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Building the Cloud Metro: Heavy Reading Survey Analysis

A Heavy Reading white paper produced for Juniper Networks

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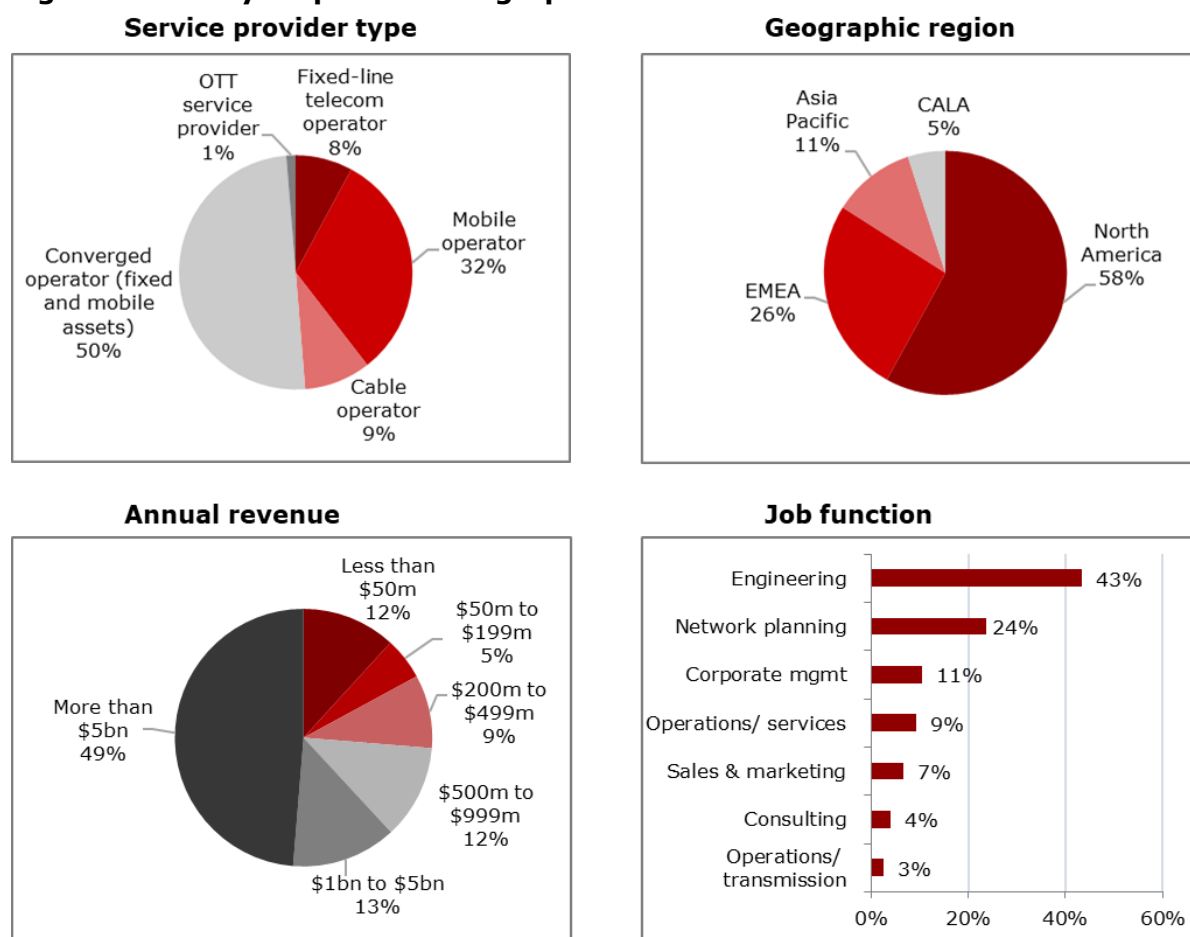
INTRODUCTION

The acceleration and convergence of IT and communications innovations are unlocking new revenue opportunities for service providers. In 5G, the biggest differentiation will come from the introduction of standalone 5G cores and 5G Advanced capabilities, much of it aimed at enterprise use cases and much of it just beginning. Cloud adoption continues globally, with the migration of cloud from core to edge set to underpin many of the emerging 5G use cases. This migration will also help transform the communications service provider (CSP) networks themselves.

The metro network plays an essential role in this future, providing capacity, connectivity, and intelligence for wireline and wireless applications. To learn more about CSPs' views and strategies for their metro network evolution, in April 2022 Heavy Reading launched a global survey of 76 CSPs. This white paper presents a high level view of the key findings from the survey, including metro network modernization drivers, essential networking capabilities, drivers for automation, and the role of pluggable coherent optics in the metro.

The survey demographics are detailed in **Figure 1**.

Figure 1: Survey response demographics



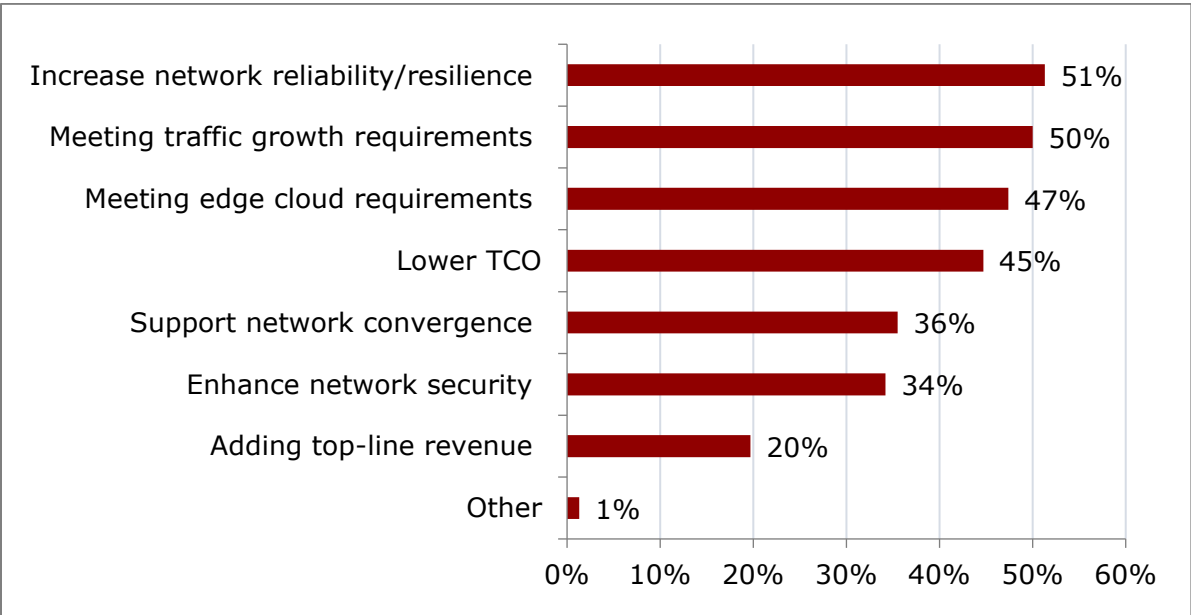
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Source: Heavy Reading, 2022

NETWORK MODERNIZATION DRIVERS

A majority of CSPs surveyed are already at some stage of metro network modernization, driven by both business and application drivers. On the business side, metro network modernization is driven by the need to increase network reliability and resilience, meet traffic growth requirements, meet edge cloud requirements, and lower network total cost of ownership (TCO). Each of these four drivers was selected by at least 45% of respondents (see **Figure 2**).

Figure 2: What are the primary business drivers to modernize your metro network?



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Source: Heavy Reading, 2022

Lowering TCO is important to service providers (as always), but it is interesting that it is not the top business driver to modernize, as reliability, traffic growth, and edge cloud all rank higher. Although reliability has always been important, it stands out in this survey as the top driver for modernization (selected by 51% of respondents). This result is consistent with findings from other recent Heavy Reading surveys that point to the increasing importance of network reliability to ensure an excellent service experience for customers and to differentiate their services from those of their competitors, particularly around emerging 5G and edge services.

5G emerges as the top application/use case driver for metro network modernization based on a weighted score ranking, ahead of the second place driver, edge/cloud services (see **Figure 3**). 5G and edge cloud are tightly coupled megatrends that will augment one another. The higher priority placed on 5G may reflect the fact that 5G deployments are much further along. Global 5G subscriptions are set to exceed 1 billion in 2022, according to Omdia. However, the advanced 5G applications that will require extensive edge connectivity are a bit further out. Many now see the 3rd Generation Partnership Project (3GPP) Release 18 (expected in 2023) as the launch pad.

Figure 3: What is the main application/use case driver for modernizing your metro network?

Driver	Overall rank	Score
5G	1	169
Edge/cloud services	2	110
Enterprise services (including SD-WAN)	3	70
IoT (Internet of Things)	4	65
Wireline broadband	5	39

Note: The score is calculated by assigning a weight to each rating where the highest priority rating holds the highest weight.

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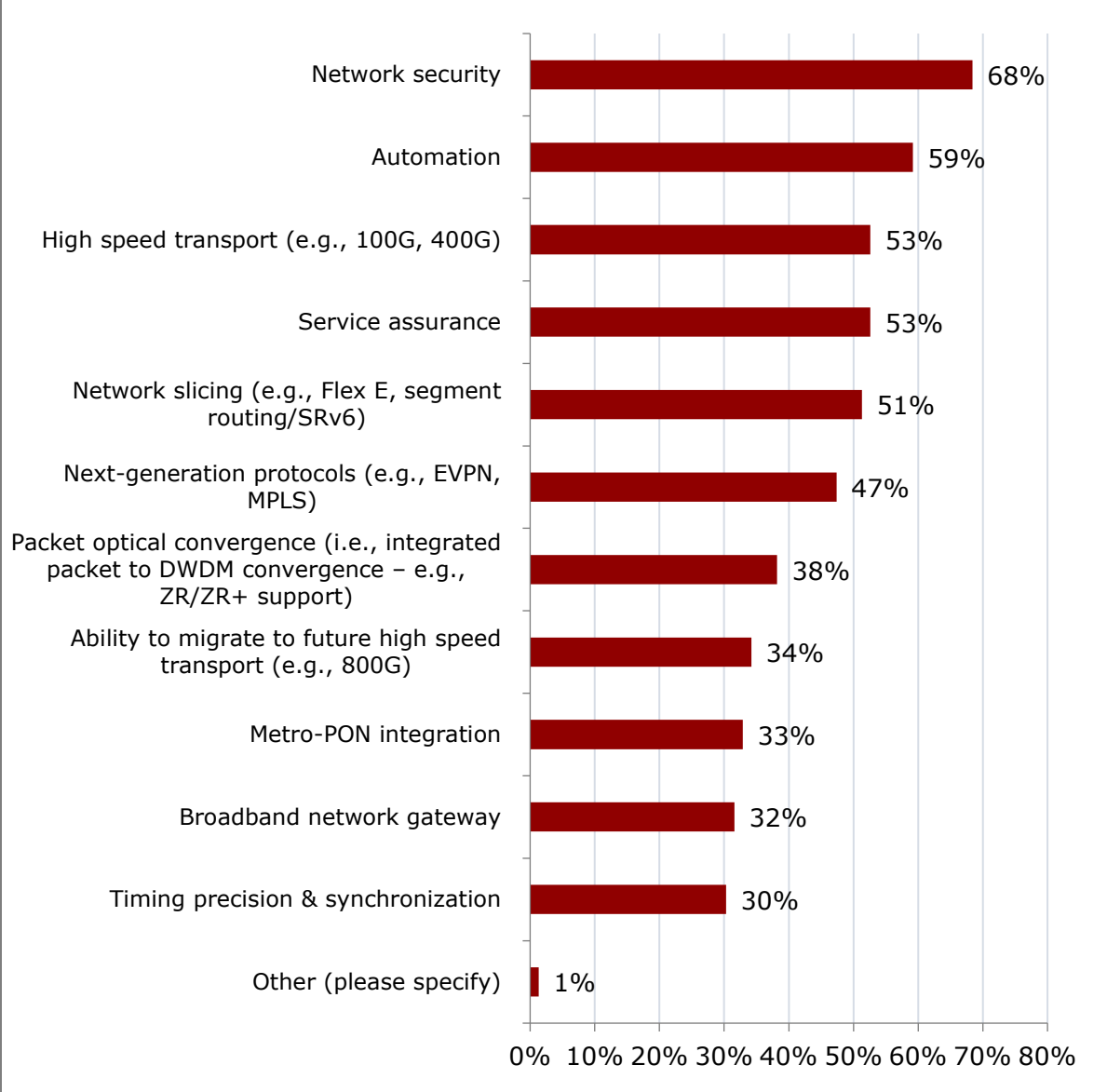
Source: Heavy Reading, 2022

CSPs also understand that the migration to edge cloud will bring significant changes to metro networks and their metro architectures. Consistent with the moves to cloud and virtualization, server-to-server (or east-west) traffic will increase as a share of overall metro traffic. Most significantly, more network traffic will remain within the metro as data centers move closer to end customers. CSPs will need to upgrade line rates as well as overall system capacities to accommodate the increasing metro-contained traffic volumes. Much will depend on where they locate these edge data centers and how many of them will be required within metros.

NETWORKING CAPABILITIES

When evaluating metro vendors’ metro networking capabilities, security (selected by 68% of respondents) and automation (selected by 59%) top the list. In addition to these, higher speeds, service assurance, network slicing, and next-generation protocols (such as segment routing) are also highly important (see **Figure 4**). Networking capabilities have a direct correlation to metro modernization business and application/use case drivers. In particular, 5G and edge will require greater capacities and speeds, network slicing, and extensive automation.

Figure 4: Which are the most important metro networking capabilities?

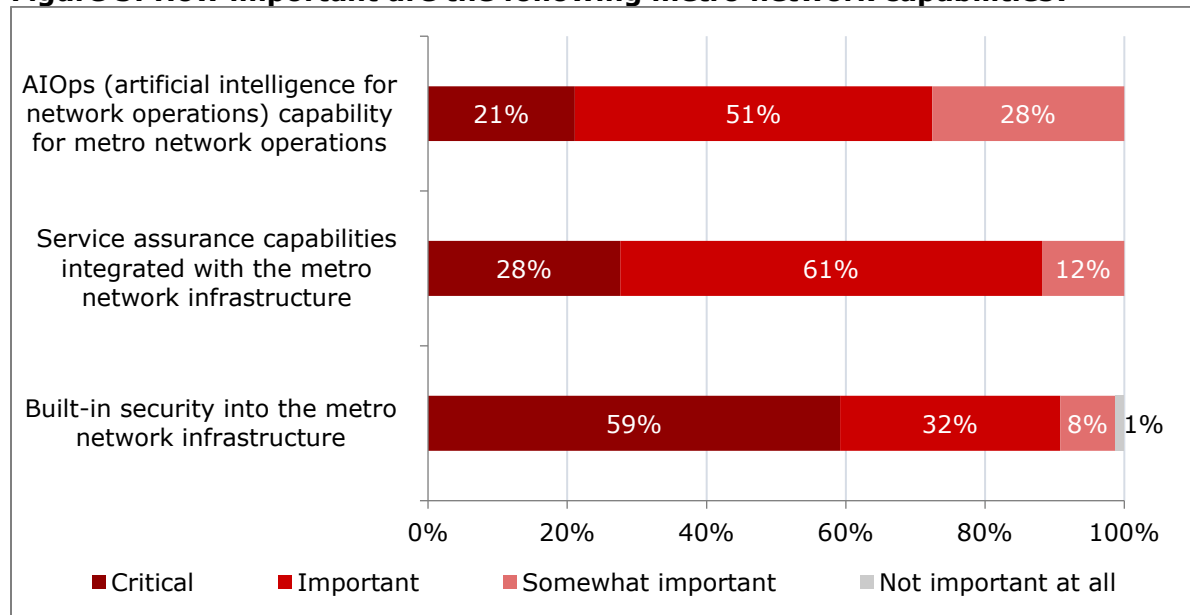


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Source: Heavy Reading, 2022

Network security, meanwhile, has been top of mind for service providers for several years. It is only becoming more important as both customer and internal applications continue to move to the cloud.

Underscoring the focus on security, a solid majority of 59% of respondents identified built-in security in the metro network architecture as “critical,” well ahead of integrated service assurance (which is also important but not at the same level as integrated security based on the survey results; see **Figure 5**).

Figure 5: How important are the following metro network capabilities?



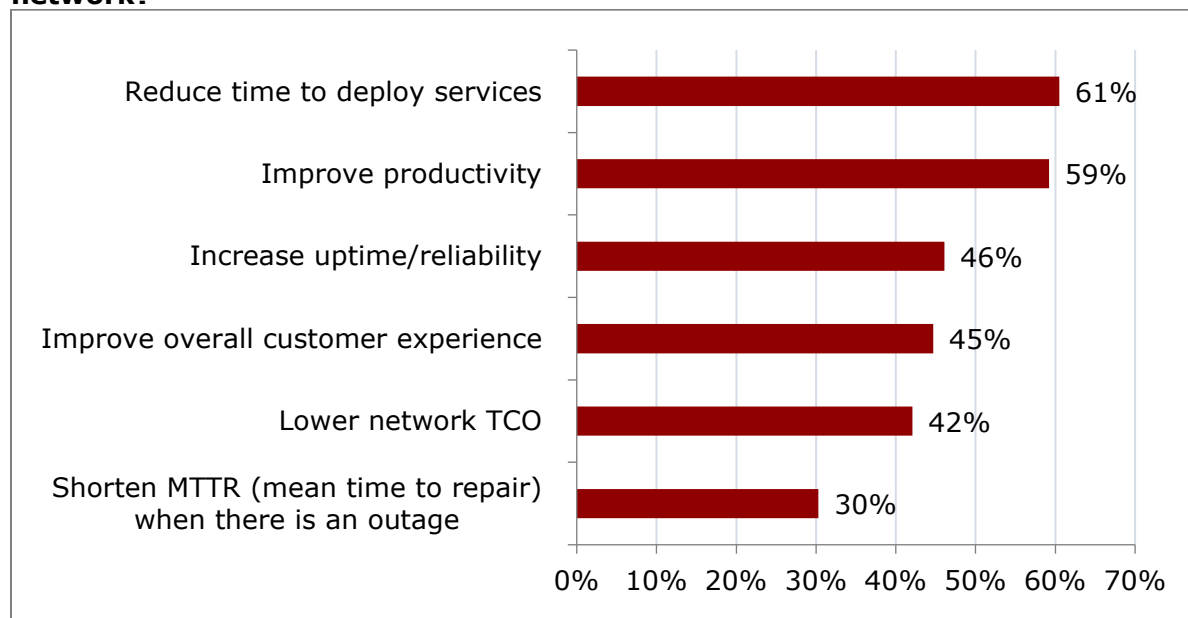
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Source: Heavy Reading, 2022

AUTOMATION

As noted above, and as strongly supported by other Heavy Reading survey research, increasing automation is a megatrend in communications. In this project, Heavy Reading sought to better understand the motivations and requirements for metro network automation. According to respondents, reducing the time to deploy services (selected by 61%) and improving productivity (selected by 59%) are dual primary drivers for implementing automation in the metro. Three drivers are of secondary importance, including increasing reliability, improving customer experience, and reducing TCO (see **Figure 6**).

Figure 6: What are the primary drivers for implementing automation in your metro network?



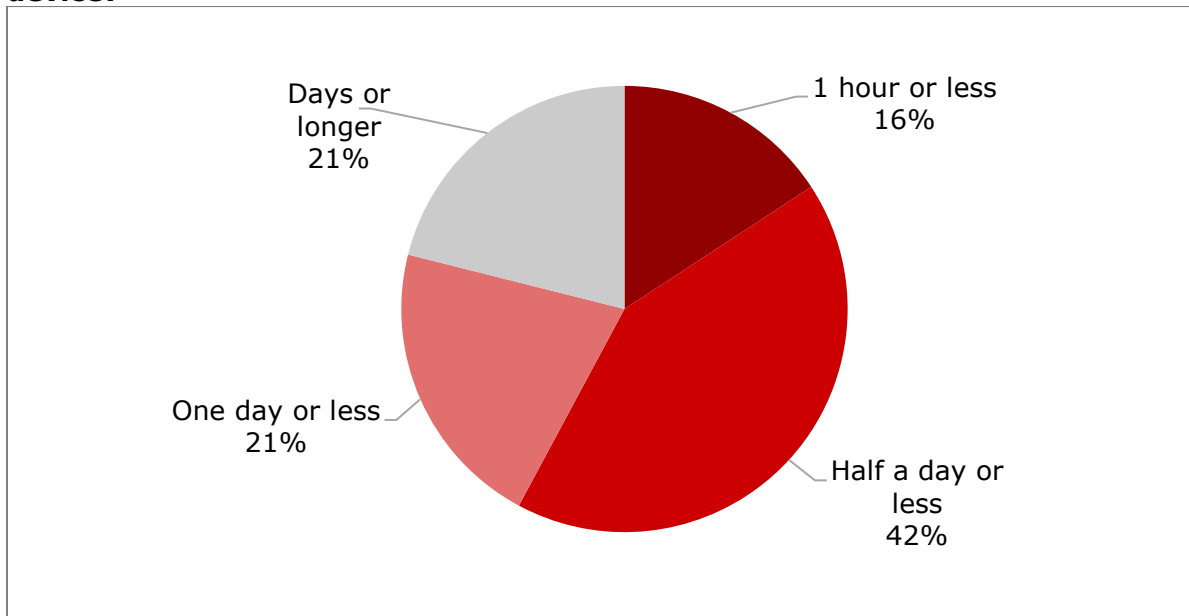
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Source: Heavy Reading, 2022

For many operators, reducing time to deploy services is an early goal for network automation, particularly in metro and access networks in which elements number in the hundreds and thousands. There are many tasks involved in deploying a service, including activation and provisioning, element configuration, and device onboarding. Manually performing each task, device by device, is a significant burden for service providers.

A look at one of the tasks—onboarding networking devices—confirms that there is significant room for improvement. The data in **Figure 7** shows that, at 84%, an overwhelming majority of CSPs surveyed takes more than one hour to onboard a metro device today. For just over one-fifth of the survey group, onboarding devices takes days or longer.

Figure 7: How long does it take for your team to onboard a metro networking device?



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Source: Heavy Reading, 2022

Automating transport networks is not without its challenges. In a separate service provider survey, also conducted in 2022, Heavy Reading finds that inadequate generic automation frameworks and a lack of internal software expertise are primary barriers to automation adoption. The same survey also finds a high level of interest in adopting transport network automation from the cloud.

Specifically, 61% of CSPs surveyed plan to use transport automation from hybrid public and private cloud or public cloud alone. Among automation early adopters, the affinity for cloud-based automation is even higher, with 83% implementing/planning either hybrid cloud or public cloud based transport network automation. Heavy Reading believes the growing interest in the cloud model is likely a response to the adoption barriers as CSPs seek new and innovative ways to overcome these challenges. Service providers will likely start with noncritical functions and move to more critical use cases over time as these become more comfortable with the cloud model.

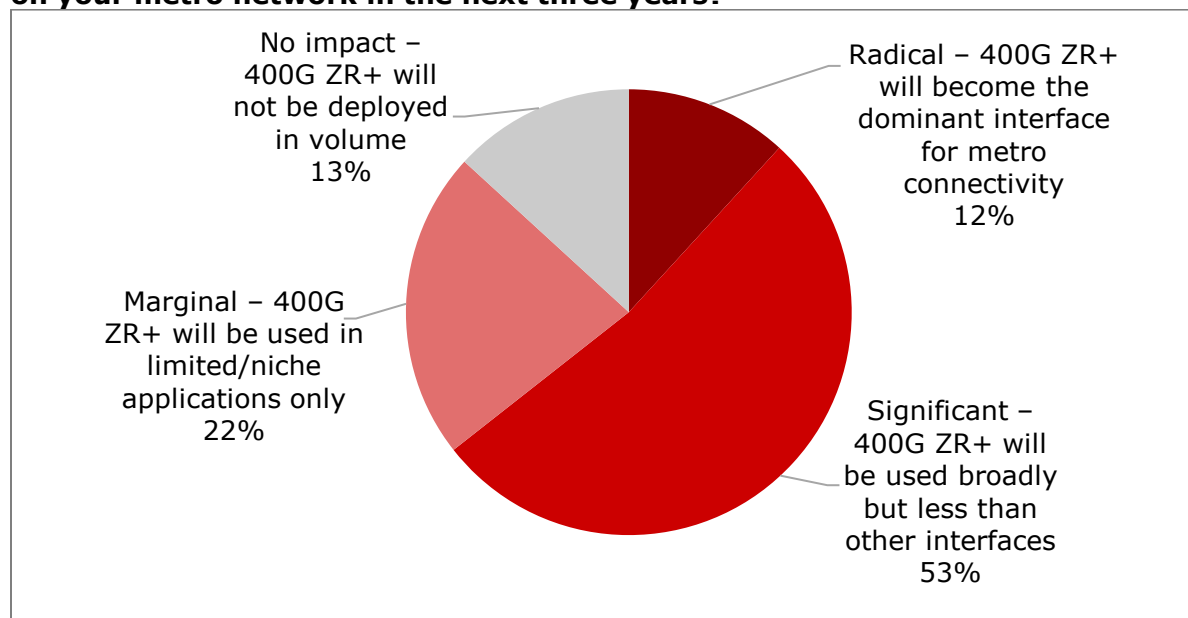
COHERENT PLUGGABLE OPTICS

The 400ZR specification was defined by the Optical Internetworking Forum (OIF) with the goal of integrating 400G pluggable coherent dense wavelength division multiplexing (DWDM) modules within next-generation 400 gigabit Ethernet (GbE) routing and switching platforms. Hyperscalers see 400G coherent pluggables for massive point-to-point connectivity between data centers as their primary use case. However, the appeal of 400G coherent pluggable optics is quickly expanding well beyond the point-to-point data center interconnect (DCI) application and well beyond hyperscalers alone.

In particular, CSPs are interested in high performance versions of 400G coherent pluggables that fit into small form factors (like QSFP-DD or OSFP) but also achieve metro/regional-type distances and are capable of passing through multiple reconfigurable optical add-drop multiplexer (ROADM) hops along a route. The industry labels these emerging coherent pluggables as 400G ZR+, and they are being defined in groups, including the Open ZR+ multisource agreement (MSA), the Open ROADM MSA, and the Open XR Forum.

Service providers have high expectations for 400G ZR+ pluggable optics. A majority of CSPs surveyed (53% of the group) expect 400G ZR+ will have a "significant" impact on their metro networks over the next three years. An additional 12% of respondents expect 400G ZR+ to have a "radical" impact as it becomes the metro dominant interface. "Significant" is defined as being used broadly, though less than other interfaces (see **Figure 8**).

Figure 8: How much impact do you expect 400G ZR+ coherent pluggable to have on your metro network in the next three years?



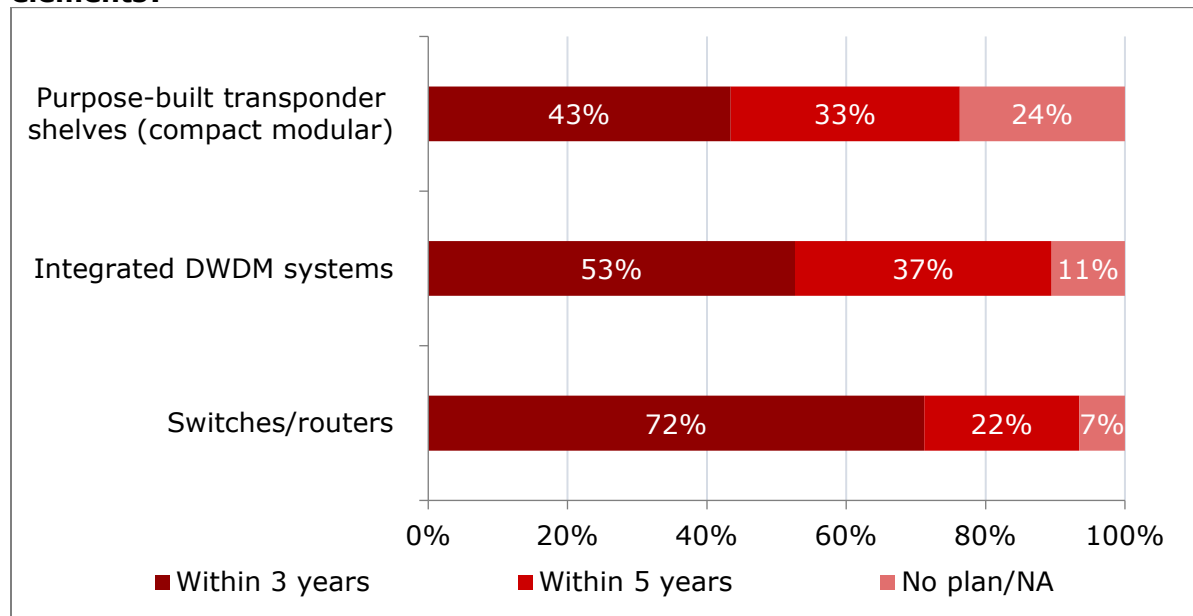
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Source: Heavy Reading, 2022

The physical integration of long-reach pluggable optics on routers—known as IPoDWDM—is experiencing a renaissance at 400G, sparked in large part by coherent pluggable optics that fit in “client-sized” form factors QSFP-DD and OSFP. Integrated optics on routers is the preferred architecture for hyperscalers deploying 400ZR. Heavy Reading survey research shows that the IPoDWDM architecture is also highly important to CSPs. An overwhelming majority of 72% of respondents intend to deploy coherent pluggables in switches/routers within three years, indicating that, like hyperscalers, CSPs expect to benefit from the capital expenditures savings of IPoDWDM (see **Figure 9**).

Still, coherent pluggable optics are not just about IPoDWDM. At 53%, a majority of CSPs also expect coherent pluggables to be housed in traditional DWDM systems within three years. In traditional DWDM systems, coherent pluggables add density improvements, greater flexibility/modularity, supplier diversity, and potentially lower costs due to volumes and competition. These same benefits can apply to compact (or purpose-built) DWDM systems, but perhaps less so, as the systems are already modular by design.

Figure 9: When will you deploy coherent pluggable optics to the following network elements?



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Source: Heavy Reading, 2022

CONCLUSIONS

CSPs are eyeing new revenue opportunities in 5G, edge, and cloud, but they understand that network modernization is required to succeed, particularly in the metro. Heavy Reading's Cloud Metro Survey identifies three major trends that will define these cloud metro networks of the future:

- **Security:** Network security ranks at the top of the list of important metro networking capabilities, which is not surprising, as both customer and internal applications continue to migrate to the cloud. Underscoring its importance, 59% of respondents identified built-in security in the metro network architecture as "critical."
- **Automation:** Reducing time to deploy services and improving productivity are driving CSPs to automate their metro networks, well ahead of the need to lower costs. Seeking innovative ways to address automation challenges, a majority of CSPs are interested in using cloud-based models for at least some of their transport automation use cases. This trend will only increase.
- **Coherent pluggables:** Coherent optics in "client" form factors (e.g., QSFP and OSFP) is the launch pad for an IPoDWDM revolution, specifically at 400Gbps. Higher performance optics, known generically as 400G ZR+, will bring this revolution to CSPs.