance and streamline network operations.

**Figure 5. What are your primary motivations for implementing AI in your IP network?**



Note: n=112

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Source: Omdia Optical Transmission – CSP survey

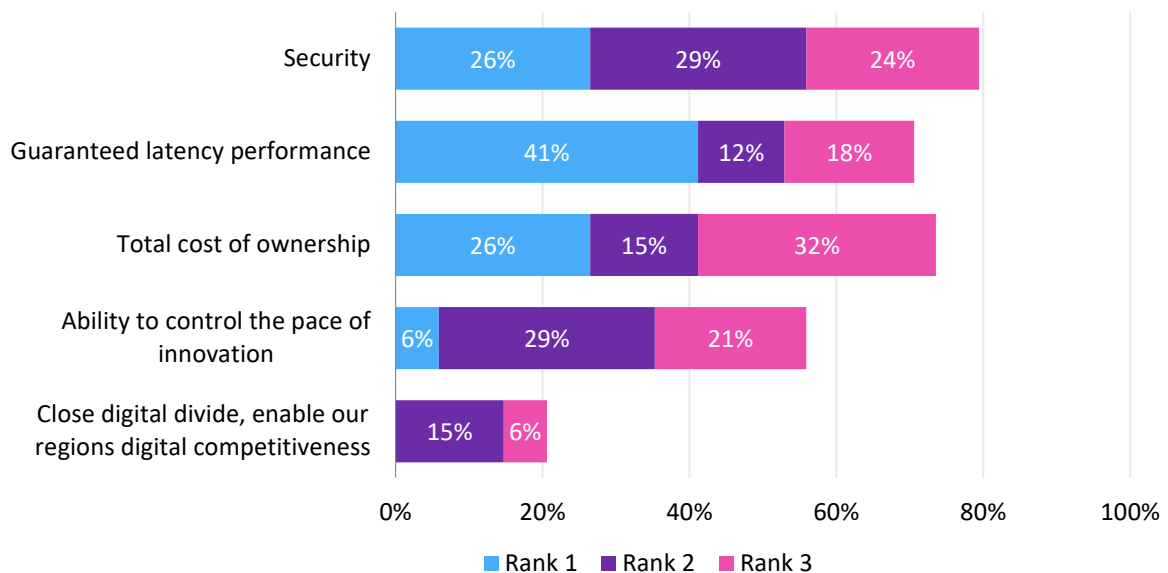


# Enterprise view: 100G and packet

## Enterprise motivators for PON

Enterprises are also evaluating next-generation optical networks. Many enterprises, via their own rights of way or via procured dark fiber, operate substantial private optical networks. The enterprises Omdia surveyed highlighted their top motivators, citing security, TCO, and latency as key.

Figure 6. Rank in order of importance your motivations for your private fiber optic network



Note: n=96

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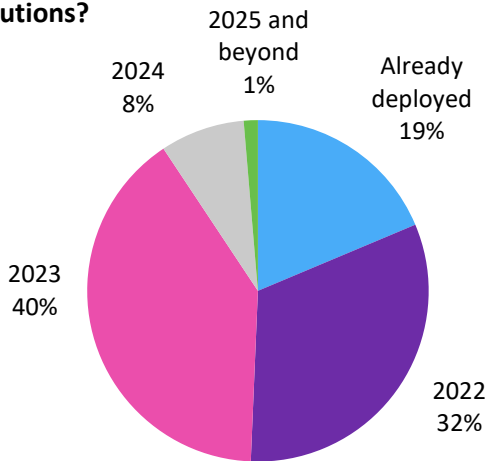
Source: Omdia Optical Transmission – Enterprise survey

## Enterprises adopting access 100G and core 400G

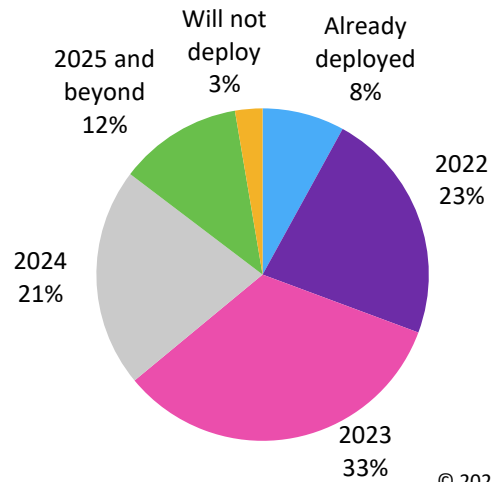
Enterprises that operate their own private optical networks want to stay at the leading edge of technology adoption. Enterprises have decided to deploy 100G in access and 400G in their core.

Figure 7. Transitioning access to 100G and core to 400G

When will you transition the access-aggregation layer to 100GbE-based solutions?



When will you transition the core layer to 400GbE-based solutions?



Note: n=75

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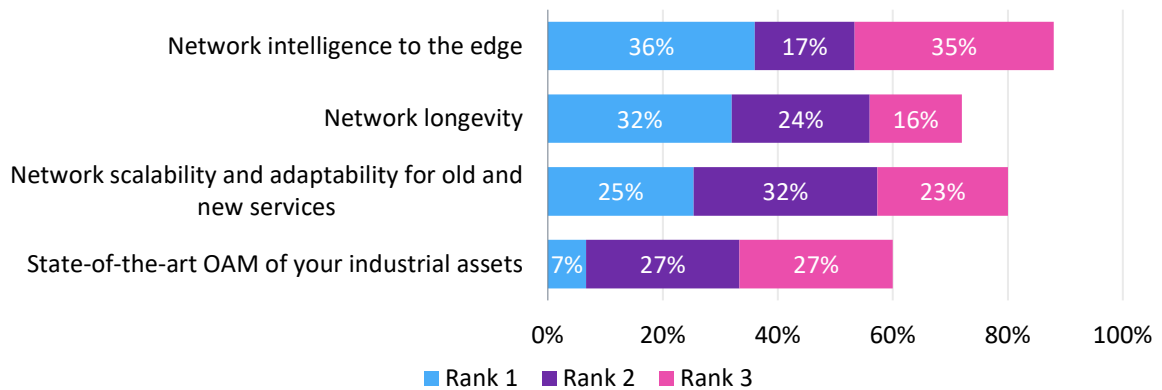
Source: Omdia Optical Transmission – Enterprise survey

## Enterprise packet modernization motivators

Enterprises will migrate network intelligence to the edge to support SLAs and next-generation services.

Figure 8. Packet modernization motivators

Rank in order of importance to your next packet modernization effort



Note: n=75

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Source: Omdia Optical Transmission – Enterprise survey

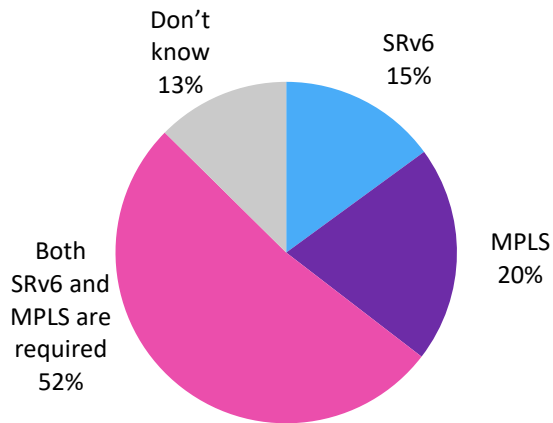
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## Mission-critical packet functions for enterprises

Enterprises are evaluating SRv6 for the next-generation networks. They are also extending QoE capabilities to the IP edge.

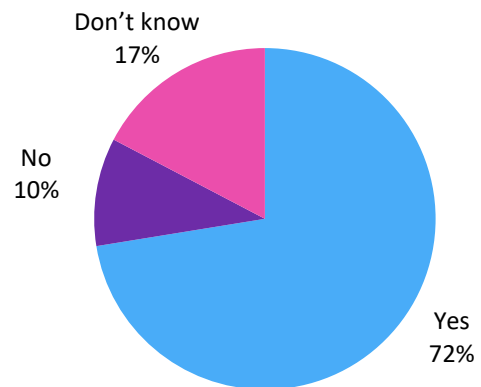
Figure 9. Will you support SRv6, and will the QoE move to the IP edge?

Will you support SRv6 or MPLS in your next-generation, mission-critical network?



Note: n=127

Do you believe IP edge will be responsible for better end-user QoE in future next-generation architectures?



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Source: Omdia Optical Transmission – Enterprise survey

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# Architecture and technology directions

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## CSP optical and packet architecture evolution

Historically, access sites could be handled with 1Gb/s or 10Gb/s demarcation solutions. Today the need and desire of CSPs for network edge and access scale is apparent. The industry has moved into the 100G access era, and 5G RAN networks will rapidly progress from 10G and 25G to 100G.

Packet optical integration is another fundamental tenet for edge applications. The industry does not have room for multi-box solutions. Optics and packet must share an edge-optimized space. Optics have miniaturized dramatically over the years, down to QSFP-DD form factors for high-performance coherent solutions.

CSPs need to evolve network architecture and introduce technology solutions that address the growing needs for bandwidth and intelligence. At the same time, new solutions will need to be 'Day 1' rightsized for the network edge access environment with the flexibility to scale over time.

Key network architecture and technology solution attributes for next-generation access are:

- Access solutions must support both enterprise demarcation and 5G xHaul applications. CSPs want to minimize product skews.
- The access environment necessitates small form-factor devices for enterprise sites and space-constrained RAN deployments.
- The RAN environment requires ruggedized and hardened solutions.
- The RAN environment requires precision timing: GNSS, SyncE, and 1588v2.
- Security is paramount. FlexE enables service isolation.
- Modern, automated network management is needed for service turn-up and ongoing control.
- Onboard switching for traffic routing and peering is necessary.
- The essential routing protocols must be deployed.
- Carrier Ethernet OAM and virtual LAN (VLAN) support is required.

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# Conclusions

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The edge environment has always been a multivariant challenge. CSP and enterprise needs include:

- Ability to scale, with minimalist 'Day 1' configurations but capability to ramp
- Low cost
- Small form factor
- Converged, multilayered, and highly integrated
- Multi-application support
- The ability to deploy essential SLA functions while not going overboard with functional bloat

Technology and miniaturization advances are enabling new options for CSPs and enterprises to consider when evolving their networks to a next-generation footing.

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# Appendix

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