White Paper

Extending VMware Cloud Foundation to Edge Locations

Sponsored by: VMware

Dave McCarthy Eric Sheppard
April 2021

IDC OPINION

IDC believes the future of digital infrastructure is cloud, everywhere. Infrastructure is not just bought, deployed, maintained, and replaced. It is a set of resources that are consumable anywhere, but centrally governed. Ensuring application delivery, resiliency, security, and flexibility as well as making workloads extensible to a wide range of deployment locations will be the hallmarks of a successful digital infrastructure strategy.

This has led to a new definition of hybrid. Originally a binary concept consisting of on-premises and public cloud infrastructure, hybrid has evolved to include a mix of datacenter, service provider, public cloud, and edge facilities. Hybrid architectures are essential to software-defined computing, allowing organizations to place workloads where they will best perform.

Edge products and services are powering the next wave of digital transformation. With the ability to deploy infrastructure and applications close to where data is generated and consumed, organizations of all types are looking to edge technology as a method of improving business agility and creating new customer experiences. According to IDC's Worldwide Edge Spending Guide, the edge market will reach $250.6 billion in 2024 with a compound annual growth rate (CAGR) of 12.5% over the 2019–2024 forecast period.

In response to this market demand, VMware has introduced VMware Cloud Foundation Remote Clusters. The full-stack hyperconverged infrastructure (HCI) solution addresses the key challenges associated with deploying edge workloads. By providing the flexibility to centrally manage any combination of virtual machines (VMs), containers, and Kubernetes clusters, VMware is making it easier for organizations to build the digital infrastructure for their future.

SITUATION OVERVIEW

The IT infrastructure market has been on a path of rapid evolution over the past several years. Customer priorities are shifting from discrete compute, networking, or storage infrastructure to a broader set of requirements around cloud computing, application modernization, and workload management. As such, the types of infrastructure in demand are increasingly geared toward the elimination of silos of datacenter infrastructure that require silos of IT experts spending most of their time performing highly manual, low-value management tasks.

Directly related to this trend is the increased use of software-defined and hyperconverged infrastructure solutions that can help remove silos of discrete compute and storage systems and

eliminate the inefficiencies related to the need for independently managing each of these technologies. Indeed, the ability to decouple storage, compute, and network services from the underlying hardware has cleared the way for an innovative set of software-defined solutions that drive new levels of datacenter efficiency by comingling these services on a common set of physical resources. When combined with highly automated management and orchestration software, these consolidated software-defined infrastructure (SDI) solutions are able to drive new levels of operational simplicity that are required to ensure IT teams are truly responsive and agile enough to support the rapid pace of innovation within their business.

It should be noted that the recent proliferation of enterprise-class, software-defined infrastructure solutions would not have been possible without rapid improvements in core infrastructure components. One can draw a straight line between increased SDI adoption and the considerable advancements to CPU silicon, flash media, and network speeds. Such advancements include clustered, scale-out, and software-defined approaches for delivering storage systems. The powerful combination of advanced infrastructure hardware and highly automated infrastructure software ensures the performance and scalability of modern SDI systems are able to truly rival traditional (discrete) infrastructure stacks at an attractive price point. Further, with enterprise-grade service quality features, SDI systems are far more capable of running mission-critical and business-critical workloads at a much lower operational cost.

Importantly, SDI solutions are evolving rapidly and experiencing an expansion of real-world use cases beyond datacenter deployments. Edge computing has become one of the more important use cases that are newly materializing for SDI and HCI solutions. Indeed, IDC believes edge computing is the next frontier for SDI and HCI solutions. It is one of the top areas of strategic IT investments, especially in the light of companywide digital transformation initiatives. Edge computing enables delivery and analysis of data and resources to people and things in a timely fashion. An "intelligent" edge is a crucial link between the core and endpoints that provides a distributed compute, data persistence, and network aggregation layer and that serves as the intermediary analytics of collected data. HCI systems bring the IT paradigm to operational technologies (OT) and communications technologies (CT) environments. They enable organizations to replace field-based vertically integrated stacks with a common infrastructure layer that can be managed in a similar fashion as infrastructure in an IT datacenter.

Understanding the Needs of Edge Computing Environments

There are several factors driving the need for edge deployments. By far, the most cited is network latency, which represents a delay between a request and a response. Even though new network access methods like 5G promise to reduce latency, they can only solve one part of the equation. The physical distance between an endpoint and the datacenter hosting a workload can be problematic for real-time use cases.

Another factor is cost. The proliferation of Internet of Things (IoT) devices and other connected equipment has led to an explosion of data creation in field locations like factories, warehouses, hospitals, and retail stores. The volume and velocity of this new source of data can be costly to transmit back to a central location for processing. More importantly, not all of it needs to be retained long term.

While originally considered a concern, security has become a benefit associated with edge computing. By limiting the movement of data, it is easier to comply with corporate governance, industry regulations, or data sovereignty requirements. Given its importance, edge solutions have security as a critical element of their architecture and design.

Finally, edge can be used as a way of ensuring continuity of operations. Despite best efforts, there are times when centralized computing resources are unavailable. Whether due to issues with wide area networks or within the datacenter itself, distributing workloads to edge locations keeps businesses running by enhancing resiliency.

In most cases, CIOs face a combination of the concerns described previously. For example, consider an electric utility. Utilities have massive investments in capital-intensive, revenue-generating equipment. They are also in a regulated industry with narrow margins and a low tolerance for unexpected downtime of the electric grid.

As utilities and similar organizations look to deploy new and emerging use cases employing IoT, machine learning, and artificial intelligence (AI), a centralized approach to infrastructure would face numerous challenges. In contrast, distributing computing resources to edge locations would enable real-time decision making, minimize communication costs, improve compliance efforts, and maximize the overall uptime of services.

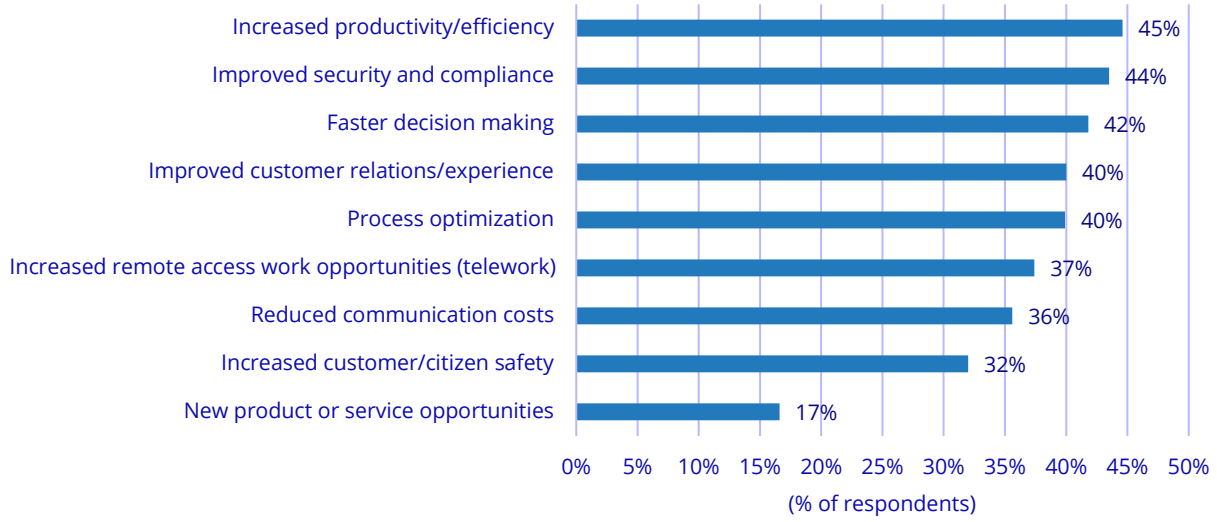
The potential for edge to accelerate innovation in terms of autonomous operations, richer customer experiences, and overall business agility has it quickly rising on the priority list of IT decision makers. In a global IDC survey on edge deployments, 73% of respondents viewed edge as a strategic investment, with an additional 17% stating it is required by business operations. Edge solutions are gaining traction, with 22% of respondents having deployed a new edge solution in the past 12 months and 27% planning to invest in the next 12 months.

As shown in Figure 1, organizations are expecting a wide range of benefits from edge solutions. Staying consistent with reasons driving edge investments, increased productivity, improved security, and faster decision making top the list. Like most new technology initiatives, foundational needs must be met first. These are often tied to actions that can improve the bottom line. New product or service opportunities will gain momentum as organizations unlock the potential of distributed, software-defined infrastructure.

FIGURE 1

Top Business Benefits of Edge Solutions

Q. What business benefits do you expect edge will add to your organization?



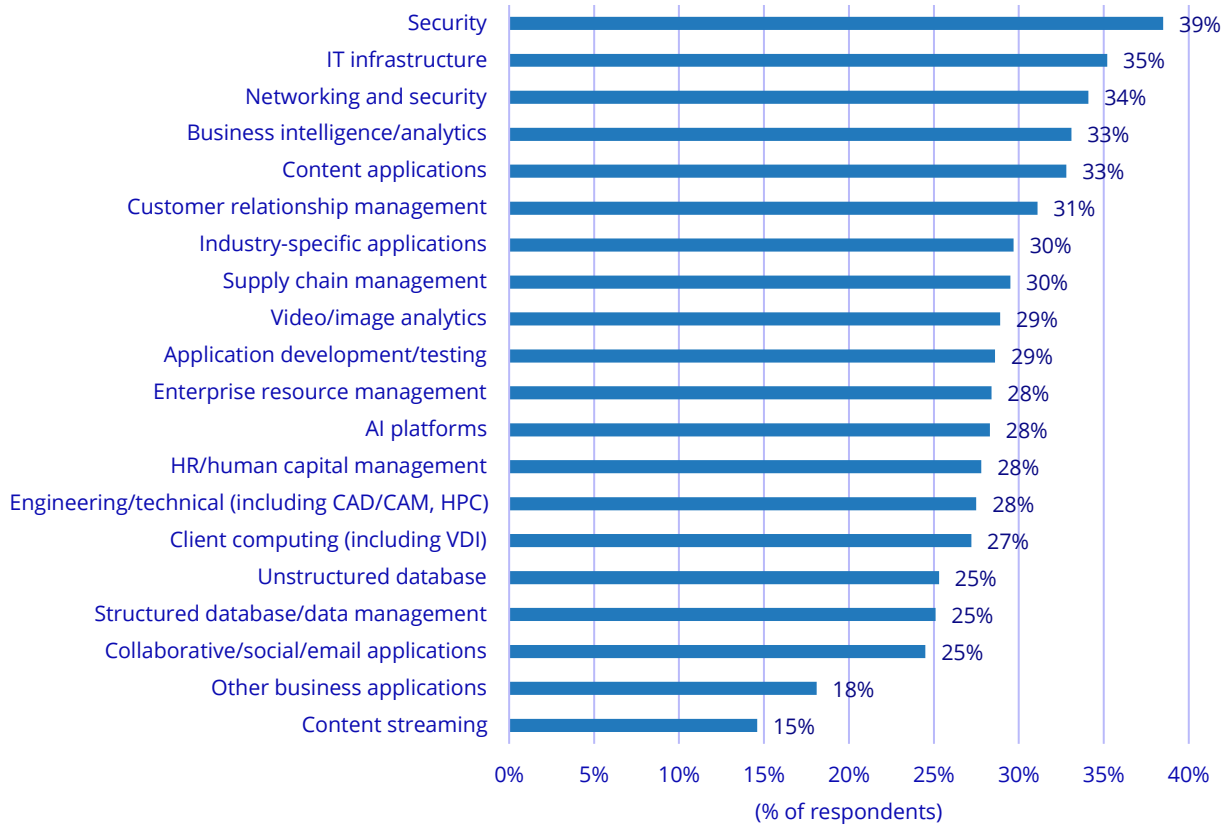
Source: IDC, 2021

The universal applicability of edge to various organizations is illustrated in the diversity of workloads shown in Figure 2. Similar to benefits, the most prevalent workloads are related to creating and managing distributed infrastructure. However, traditional enterprise workloads like business intelligence, customer relationship management, and enterprise resource management are also strongly represented. Since edge workloads can also be specific to their deployment location, vertical industry-specific applications also rank high.

FIGURE 2

Top Workloads Deployed at the Edge

Q. Which workloads used by your organization will be deployed at the edge in the next 12–24 months?



Source: IDC, 2021

HCI at the Edge

Edge locations have different operating requirements than traditional datacenters, and this is reflected in how infrastructure is designed and managed. These are often smaller facilities serving a limited number of users. This makes hyperconverged infrastructure an attractive option with configurations consisting of 3–4 hosts.

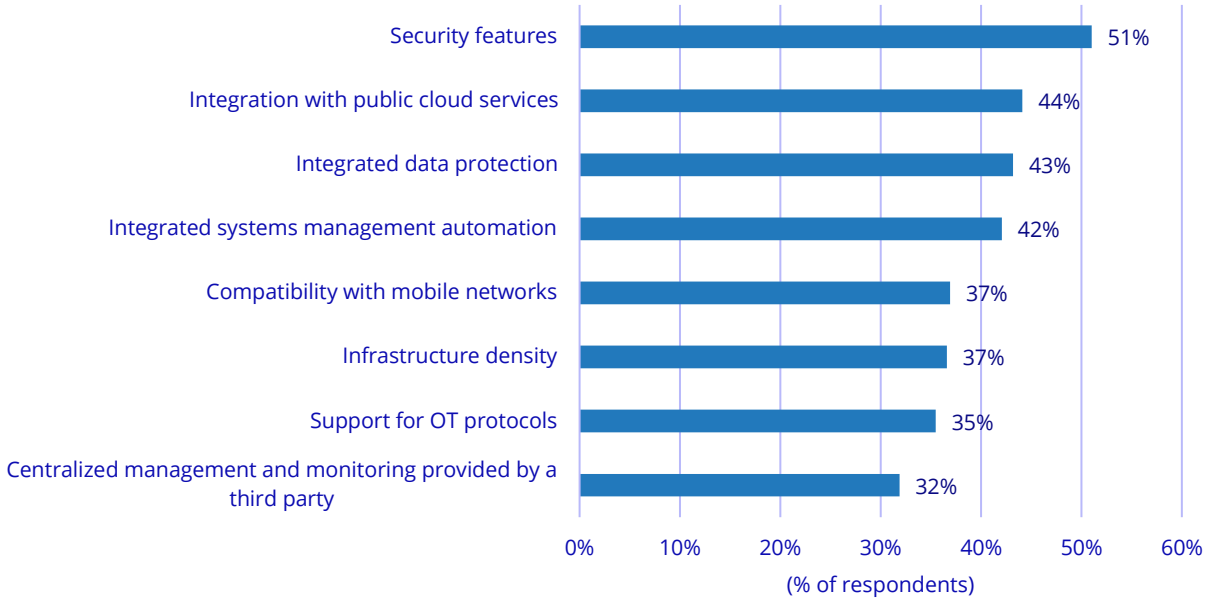
Another common characteristic is little to no onsite technical staff, placing a greater emphasis on security and remote management. As the number of edge sites grows, centralized management of configurations and software life-cycle management, including patching and upgrading of all remote HCI elements, is mandatory.

Figure 3 describes the key attributes organizations consider when purchasing HCI systems specifically for edge deployments. In addition to centralized management and security, integration with other systems, local and remote, is a desirable feature.

FIGURE 3

Top Factors Considered When Purchasing an HCI System for Edge

Q. What attributes does your organization consider when purchasing HCI systems for edge?



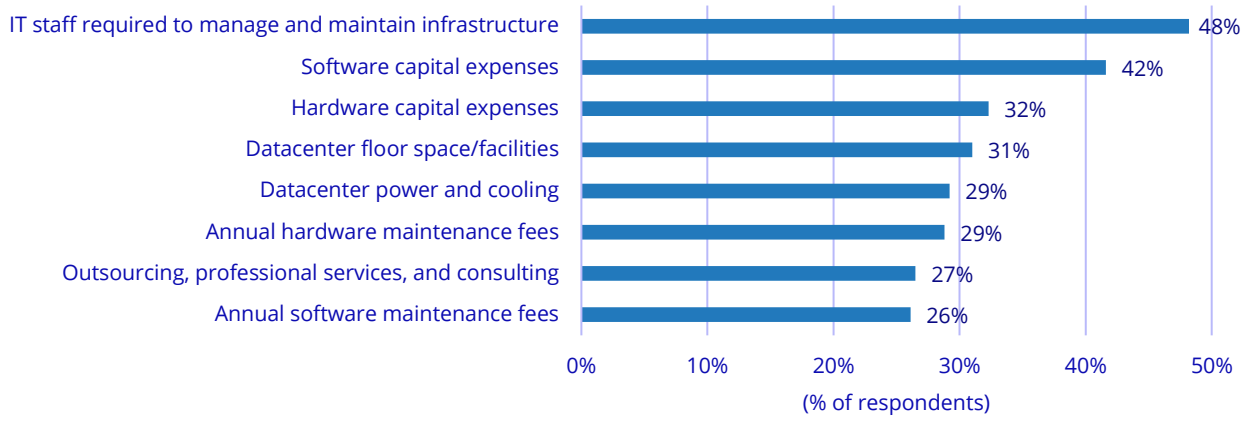
Source: IDC, 2021

HCI solutions also address cost considerations in several areas that align with the characteristics of edge deployments (see Figure 4).

FIGURE 4

Top Areas of Savings Related to HCI Deployments

Q. What areas are realizing the greatest percentage of budget savings directly related to HCI deployments?



Source: IDC, 2021

VMWARE CLOUD FOUNDATION REMOTE CLUSTERS

VMware Cloud Foundation (VCF) is a hybrid cloud platform for managing VMs and orchestrating containers, built on full-stack HCI technology. With the ability to optimize performance, resilience, and availability of critical workloads, VCF ensures enterprise-level security and simplified management on a standardized architecture.

To address the growing needs of edge deployments, VMware has introduced VCF Remote Clusters. With VCF Remote Clusters, organizations can experience consistent operations in a cloud operating model across datacenter and remote edge sites. Using familiar tools, it is possible to centrally perform policy-based VCF operations and life-cycle management, adding and removing clusters across infrastructure deployed in a variety of locations.

Maintaining security at remote locations is critical, especially considering that remote sites may be unstaffed by IT admins. By extending the underlying security built intrinsically within VCF out to edge locations, network isolation and micro-segmentation can reduce threat vectors and vulnerabilities significantly. Encryption of data at rest and data in flight as well as security compliance managed within VCF provide comprehensive security protection at these remote sites.

Today's modern applications utilize cloud-native design – a combination of microservices, containers, and API-driven orchestration. VCF with Tanzu includes an embedded Kubernetes runtime environment, enabling a unified control plane for VMs, containers, and Kubernetes clusters. Remote Clusters extend this hybrid cloud platform to edge sites connected with a minimum of 10Mbps of bandwidth and a maximum of 50ms of latency.

Use Cases

While applicable to a wide range of scenarios, VCF Remote Clusters are targeted to three use case categories:

- **Datacenter extension:** Industries like education and healthcare often deal with extremely large volumes of both structured and unstructured data that is generated in remote locations. By limiting the movement of this data and placing workloads locally, studies are completed faster at a lower cost.
- **Consolidation at remote sites:** Whether in a retail store or in the mobile battlefield, there are an increasing number of systems that must aggregate and analyze IoT data, video feeds, and other data sources. Consolidating these workloads on edge infrastructure improves visibility into operations and facilitates real-time decisions.
- **Remote site processing:** Utilities, telecoms, and oil and gas companies manage a highly distributed physical infrastructure. As these industries deploy new workloads such as 5G services and AI applications, they need a remotely managed cloud platform that can handle a mix of new and legacy technology.

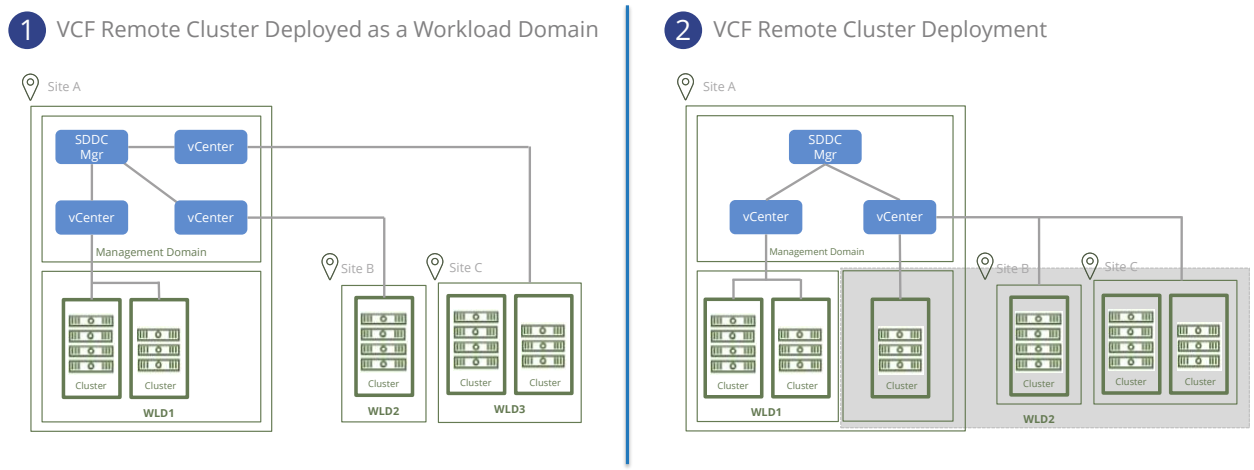
Deployment Options

VCF Remote Clusters support two deployment options (see Figure 5). In option 1, the VCF Remote Cluster is deployed as an independent Workload Domain with a dedicated vCenter server. This is preferable for environments with limited projected growth and benefits from a simplified upgrade process.

In option 2, each remote location can be a site cluster sharing a common vCenter. For high-growth environments, this option provides the ultimate in scalability. However, the nature of this deployment adds additional upgrade complexity.

FIGURE 5

VCF Remote Cluster Deployment Options



Source: VMware, 2021

Designed specifically for edge deployments, VCF Remote Clusters are ideal for situations requiring three to four hosts. Recognizing that smaller deployments must be cost optimized, VMware has introduced a new VCF ROBO licensing model that is based on the number of VMs (in multiples of 25). Alternatively, it is also possible to purchase standard VCF CPU licensing.

Case Study

Established in 2007, Abu Dhabi Healthcare Company (SEHA) is the largest and most comprehensive healthcare network in the UAE. The company owns and operates 13 public hospitals and 60 clinics with the mission of providing residents and citizens with integrated healthcare services following the highest international quality and safety standards.

In recent times, SEHA has experienced rapid growth in business applications, hospital workloads, and patient data. "Our data is growing very fast," says Mohammed Muthanna Ahmed, group director, Infrastructure and Enterprise Technology at SEHA. "It is massive."

The company also reached a point where a majority of its infrastructure was at the end of its useful life, and many of the systems were managed independently of each other. "Before we started the refresh project, there were different silos of infrastructure with each hospital maintaining its own datacenter," says Mohammed. "We had two options: upgrade in a traditional manner with general-purpose servers and storage or do something differently."

SEHA concluded that a software-defined HCI solution would best fit its needs both today and into the future. The ability to deploy compute, storage, and network resources in an integrated fashion helped reduce the footprint in each datacenter and improve management of resources without compromising security and performance.

In selecting a vendor, SEHA evaluated a range of solutions and ultimately decided on VMware Cloud Foundation. Mohammed explained that VMware's reputation as a trusted leader in virtualization was a key factor. He also cited VMware's clear road map and strong support in the region as important differentiators.

Managing a distributed infrastructure with multiple edge locations can be challenging. As traditional infrastructure grows, there is an increased management burden that often requires additional man power to monitor and maintain the environment. A lack of local IT staff can lead to reduced visibility into operations and longer remediation times when problems arise.

VCF improves this situation by offering centralized management. This enabled SEHA to monitor, operate, and manage the full life cycle of edge infrastructure seamlessly from a single site. Since requirements for edge locations vary, the flexibility in VCF Remote Cluster deployment configurations easily accommodated its site-specific needs.

Mohammed reports that the migration to HCI has yielded many benefits. "vSAN was critical for us, including the concept of having storage policies based on workload with features like compression and encryption. Performance improved by 60% for most workloads and capex was reduced by 30%." The improved visibility of the environment also contributed to maximizing utilization and performance.

By modernizing its infrastructure, SEHA achieved its goals in reducing its datacenter footprint and total cost of ownership while increasing its ability to implement new technologies like container-based cloud-native applications and AI workloads. Mohammed added, "I can say with full confidence this

solution provides me the agility within my infrastructure to deliver services faster and speed our time to market."

CONCLUSION

The edge is the next frontier in infrastructure modernization. By expanding cloud-native application development concepts and software-defined infrastructure into edge locations, organizations can place workloads in optimum locations to better server employees, customers, and partners.

VMware Cloud Foundation Remote Clusters are designed to simplify the deployment, management, and security of distributed infrastructure. With an emphasis on smaller configurations, cost optimization, and centralized management, VMware is enabling the future of digital infrastructure.

About IDC

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Global Headquarters

140 Kendrick Street
Building B
Needham, MA 02494
USA
508.872.8200
Twitter: @IDC
idc-community.com
www.idc.com