



WHITE PAPER

Partnering with Dell to Navigate Application Modernization in a Multi- cloud, Multi-venue Universe

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Executive Overview

Agility is no longer simply a desirable business characteristic. Because of the unprecedented levels of agility that have been enabled by IT, it is now a critical business quality. To maintain competitive levels of agility and keep pace with a quickly evolving macro-IT environment, organizations are currently facing a pressing need to modernize both their applications and their methods for developing and deploying those applications. Organizations that have already done so are reaping the benefits of faster application development and deployment, as well as greater portability across their expanding environments, which can include multiple public clouds, on-premises data centers, and edge locations. IT organizations that don't modernize their applications will not only fail to enjoy these benefits, but will also be unable to sustain competitive levels of agility.

The foundational elements of application modernization are the containerization or refactoring of existing applications, the automation of both development and operations (DevOps) workflows, and the adoption of an application-centric view of infrastructure. Implementing these changes involves multiple challenges and is not a simple task. For many IT organizations, these are uncharted waters, and the task is compounded by a lack of skills and experience. Research completed by TechTarget's Enterprise Strategy Group (ESG) has found that 73% of midsize and enterprise-class (employee size of 999+) organizations in North America use at least 250 business applications, and more than half (53%) support 500 or more such workloads.¹ These are the reasons why 94% of organizations expect near-term increases in IT spending to support application modernization, and 43% expect those increases to be significant. Given the sense of urgency behind such projects, it is no surprise that almost half of organizations plan to determine their modernization strategies with help from experienced IT partners.²

Introduction

Container-based microservices application architectures, cloud-native application development, DevOps automation, and the use of hybrid cloud strategies are all interrelated activities that accelerate application development and deployment. Collectively, they represent the current state of application modernization.

Microservices-based architectures use multiple independent application elements or modules to replace traditional monolithic code. Although there are multiple ways of implementing microservices, the most widely adopted method is containerization, or the packaging of microservices or software modules within individual run-time environments, or containers. As a form of virtualization, containers are lightweight, secure, scalable, and highly portable across multiple environments. When containerization is combined with advanced levels of DevOps automation and continuous integration and continuous delivery (CI/CD) pipelines, it generally qualifies as cloud-native application development, although there are varying definitions of the latter term.

Containerization and cloud-native application development are being taken up by large numbers of IT organizations because of the significant potential benefits. However, organizations embarking on this application modernization journey have also faced a number of challenges.

The First Hurdle: Containerization

Over the last three years, IT organizations have been adopting microservices application architectures at a rapid pace, using containerization in combination with modern development frameworks, a range of Kubernetes-based orchestration

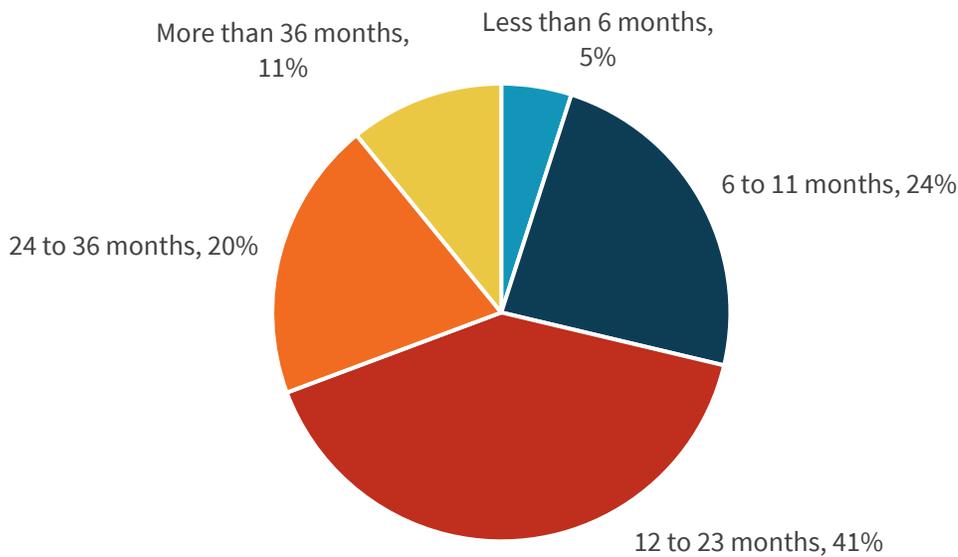
¹ Source: Enterprise Strategy Group Research Report, [Application Infrastructure Modernization Trends Across Distributed Cloud Environments](#), March 2022.

² Source: Enterprise Strategy Group Research Report, [Cloud-native Applications](#), May 2022.

mechanisms, and API-linked backing services or functions. A recent survey completed by Enterprise Strategy Group (ESG) found that among almost 300 enterprises that had adopted container technology in 2021, 90% had done so within the previous 36 months, and more than two-thirds (70%) had done so within the previous 23 months (see Figure 1).³

Figure 1. Significant Movement of Production Applications to Containers from 2019 to 2021

**For how long has your organization run production applications on container technology?
(Percent of respondents, N=293)**



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

One major reason why enterprises are embracing containerization is that it accelerates code development and modification, which drives agility. However, that is far from the only benefit of containerization, as it also heavily boosts the portability of workloads across a range of environments that includes disparate public clouds, customer-owned data centers, and edge locations. Not surprisingly, there is a strong correlation between the usage of containers and public clouds. In a separate ESG research survey, 40% of the organizations using containers were also hosting more than half of their applications in public clouds.⁴

Not all existing workloads are being containerized or refactored immediately, and some system-of-record applications may well remain unchanged even in the medium or long term. However, the overall adoption of containerization is strongly impacting enterprise IT infrastructure strategies by increasing the distribution of application processing across disparate locations. Almost half (48%) of enterprises surveyed by ESG claimed that one of the biggest impacts containerization had on their infrastructure strategy was a notable increase in the number and type of execution venues.⁵

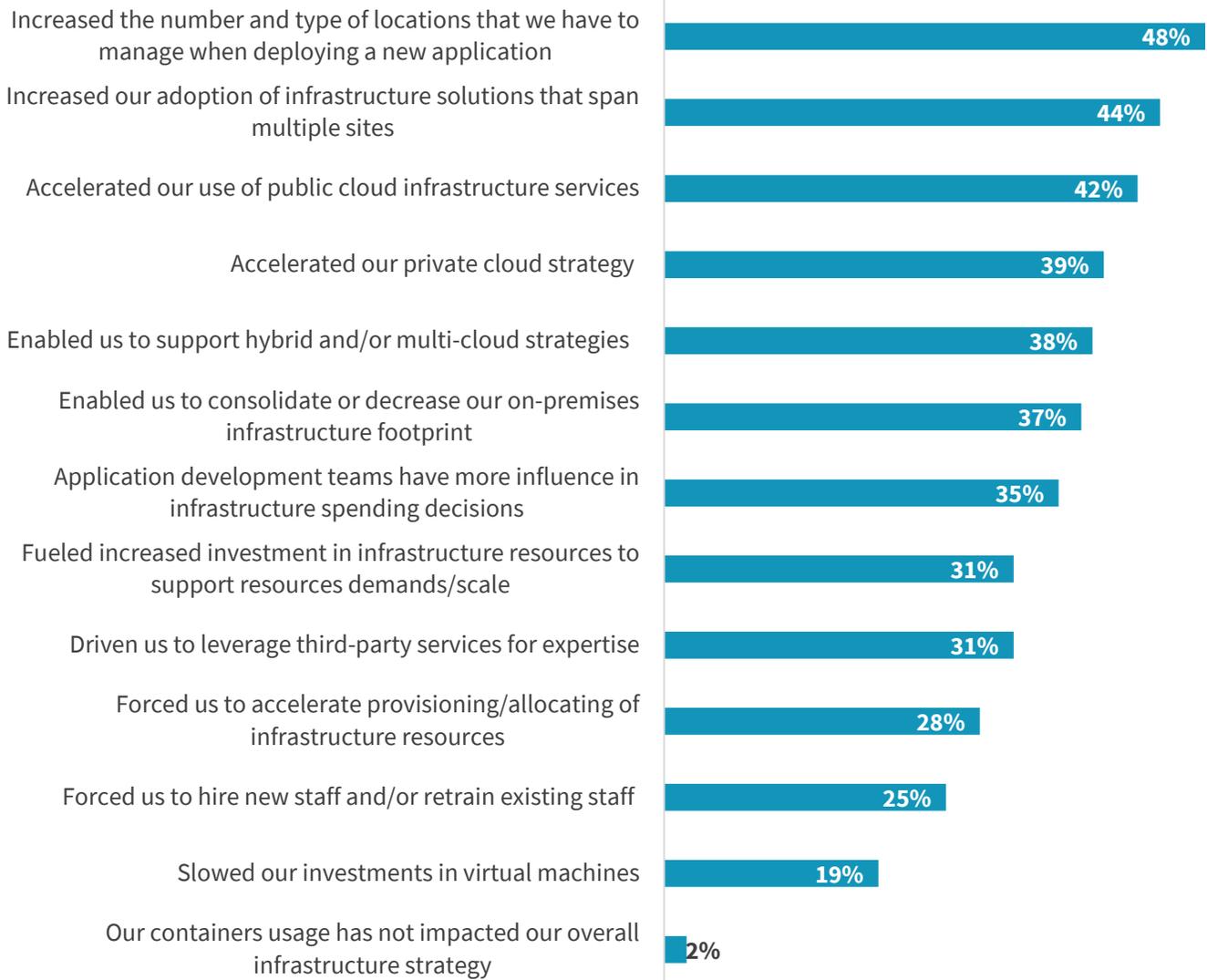
³ Source: Enterprise Strategy Group Research Report, [The Maturation of Cloud-native Security](#), May 2021.

⁴ Source: Enterprise Strategy Group Research Report, [Application Infrastructure Modernization Trends Across Distributed Cloud Environments](#), March 2022.

⁵ Ibid.

Figure 2. Container-driven Transformation Is Fueling Increased Distribution of IT

What impact has your organization’s usage of container technology had, or do you expect it to have, on its overall infrastructure strategy? (Percent of respondents, N=365, multiple responses accepted)



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Containerization is also creating challenges in multiple areas, such as security, infrastructure integration, and performance monitoring. How well IT organizations deal with these challenges depends on their level of in-house skills, third-party support, and experience with containerization.

Decisions made during containerization projects can have long-term consequences. One example is the choice of mechanism for container orchestration. There are several options for this, including containers-as-a-service, managed Kubernetes services, and the use of upstream open source Kubernetes distributions. Each of these options is widely used, and each has its own advantages and disadvantages. Without the necessary technical skills, this wide range of options can cause a state of decision paralysis for organizations that are rightfully fearful of the negative consequences of making the wrong choice.

80% of respondents reported that their organizations are most reliant on managed or proprietary solutions for container orchestration.⁶ It's clear that organizations have an aversion to open source container orchestration. Whether this is due to a skills gap or lack of trust in open source, MSPs that provide container orchestration and IaaS infrastructure offerings should take advantage of the market's affinity for a managed option.

Kubernetes is a key approach to container orchestration. However, the challenges that must be overcome should equally weigh into the decision process. Working with a trusted advisor, like Dell, allows enterprises exploring Kubernetes and containers to overcome IT skills gaps, resolve orchestration challenges, and meet required SLAs.

As one example of a wider issue, data protection is as much a necessity for containerized or cloud-hosted applications as for any other workloads, but in many enterprises it is immature. There is a natural domino effect of deploying new technologies in production when it comes to backup and recovery. At some organizations, containerization has caused reductions in disaster recovery, with unpleasant real-world discoveries of major differences between promised service levels and what was actually achieved in the real world for recovery point objectives (RPO).⁷ Avoidance of such major problems must involve a site recovery engineering (SRE) approach to IT operations that includes the test and measurement of key parameters such as RPOs, recovery time objectives (RTOs), and uptime.

A Tougher Second Stage: Going Cloud-native Is No Breeze

Containerization streamlines application packaging and simplifies the process of moving workloads across environments for both in-house developed applications and applications bought from third parties. However, on its own it cannot deliver competitive levels of agility for an IT organization or its parent enterprise. To achieve competitive levels of agility, IT organizations must also adopt agile methodologies and practices that automate their development, test, and deployment processes, and match or exceed the levels of automation achieved by their peers at rival enterprises. In this area, the competitive bar is already high and rising.

Often as a complementary effort to containerization, a large majority of IT organizations have automated at least a portion of their DevOps processes and implemented a beginner level of CI/CD pipeline. This has already enabled some organizations to achieve very fast rates of iterative code improvement. In a recent Enterprise Strategy Group (ESG) research survey, over half of the respondents (51%) declared that their organizations deploy new code at least once per day, and 26% stated that they do so at least several times per day.⁸

This is often done by utilizing infrastructure as code (IaC) to achieve consistency and repeatability and leverage IT generalist for deployments. This approach allows for compliance without compromising the delivery of the infrastructure. In fact, we see that 62% of respondents indicated their organization uses IaC extensively or in a limited fashion. When it comes to scaling their implementation of IaC, organizations reported that they have experienced the following issues:⁹

- The need to ensure quality and consistency across teams (57%).
- The need to make sure changes are safely made to the infrastructure (56%).
- The lack of security to detect and remediate configuration vulnerabilities (50%).
- The need for autonomy to deploy (46%).

⁶ Source: Enterprise Strategy Group Custom Research Commissioned by Dell, [Infrastructure for Cloud-native Development Enablement](#), February 2022.

⁷ Source: Enterprise Strategy Group Research Report, [Data Protection Trends and Strategies for Containers](#), December 2020.

⁸ Source: Enterprise Strategy Group Research Report, [Cloud-native Applications](#), May 2022.

⁹ Ibid.

In the same survey, 94% of respondents declared that their organizations plan to increase spending on technology, people, and services to support cloud-native application development over the next 12 to 18 months. 43% said those increases will be significant. This spending will underpin a range of strategies. Almost half of the respondents declared that their organizations plan to work with professional service providers to refine their plans.¹⁰ This reflects an understanding that implementing these strategies too quickly and without sufficient understanding can create significant problems.

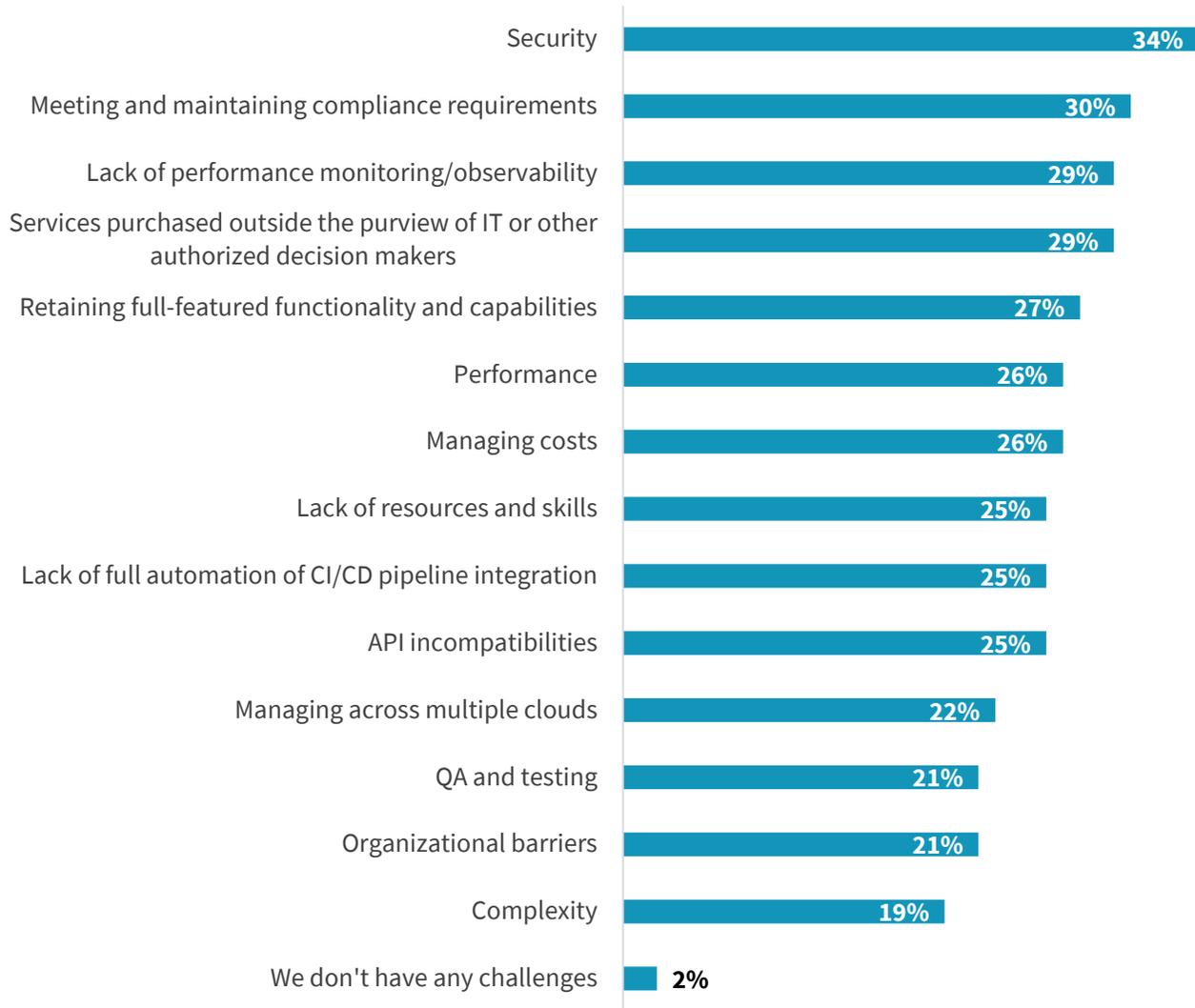
When ESG asked IT professionals to identify the difficulties their organizations faced or expected to face when deploying cloud-native applications, the breadth and depth of the responses was striking. Predictably, security was the challenge most often identified, named by 34% of respondents (see Figure 3). But the survey gave respondents the freedom to identify multiple challenges, and the large number and wide-ranging spread of responses highlighted multiple difficulties in multiple areas. Only 2% of respondents said they faced or expected no difficulties.¹¹ Notably many of these challenges can be addressed with pervasive adoption of DevOps practices supported by automation across the application lifecycle.

¹⁰ Ibid.

¹¹ Ibid.

Figure 3. Biggest Cloud-native Application Challenges

What are the biggest challenges your organization has faced, or expects to face, with its cloud-native applications? (Percent of respondents, N=387, multiple responses accepted)



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

Multi-venue Application Portability will Become Even More Important

Multi-cloud strategies have now been almost universally adopted, with 90% of respondents in a recent Enterprise Strategy Group (ESG) survey reporting that their organizations use at least two public cloud IaaS or PaaS services, and 42% stating that their organizations use more than four such services.¹² This use of multiple clouds is being driven by the growing diversity of enterprise applications and the different needs of those applications in areas such as compliance, geographies, and resilience. Application diversity has become a major IT challenge. In their journeys to achieving operational efficiency, organizations are often faced with obstacles, including the increasing diversity of applications and the resulting increase in the number and diversity of places where applications run, which is being caused by more than just multi-cloud strategies. Perhaps counter-intuitively, public clouds do not spell a reduction in on-premises computing. Instead, on-premises data centers are growing in number while changing in nature. Among IT professionals at mid-range to large enterprises recently

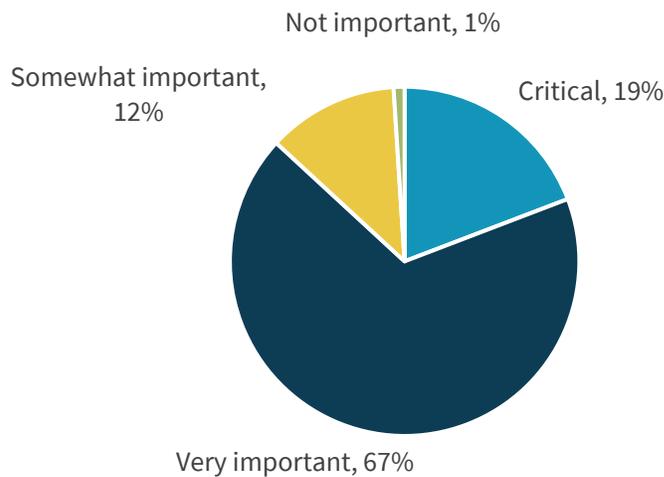
¹² Ibid.

surveyed by ESG, almost two-thirds (64%) expected their organizations to be managing at least six data centers by 2027, and 29% expected to be running more than ten data centers by that same time. Only 2% expected to be operating no data centers.¹³ This proliferation is happening because, although many applications are moving into the clouds, there is still quite a bit of processing that needs to be completed at smaller data centers, like edge or remote locations, to meet performance, compliance, cost, and other requirements. Edge computing is already increasing, and, as a huge greenfield opportunity, it promises first-mover benefits to those enterprises that implement the technology.

Containerization simplifies the process of moving applications across these diverse environments. According to ESG research, 67% of respondents said application portability was very important to their organizations, and 19% said it was critical (see Figure 3).¹⁴ As applications diversify and the number of both public cloud and on-premises environments continues to grow, this need for application portability will become even more critical.

Figure 42. Portability of Cloud-native Apps Is an Important Factor

How important is application portability (e.g., ability to move from data center to edge to cloud, cloud to cloud, etc.) to your organization? (Percent of respondents, N=387)



Source: Enterprise Strategy Group, a division of TechTarget, Inc.

This is driving IT organizations to switch from a traditional infrastructure-centric view of IT operations to an application-centric view. Under the latter approach, the ability to use multiple execution venues must be accompanied by the ability to determine the best venue for any specific application, based on parameters, such as latency and connectivity, compliance, cost, and the expected service life of the application. It must also be achieved while maintaining levels of security, performance, disaster recovery, and protection against ransomware attacks. This is not simple to do, as the coding of an application is very different than the codification of its requirements. One approach is to enforce as much consistency across multiple environments as possible. If the same services and management interfaces can be employed in different runtime environments, complexity and cost can be reduced.

Another approach is to implement infrastructure-as-code (IaC) as part of application modernization. IaC usage is now a majority sport that is growing fast as an important part of multi-cloud strategies and as a means of achieving a consistent approach to automation across public and private clouds and on-premises execution venues. However, IaC also creates

¹³ Source: Enterprise Strategy Group Research Report, [Application Infrastructure Modernization Trends Across Distributed Cloud Environments](#), March 2022.

¹⁴ Source: Enterprise Strategy Group Research Report, [Cloud-native Applications](#), May 2022.

multiple challenges. 57% of ESG research respondents at organizations that had implemented IaC reported problems ensuring quality and consistency across teams, 56% had suffered problems with infrastructure change control, and 50% believed security was compromised by the difficulty of identifying and remediating vulnerabilities.¹⁵

Dell Technologies' Services

Adding Container Support

Containers are the new way to deploy applications. Containers need Kubernetes orchestration. While it is possible to build a Kubernetes platform from open source, most organizations will avoid complications by taking advantage of one of the major commercial distributions. Dell is committed to driving a strong ecosystem of partnerships with the major providers of Kubernetes, and [Dell has solutions today](#) for Amazon EKS Anywhere, Google Anthos, Microsoft Azure Kubernetes Service, Red Hat OpenShift, Suse Rancher, and VMware Tanzu. These solutions include options for both bare-metal and virtualized deployments. Organizations can choose from a range of hosting options, including fully managed as-a-Service, turnkey pre-integrated platforms, or even a build-their-own solution for complete control of the components and configurations. As containerized apps are becoming business-critical, Dell also offers solutions for data protection and cyber resilience for containerized apps. In addition, Dell provides flexible consumption options, including CapEx or OpEx, pay-as-you-go, and pay-as-you-use, which help align how organizations pay for their infrastructure with how they use it.

Accelerating DevOps practices

Automation tooling eliminates manual steps, resulting in increased efficiency and improved service levels. The right tooling, along with guidance from other experienced practitioners, can help organizations extend their existing investments and speed DevOps transformation. Dell Technologies has [standardized REST APIs](#) for its products and offers pre-built integrations with modern automation tooling, such as Ansible, Terraform, and ServiceNow. Dell's solutions help organizations deliver the right service levels for business continuity, disaster recovery, data security, and cyber-resilience. Dell also can help organizations [accelerate their DevOps transformations](#) with the proven expertise of Dell's services organization.

Connecting All of an Organization's Environments

Dell Technologies solutions help organizations drive consistency across private, public, and edge locations. This enables truly agile workload placement by eliminating the time and cost involved in porting. It also eliminates management silos that can increase complexity and helps organizations simplify security and policy governance across deployment options. Dell Technologies is bringing their unique innovations to public cloud environments and is incorporating best-of-cloud innovations in their on-premises solutions. This allows organizations to rapidly deploy and run applications across the right location based on workload requirements. As a result, organizations can increase operational efficiency and reduce compliance challenges with consistent operations across public, private, and edge.

The Dell Technologies portfolio of solutions for modern applications is inclusive. Dell's open approach incorporates the technologies and services across the cloud-native ecosystem. Dell is practicing what it preaches and has seen tremendous results with its own [in-house adoption](#) of cloud-native patterns.

¹⁵ Ibid.

The Bigger Truth

Application modernization is an inevitable requirement for IT organizations, and the negative consequences of delaying the process will continue to become more acute. However, it is also a major and complex transformation of both development and operational processes and, as such, should be considered a multi-stage journey.

When implemented properly, containerization provides multiple benefits, including faster application deployment and updating, greater scalability and security, and simpler portability across environments. However, containerization alone is not sufficient to provide competitive levels of agility and workload portability across the growing number of public cloud and on-premises environments used by IT organizations. To meet these requirements, IT organizations need to embrace automation and modernization at the level of cloud-native development, as well as in the processes that implement and manage their infrastructure and ongoing support services underlying their application environments.

The change from an infrastructure-centric to an application-centric view of operations not only requires organizations to deploy new technologies, but also to develop new operational procedures. Implementing consistent procedures for the deployment and movement of workloads across multiple locations is essential to protect service levels in critical areas, such as security, compliance, resilience, and disaster recovery. This is in addition to the need to identify which of those locations provides the optimal combination of cost, compliance, and performance for each of the multiple and diversifying workloads for which IT organizations are responsible.

The adoption of public clouds has not been an overnight process; instead, it has been a journey in which many organizations have made missteps, resulting in cost overruns and the eventual repatriation of applications. Application modernization will be similar for those organizations that do not sufficiently understand the process to establish a successful plan. However, and exactly as it has been with the use of public clouds, a skills gap is making the required levels of experience and understanding scarce. Enterprise Strategy Group (ESG) believes that, for the many organizations that are facing this skills shortage, it is essential to engage the assistance of third parties with proven expertise in providing, configuring, and managing modern applications environments and related services. Such organizations can pass on the lessons that they have learned while helping previous clients plan and execute application modernization. This advice can span technical and tactical issues, as well as strategies and roadmaps for the overall process.

Dell Technologies is one of the industry's largest providers of such solutions and services, giving it a broad and deep experience of application modernization. The company's guidance benefits from its experience developing Dell's leading and comprehensive portfolio of infrastructure technology products, as well as its successful adoption of cloud-native approaches for [its own IT operations](#). ESG believes enterprise IT organizations should strongly consider Dell as a candidate provider of solutions and services to ensure a successful application modernization strategy.

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