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Power New Edge Use Cases And Momentum In Evolving Environments

Four Recommendations To Drive Success

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Executive Summary

Interest in edge computing is accelerating among technology and business stakeholders in organizations across vertical markets and geographic regions. The influx of data from a fragmented array of edge devices and equipment is enabling optimized workloads that address various applications and edge environments. These edge solutions put compute, storage, and intelligence where it's needed, and help firms anticipate customer needs, act on their behalf, and enable efficient operations in localized contexts.

In September 2022, Dell and Intel commissioned Forrester Consulting to evaluate edge computing deployment strategies, use case initiatives, and transformation opportunities. Forrester conducted an online survey with 619 respondents and six qualitative interviews with senior IT and operational technology (OT) professionals at global enterprises to explore this topic. For the purposes of the study, we defined IT as individuals responsible for information technology systems and processes, such as servers, storage and security; and OT as individuals responsible for operational technology systems and processes, such as the transportation and logistics systems in warehouses and manufacturing lines in factories.

We found common characteristics of mature edge organizations that have built a comprehensive edge strategy. Edge Mature organizations currently deploy a range of edge use cases with more edge cases planned in the future. Also, Edge Mature firms actively generate business results from their data at the edge, and they are more likely to undergo an IT and OT transformation as they modernize their business operations.

Edge decision-makers can learn from these best practices as they identify and deploy their edge modernization and transformation initiatives.



Key Findings



Edge use case implementation is expanding to include a diverse array of deployments. Spending on edge computing is increasing. Firms are implementing or planning to implement a variety of edge use cases across a range of environments and use cases.

IT and OT edge decision-makers face key challenges. An array of IT and OT decision-makers participate in edge decisions. However, lack of collaboration and tension between IT and OT organizations can hamper edge deployment. IT teams may lack the ability to blend and contextualize capabilities to combine IT data about customers and orders with high-volume streams of OT data. These stakeholders must collaborate to align edge business scenarios, engage with an array of internal stakeholders involved in edge decision-making, and tamp down friction that may arise between IT and OT teams as they wade through edge complexities.



Firms exhibiting advanced edge maturity provide a roadmap for overcoming deployment hurdles. Edge Mature organizations proactively deploy a wide array of edge solutions to modernize business processes, IT initiatives, and OT processes.



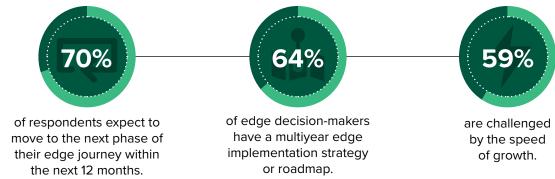
Edge Deployment Extends Beyond The Basics

Edge computing isn't a single emerging technology; it's many technologies working together to create new capabilities. The growth of edge initiatives is inevitable as edge innovation leads to smarter, faster digital experiences everywhere. And, with the explosion of use cases, "edge computing will turn industries on their heads." In surveying 619 edge decision-makers, we found that:

• Planning and spending for edge computing is expected to grow in the next year. Seven out of 10 respondents expect their organizations' edge journey to move to the next phase within the next 12 months, while the remaining 30% anticipate their next phase happening in the next one to three years. As they enter this next phase, 64% of edge decision-makers report their companies have a multiyear edge computing implementation strategy or roadmap, and they anticipate edge spending as a percentage of IT spending to grow in the next fiscal year. They are being purposeful and planning for implementing use cases or broadening deployment (see Figure 1). And, while this deployment is impressive, 59% of decision-makers feel challenged by the speed of growth.

Figure 1





On average, enterprises currently spend 14% of their IT budget on edge computing, **growing to 17% in the next fiscal year**.

Base: 619 global decision-makers of edge strategies or solutions Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

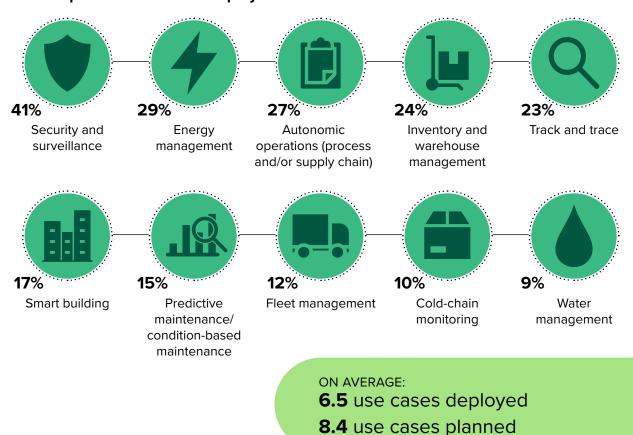
- The complexity of deployment is exploding as firms implement both horizontal and vertical use cases. Innovative Al/machine learning (ML), analytics, internet of things (IoT), and container solutions enable new applications, deployment options, and use cases in a range of public and private edge environments. On average, companies have currently deployed 6.5 use cases, and plan to have an average of 8.4 use cases deployed in the coming year. The top 5 deployed use cases across all industries include: 1) security and surveillance; 2) energy management; 3) autonomic operations for either processes or supply chain; 4) inventory and warehouse management to track inventory levels and manage warehouse operations; and 5) track and trace solutions, which capture a product's status throughout the entire value chain and identify and verify its path at each stage (see Figure 2). Key edge use cases span both horizontal and vertical scenarios, including the following:
 - Horizontal:
 - Security and surveillance; inventory and warehouse
 - Vertical:
 - Retail: Loss prevention, supply and demand warehouse fulfillment
 - Manufacturing: Inventory monitoring and management, predictive maintenance
 - Public sector: Environmental monitoring, public transport management

"Switching to the IoT sensors was huge for us to facilitate new store openings and enable our aggressive store growth plan. We brought in some additional features to make our associates more efficient. I didn't have to do any maintenance to provide new content to it, and, overall, it's a better experience."

Director of IT innovation, retail

Figure 2

Most Important Use Cases Deployed



Base: 455 global decision-makers of edge strategies or solutions who have currently deployed use cases Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

"Computing initiatives are easier to deploy now. The difficulty was that to make it easier to deploy them, we had to change the business model. All of these things can't be compartmentalized. When you look at one thing, it suddenly is an enterprisewide, all-business thing."

Vice president of R&D and technology transformation, retail

Growing Edge Maturity Alleviates Challenges

A solid majority of edge decision-makers believe their edge initiatives are mature, however only a fraction of them report they are in full deployment. In our analysis, we noticed a small segment of the most mature edge customers reported greater success in a number of areas in their organizations. After taking multiple variables into consideration, we isolated around 88 of what we're calling Edge Mature organizations.

This group is largely focused in five industries: manufacturing, telecommunications, retail, healthcare, and government. These industries represent 64% of the total Edge Mature organizations. On average, these companies currently have 13.3 use cases deployed and 7.5 use cases planned for deployment. Edge Mature companies are actively generating business results from their data at the edge, and they are more likely to undergo an IT and OT transformation as they modernize their business operations. This group is further along their implementation journey than the moderately mature companies and can provide guidance as firms work to grow edge maturity.

In our study, we found that companies across all maturity levels had process and technology challenges.

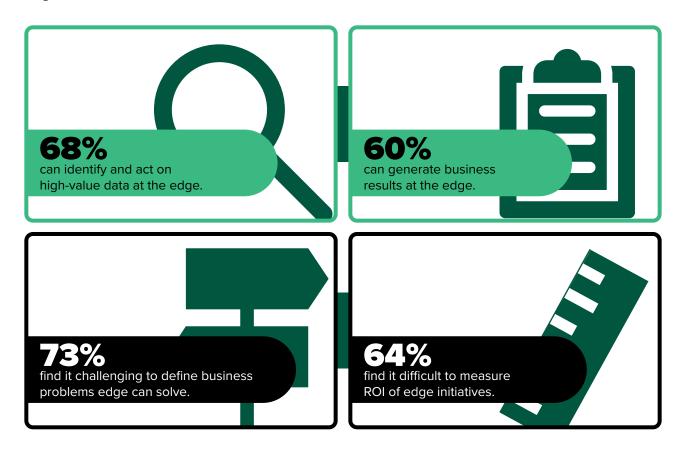
PROCESS CHALLENGES

Defining and measuring the success of edge initiatives. As enterprises work to deploy more complex use cases and solutions, 68% of respondents feel confident that their organizations can act on data that comes from the edge. However, the vast majority (73%) have difficulties determining the business problems this data can solve. This means they need to collaborate with OT to identify a pain point or operational process the organizations face and ensure the necessary data is captured to evaluate the impact of the edge solution.

In addition, nearly two-thirds (60%) of edge decision-makers agree they can generate business results from data at the edge, yet two-thirds (64%) report that measuring ROI of edge implementations remains difficult (see Figure 3).

Edge Mature organizations are much more likely to generate business results from data at the edge as 90% report they can generate results compared to 60% of organizations of moderate maturity. And Edge Mature companies are more likely to include OT in setting edge computing strategies and overseeing edge deployments. This highlights the value of edge solutions that span across a range of operational processes, which require OT stakeholder participation and collaboration with IT for seamless deployment.

Figure 3



Base: 619 global decision-makers of edge strategies or solutions
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

TAKE ACTION:

Edge stakeholders must be proactive to understand the impacts of the organization's edge maturity by enhancing edge features, functions, and strategic initiatives. Start by identifying currently deployed edge use cases and future plans to deploy edge solutions to enhance critical IT and operational processes. Develop a roadmap identifying new use cases and the impact of these use cases on the data needed to support key strategic goals and corporate priorities. Include IT, OT, and business stakeholders in edge strategy development and define clear ROI metrics to measure the success of each edge use case.

THE GROWING COMPLEXITY OF EDGE DECISION-MAKING

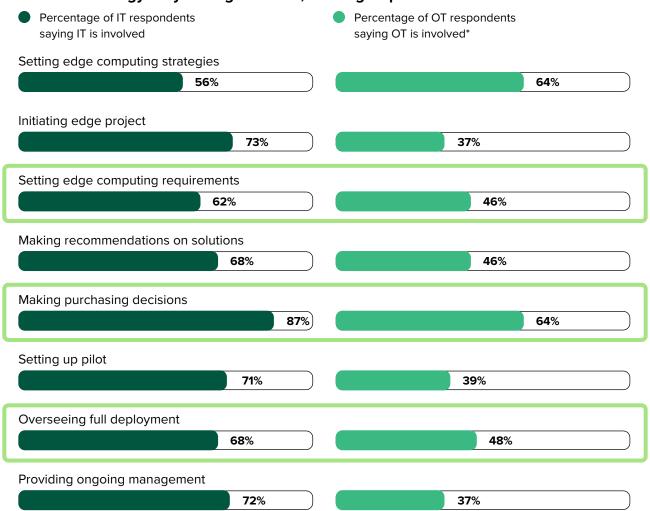
- There are more groups involved in edge decisions. While IT continues to be highly involved at each phase of strategy/deployment, OT and line-of-business (LOB) teams are increasingly involved in the process as 61% of edge decision-makers report that OT is involved in setting computing strategies and 42% say that OT is making purchase decisions. In Edge Mature organizations, OT is even more likely to be involved than more moderate maturity organizations in making recommendations on solutions (55% vs. 43%) and making purchase decisions (45% vs. 41%), which points to tighter IT in there is the process.
- in the buying cycle. IT and OT respondents are in agreement on who is setting edge strategies
 (OT), who initiates edge projects and sets up pilots
 (IT), and who oversees and manages ongoing deployments (IT). OT believes they are partnering with IT, but the level of collaboration seems out of alignment. For example, OT respondents report that they are more involved in setting edge computing strategies, compared to IT's perception of OT involvement in these edge strategies. In addition, OT respondents believe they are more involved in making purchase decisions than IT, while IT respondents say that OT is far less likely to make purchase decisions than IT (see Figure 4).

"The biggest challenge is still the IT-OT convergence, there is no seamless convergence between those two areas."

CIO/CISO, manufacturing

Figure 4

"For each of the following steps in the development of an edge initiative/strategy for your organization, which group is involved?"



OT respondents believe they are more involved in making purchase decisions than IT, while IT respondents say that OT is far less likely to make purchase decisions than IT.

Base: 308 global IT decision-makers of edge strategies or solutions

*Base: 311 global OT decision-makers of edge strategies or solutions

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

• The relationship between IT and OT teams is changing. More than half (55%) of edge decision-makers agree that IT and OT roles inside their organization are changing as a result of edge computing, and an overwhelming majority (74%) believe that IT and OT teams should be more collaborative than they are today. However, there's a great deal of friction between these teams especially at the practitioner level (see Figure 5).

The friction between IT and OT teams also exists in Edge Mature organizations; however, these companies are working to overcome this friction by having comprehensive strategies and tighter goal alignment between IT and OT at the practitioner level. Edge Mature firms are also improving relationships through team integration and working to improve the skill sets of both IT and OT team members.

TAKE ACTION:

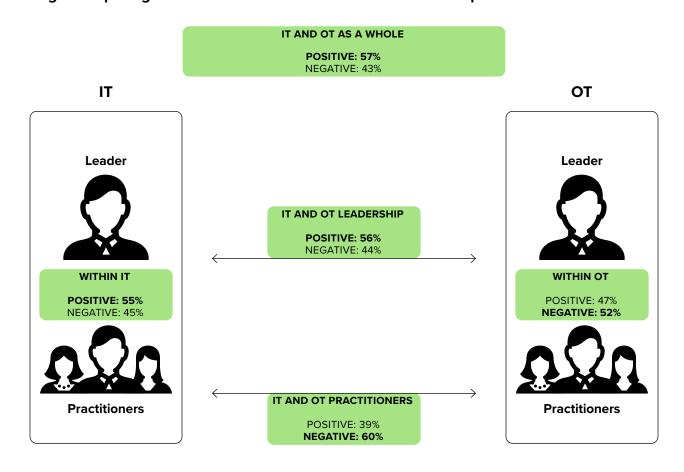
IT and OT collaboration is critical to the success of an organization's edge initiatives and the key to improving edge maturity. In order to break down these siloes, some organizations align IT and OT teams under one reporting line or align IT and OT goals and objectives. It is also imperative to identify who owns the overall edge strategy and each team's responsibility through the implementation process. IT and OT teams must clearly delineate not only budget responsibility and project goals, but also shared versus split responsibilities, so each group recognizes the needs and contributions of the other group.

74%

of edge decision-makers agree
IT and OT teams should be more
collaborative than they are today.

Figure 5

Edge Computing Collaboration Between IT And OT Needs Improvement



Base: 619 global decision-makers of edge strategies or solutions

Note: Total percentages may not total 100% due to rounding

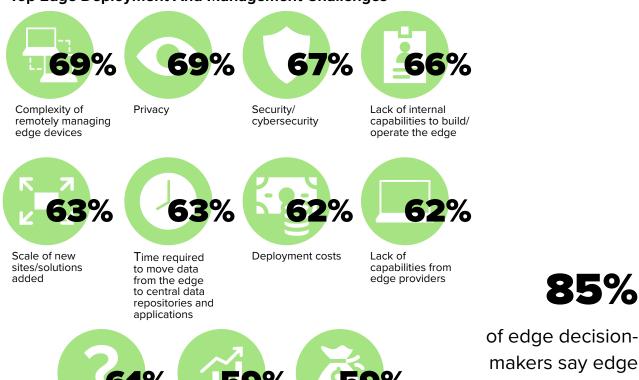
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

TECHNOLOGY CHALLENGES

• Organizations face technology management and security challenges. Nearly 70% of edge decision-makers report they are challenged by remote management of edge devices, and more than two-thirds are challenged by security and privacy. IT professionals are far more worried about security than their OT partners as they are well-versed on the challenges of securing a fragmented array of connected devices. In addition, the scale of new sites and solutions is challenging for 63% of edge decision-makers, and more than half feel challenged by the speed of growth/change (see Figure 6). A strong majority agree (85%) that their edge computing initiatives require modernization of their current infrastructure.

Figure 6

Top Edge Deployment And Management Challenges



Cost of edge

devices

Base: 619 global decision-makers of edge strategies or solution

Note: Showing responses of 4 and 5 on a scale of 1 (not at all challenging) to 5 (very challenging)

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

Speed of growth/

change

Lack of shared

understanding

about what/where the edge is

computing initiatives

require infrastructure

modernization.

Edge Mature organizations are embracing modernization and transformation to overcome challenges like these. They are more likely than moderately mature firms to modernize or transform their business (64% vs. 54%) or embark on IT modernization (68% vs. 61%) or OT modernization (68% vs. 51%). To overcome their security challenges, Edge Mature companies are more likely to modernize or transform security in their organization (69% vs. 57%). As a result, Edge Mature firms are more likely to expand the role of edge computing in their organization now and in the next few years.

TAKE ACTION:

Edge computing initiatives require infrastructure modernization that enables business transformation. Edge maturity grows as firms consider IT, OT, and business modernization as one integrated, cohesive motion. As edge use cases proliferate, the attack surface that organizations are trying to secure grows exponentially and risk increases. To improve edge maturity, organizations must proactively weave security into their strategy and implement a secure edge infrastructure.

Security is the biggest challenge ...
With standalone devices or individual sensors, we'll lose the discovery of such assets. My attack plane is getting bigger ... all of a sudden, I could have threats in 50 or 60 different data centers depending on our deployment strategy."

CIO/CTO, retail

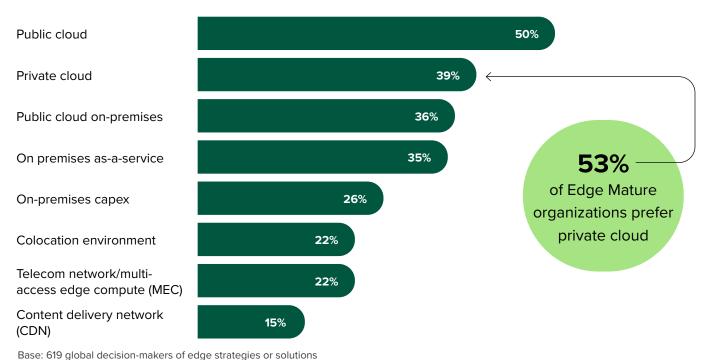
• Organizations must incorporate cloud into their edge strategies.

More than half of edge decision-makers (54%) report they find edge deployments challenging as these initiatives conflict with organizational policies intended to move more into the cloud. Three-quarters of decision-makers say that multicloud operations are important or critical to the success of their organizations' edge computing implementation. However, half of respondents report their preferred edge environment is public cloud and 39% prefer private cloud (see Figure 7).

Edge Mature organizations are more likely to prefer public cloud in comparison with their moderately mature counterparts (56% vs. 49%), but they are also far more likely to say that multicloud operations contribute to successful deployment of edge implementations spanning various environments (84% vs. 73%). In addition, Edge Mature firms are more likely to consider private cloud (53% vs. 36%), public cloud on-premises (39% vs. 36%), and on-premises as-a-service (38% vs. 33%) as their preferred edge environment.

Figure 7

Preferred Edge Environments



Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

TAKE ACTION:

Cloud strategies remain important to firms that deploy edge solutions. Our survey results reveal that companies have a complex edge-to-cloud infrastructure in place, and grapple with the speed and scale of growth that edge use cases present. In order to advance edge maturity, adoption of multicloud operations should be considered as part of an organization's comprehensive edge to cloud strategies and provide firms with opportunities to incorporate the benefits of private and public cloud.

"Cloud is also part of our digital transformation roadmap. That cloud strategy is not necessarily migration of the enterprise infrastructure to the cloud, but also the edge to the cloud direct interfaces.

This includes [software-defined wide area networks] (SDWANs) or extending the cloud to the edge infrastructure, including outposts or hyperconverged infrastructure within the edge locations."

CIO/CISO, manufacturing

How Can Third-Party Partners Help?

As companies struggle with the growth of edge initiatives and the complexity brought on by growing use cases, nearly two-thirds of edge decision-makers report they are also challenged by a lack of internal edge capabilities. The job market remains strong and competitive, so hiring edge capabilities into the organization is also challenging. Many edge decision-makers are turning to an assortment of partners to bridge their skills gap and accelerate edge initiatives. However, the partner landscape is complex. Our study found that:

• Investment in edge solutions will continue. More than 40% of decision-makers say their company is expanding IoT sensor use and the modernization of their business operations. In addition, many edge decision-makers plan to adopt purpose-built edge hardware, purpose-built management and orchestration platforms, and purpose-built edge security technologies and practices in the next 12 months. Many of these decision-makers believe purpose-built technologies are critical to the success of their organizations' edge implementation. These purpose-built solutions are often deployed in industry environments such as retail or manufacturing (see Figure 8).

"It was very difficult for us to figure out which platforms to use to support our retail edge requirements.""

Vice president of R&D and technology transformation, retail

Edge Mature organizations are more likely to expand their implementation of all the technologies listed in Figure 8 in comparison to companies with moderate maturity. In addition, those Edge Mature firms are more likely to see the importance of emerging technology solutions, such as AI/ML solutions, 5G, and modern data management.

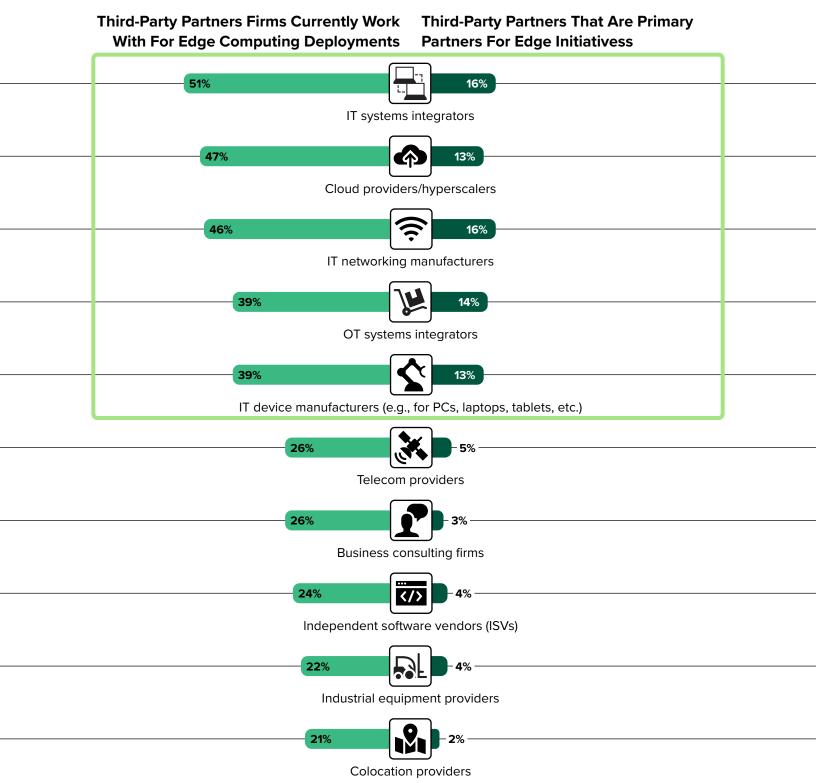
• Firms are stitching together a patchwork of partners to implement their use cases. Edge decision-makers report they are working with multiple partners for edge computing deployments, and the lack of capabilities from edge providers challenge more than 60% of respondents (see Figure 9). Seven in 10 decision-makers say it's a high priority that their third-party partners can provide an end-to-end or turnkey implementation, but that is not the reality of their experience today.

Figure 8

Top Technologies For Edge Tech Organizations Plan To Adopt Computing Implementation Success To Support Edge Deployments Expanding or upgrading implementation Critcal/important Planning to adopt in the next 12 months Data analytics solutions Internet of things (IoT) sensors **78**% 43% 20% Purpose-built edge security Modernized business operations **77**% 40% 25% Internet of things (IoT) communication protocols Modernized IT operations 76% 38% 29% Modern data management Modernized OT operations **75**% 38% 33% Multicloud operations Edge data management **75**% 36% 34% Purpose-built edge management and orchestration platforms Edge data analytics 31% **74**% 40% Purpose-built edge security Data communication protocols technologies and practices 29% 41% 74% Edge-specific managed services Industrial automation/control software **72**% 28% 38% AI/ML solutions Purpose-built edge hardware 71% 26% 49% Purpose-built edge management 5G and orchestration platforms 65% 23% 43%

Base: 619 global decision-makers of edge strategies or solutions
Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

Figure 9



Base: 619 global decision-makers of edge strategies or solutions Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022 When considering these partners from the IT/OT point of view, 42% of OT respondents report working with OT systems integrators compared to 37% of IT respondents. IT respondents have more expertise and experience with more IT-centered partners, such as network manufacturers, IT device manufacturers, and integrators, as nearly half of IT respondents report working with network manufacturers.

Edge Mature companies are far more likely to work with third-party partners for edge computing deployments than those with more moderate maturity. For example, Edge Mature companies work with IT systems integrators (66% vs. 51%), cloud providers (63% vs. 47%), IT networking manufacturers (59% vs. 46%), and IT device manufacturers (44% vs. 39%).

- Third-party partners can provide needed expertise to accelerate edge initiatives. While a majority of decision-makers feel it's critical for their third-party partners to have vertical industry expertise, 74% seek OT expertise from their partners. And IT respondents place even more importance on OT expertise than OT respondents as IT stakeholders are more likely to perceive a gap in OT expertise. In addition, companies looking for a partner to fill a gap seek skill sets, including cybersecurity specialists, Al specialists, OT engineers/specialists, business technology analysts/specialists, and data architects.
- Ability to scale is the most critical capability. When selecting thirdparty partners, edge decision-makers desire capabilities that map tightly to the challenges they currently face. More than 80% of firms prioritize the ability to scale and 79% seek partners that can show a clear return on investment. IT respondents place more importance on these two capabilities than their OT counterparts, most likely because the OT view focuses on a specific operational process, while the IT view is broader. Edge decisionmakers also place a priority on staff skill sets and more than 70% seek OT or use casespecific expertise. More than two-thirds of edge decision-makers are looking to their third-party partners' ability to innovate to really help their organization gain a competitive advantage (see Figure 10).

"I'd say the biggest challenge is finding the right partners that are skilled in the things that you need."

COO/CTO, manufacturing

"It also became achallenge to find a partner that can deliver us an all-in one solution for this specific use case.""

Director of IT innovation, retail

Figure 10

Characteristics Firms Look For In Third-Party Partners



Base: 619 global decision-makers of edge strategies or solutions

Note: Showing "Critical/High priority"

Source: A commissioned study conducted by Forrester Consulting on behalf of Dell and Intel, September 2022

Key Recommendations

As edge use cases surge past pilots and limited deployments and move toward modernizing business operations, how can your organization learn from and build on your successes? Forrester's in-depth survey about implementation growth and challenges yielded several important recommendations:

Identify your firm's current edge use cases and roadmap.

Evaluate opportunities to create new edge experiences. Initial edge use cases often focus on analyzing data in edge environments. For example, intelligent building systems monitor environmental factors (e.g., temperature, humidity) and analyze captured data to automatically adjust energy and lighting to maintain building comfort. Vertical edge use cases transform operational processes. Retailers can use edge sensors, cameras, and Alpowered video analytics to monitor and optimize stock and shelf capacity in real time; transform point of sale systems to engage customers; or reduce inventory loss.

Facilitate tight collaboration between IT and OT stakeholders.

Many owners of edge use cases operate with separate initiatives from the IT and OT teams. It is important to break down these IT and OT siloes. Some organizations bring IT and OT teams into a common reporting line while others cross-train OT experts in IT disciplines such as DevOps and DataOps. In either case, the goal is mutual understanding of critical processes and culture. It is also necessary to identify who owns the edge strategy at large, as well as the individual owners of each aspect of edge.

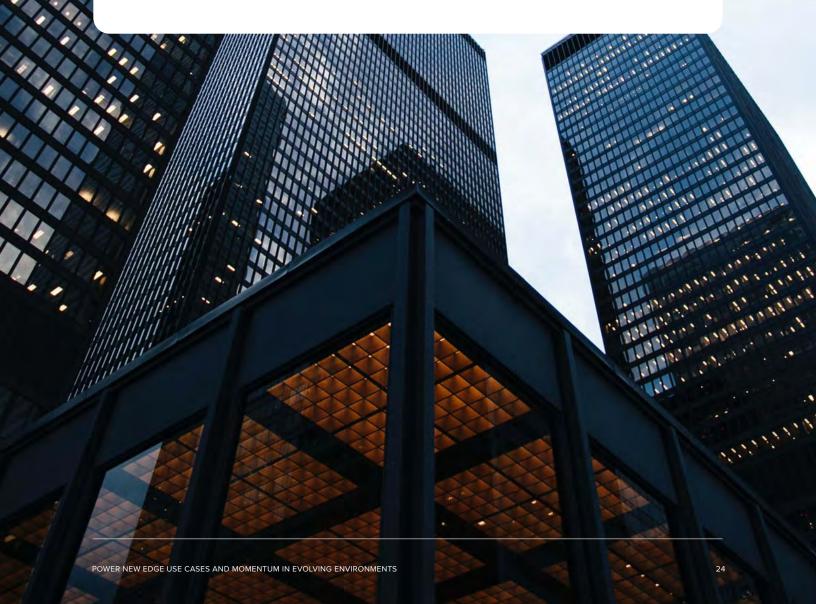
Assess your expanded risk landscape in a proactive manner.

Edge computing deployment will make trust even harder for firms to address. Edge computing requires network infrastructure in a tightly woven fabric of software, hardware, and cloud functions that securely weaves together users, data, and resources. Every new edge connection, smart device, edge server, or micro data center is an additional attack surface for hackers to

explore and potentially exploit. Implement a secure edge architecture to bring security into the holistic edge architecture. Ensure your security plan includes edge-specific coverage for your data, infrastructure, and processes across the entire lifecycle.

Navigate the partner landscape to fill skill set gaps.

The edge computing landscape is diverse and comprises an array of technologies that, when managed together, address key business scenarios and use cases. Various types of partners participate in the edge computing market. The value proposition of each partner varies according to edge use cases, partner capabilities, and business environments. Assess the expertise and capabilities of employees spanning your firm's edge initiatives to evaluate relevant third-party partners to assist with your edge deployments.



Appendix A: Methodology

In this study, Forrester conducted an online survey of 619 edge decision-makers at organizations in North America, Europe, and APAC to evaluate edge strategies and challenges. Survey participants included decision-makers in IT and OT roles. In addition, six qualitative interviews were conducted to gain more in-depth perspectives from senior IT and OT participants. The study began in August 2022 and was completed in September 2022.

Appendix B: Demographics

REGIONS	
North America	34%
Europe	33%
APAC	34%

COMPANY SIZE	
20,000+ employees	10%
5,000 to 19,999 employees	27%
1,000 to 4,999 employees	43%
500 to 999 employees	20%

JOB TITLE	
Senior-most IT/security decision- maker (CIO/CTO/CISO/CSO)	25%
IT VP/director	26%
IT/security manager	14%
Senior-most business leader	8%
Business unit VP/director	22%
Senior-most operations leader (COO)	5%

INDUSTRY	
Manufacturing	22%
Financial services/insurance	11%
Transportation/logistics	11%
Telecommunications	11%
Healthcare	11%
Retail	11%
Energy/utilities/natural gas	11%
Government	11%

IT/OT	
IT	50%
ОТ	50%

EDGE IMPLEMENTATION	
Implemented	39%
Expanding/upgrading	14%
Planning to implement	47%

Note: Percentages may not total 100 because of rounding.

Appendix C: Supplemental Material

RELATED FORRESTER RESEARCH

"The Future Of Edge Computing," Forrester Research, Inc., May 11, 2022.

Appendix D: Endnotes

¹ Source: "The Future Of Edge Computing," Forrester Research, Inc., May 11, 2022.

[&]quot;The Four Edges Of Edge Computing," Forrester Research, Inc., May 6, 2021.

² Source: Ibid.

