White Paper: **June 2023**

How Google Cloud VMware Engine Compares to Traditional Public Cloud Services

Buyers guide

vmware®

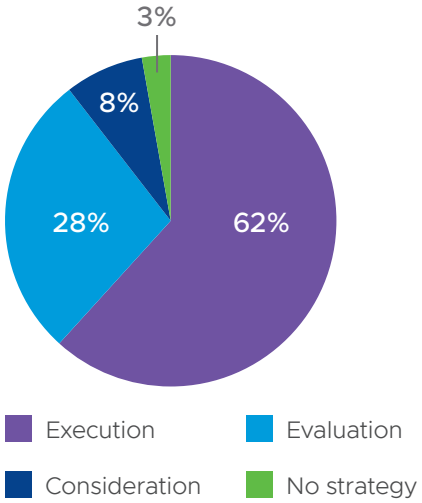
55%

of organizations use 3+ clouds in 2022, projected to be 81% within 2 years.[1]

97%

feel the pursuit of a multi-cloud strategy is critical or important to the business achieving its long-term goals.[1]

Organizations described the state of their hybrid and/or multi-cloud strategy as:[2]



How to use this guide

As organizations strive to move forward in their multi-cloud journey, they face the challenge of having different infrastructure across their private and public cloud platforms. The major public clouds use different hypervisors, networking and storage, and management tools, while most on-premises applications run on VMware vSphere®.

Organizations see the benefits of having consistent architecture on-premises as in the cloud, enabling consistent infrastructure and operations across environments. They can leverage their existing skills and automation and reduce complexity and management burden. But organizations also want to take advantage of public cloud services to modernize applications and speed up their digital transformation.

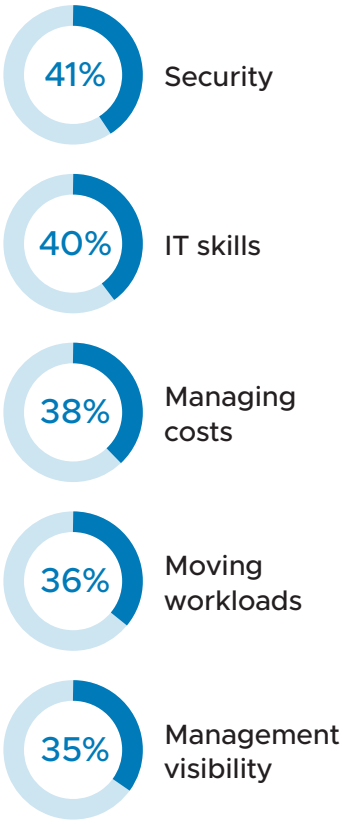
When commencing a cloud initiative, organizations may look to compare Google Cloud VMware® Engine with native public cloud services. This Buyers Guide covers how Google Cloud VMware Engine supports VMware infrastructure for traditional applications plus Kubernetes containers for modern cloud-native applications. Readers will learn how Google Cloud VMware Engine enables customers to move or extend their workloads to the public cloud fast with less effort and time, lower total cost of ownership, and without requiring refactoring or recoding of their critical business applications. Whether the use case is to migrate select applications or entire data centers to the cloud, extend capacity for seasonal demands or temporary needs, provide disaster recovery protection, modernize applications, and add or co-locate virtual desktops in the cloud, organizations need to consider many facets for their cloud initiative.

This guide outlines the key factors to consider when undertaking the use cases for a cloud initiative, including:

- Do I need the ability to move workloads to the public cloud and back on-premises?
- How much time and money must I spend on refactoring applications just to move them, and when is it worth the effort?
- Do I want to make use of my team's existing skills without requiring a lot of retraining?
- Do I have complementary partner solutions for security, disaster recovery, backup, or key management systems that I want to leverage and maintain operational consistency across on-prem and cloud environments?

Select the use case below to jump to key considerations for your cloud initiative

Most significant hybrid/ multi-cloud challenges[2]



Consideration #1: Data center migration or extension

Organizations look to the cloud to solve a growing list of business challenges. Many face situations requiring more flexibility, such as seasonal demand, resource bursting for temporary capacity, or even CxO cloud migration directives. Others face aging hardware with a costly refresh cycle, old software going end-of-life, or expiring maintenance contracts and colocation facility leases. Some have even found themselves in unfortunate situations where data centers have maxed-out power circuit capacity, inadequate floor space for expansion, or environmental challenges such as insufficient data center cooling.

Regardless of the reason for their cloud strategy, organizations face additional challenges in achieving an efficient hybrid or multi-cloud operating model — these challenges cover areas such as security, IT skills, costs, and the ability to move workloads. Migrating enterprise workloads to Google Cloud VMware Engine is a quick and easy way to solve these challenges while at the same time reducing efforts, increasing flexibility, and retaining consistent operations within your organization.

With these challenges in mind, migrating to Google Cloud VMware Engine has multiple inherent benefits:

Reduced total cost of ownership

At its core, Google Cloud VMware Engine is a VMware Software-Defined Data Center (SDDC) running within Google Cloud™ data centers on hyperconverged bare-metal server and networking hardware. The primary benefits of this SDDC are combining VMware vSphere® for compute, VMware vSAN™ for storage, and VMware NSX® for networking, **allowing virtual machines and applications to be seamlessly migrated to the cloud without refactoring or re-platforming**. In addition, standard management tools such as VMware vCenter® with the vSphere client make day-to-day operations consistent with on-premises procedures, policies, and IT workflows.

Because these technologies closely mirror an organization's on-premises environment, this yields multiple **timesaving and cost-reducing benefits**. First, administrators using familiar management tools will spend less time fumbling through unfamiliar interfaces and confidently performing their daily tasks. Second, administrators can keep using their existing procedures, tools, and scripts for automation, with very few modifications or changes in how they operate. Third, expanding cluster capacity is no longer a time-consuming exercise in racking hardware, wiring ports, configuring switches, and installing operating systems. Deploying a new private cloud (or SDDC) takes under an hour, and adding new hosts to the cluster takes just minutes.

It is possible to migrate workloads from on-premises to native public cloud IaaS or PaaS with migration tools and resources from cloud providers and third parties. Migration to public cloud typically requires changing the hypervisor,

38%

lower TCO over three years.[3]

65%

of digital infrastructure decision makers worldwide want strategic vendors to manage infrastructure so their staff can focus on the business.[4]

reconfiguring networking, redesigning storage, resizing VMs to fit into pre-defined sizes, and testing the application for resiliency, security, and performance. These projects often require a long planning cycle and an in-depth understanding of the cloud destination's architecture and software licensing model since the destination environment is very different.

Google Cloud VMware Engine provides a cloud-native VMware experience delivered as a Google-managed service, so customers no longer have the burden of managing infrastructure-related patches, updates, and upgrades. The reductions in the time required for learning new technologies and the reduced effort in managing equipment and software updates provide customers with near-immediate cost savings. With Google Cloud VMware Engine, **customers experience 38% average TCO savings** by reducing the cost of resources and creating a predictable OPEX run rate.[3]

Enterprise-grade resiliency

Regarding application availability, the VMware SDDC software stack on top of Google Cloud infrastructure provides a **service level agreement of up to four 9's (99.99%) within a single zone**. To achieve this uptime, VMware High Availability (HA) provides the host-level redundancy, vSAN protects the storage, and NSX provides network service redundancy. Most importantly, customers can proactively migrate virtual machines and applications with VMware vMotion for maintenance or disaster avoidance.

For customers requiring even higher levels of protection, Google Cloud VMware Engine can **stretch private clouds between two zones within a region**, including a separate witness zone that prevents wide-area connectivity outages from causing a split-brain condition. This stretched-cluster configuration provides an additional level of protection against zone-level failures.

Predictable performance

Unlike native public cloud offerings, Google Cloud VMware Engine private clouds do not share compute infrastructure. This means that all the host and storage hardware resources within the cluster can be allocated according to business needs. No more sharing CPU cycles, memory capacity, or storage with other customers that could potentially generate resource contention or become "noisy neighbors."

This dedicated cluster design, the NVMe storage, and the four redundant 25 Gbps network adapters provide 100 Gbps east-west networking with redundant switching to meet almost any application's high-performance needs. In addition, high CPU core counts and memory-dense cluster node configuration can provide very high consolidation ratios when used with oversubscription techniques.

Survey results found:

Live migration of apps to the cloud without downtime is the preferred approach.[1]

70%

of participants identified that their organization has had one or more cloud projects fail or be delayed due to a lack of skills.[1]

Complete control over resource optimization

With Google Cloud VMware Engine, **administrators have complete control over compute, memory, and storage resources**. The policy-driven architecture of vSAN allows storage needs to be met, while the distributed resource scheduler (DRS) load balances workloads between nodes. This allows for high consolidation ratios for low-impact workloads while still providing the ability to set resource reservations for latency-sensitive applications. Organizations can then dictate which applications share resources and which are entitled to dedicated resources.

Google Cloud VMware Engine also allows for **automatic scaling policies**, which can optimize based on CPU performance, memory performance, or storage capacity. Within each private cloud, cluster nodes can be automatically added based on policy or removed when resources are no longer needed, with rule-based triggers and customizable cool-off period settings.

Workload migration and movement can also be bi-directional for seasonal, short-term, or bursting reasons. Using VMware HCX will allow enterprise applications to seamlessly migrate into the Google Cloud VMware Engine private cloud and back to on-premises without interruption, unlike other cloud migration tools. Critical workloads can be migrated with zero downtime if needed, while the more general application moves can be orchestrated in batches with just a short cutover window. **Customers always have the choice to move their workloads to the cloud and back on-premises as needed**.

Consistent operations

VMware products in both on-premises data centers and the cloud allow for consistent operations between both environments. **Administrators can leverage their existing skills** with vSphere, vSAN, and NSX to avoid relearning and retraining on new technologies. In addition, scripts written for on-premises can be re-used and improved with additional cloud API capabilities. Furthermore, the service provides a unified experience for billing, identity, and access control with other Google Cloud services for a simpler end-to-end experience.

Additionally, many VMware customers rely on solutions from the vast ecosystem of partners for services such as data protection. Google Cloud VMware Engine offers the unique ability to elevate administrative privileges temporarily to install certain third-party solutions, further enhancing operational consistency.

Consideration #2: Disaster recovery

Protecting normal business operations and ensuring business continuity is ever-increasing as today's global organizations operate in the always-on and continually connected world we live in. When minutes of downtime can cost companies untold amounts of money, having an effective disaster recovery plan can save time and money.

Bi-directional protections

While many customers use the cloud as a backup or disaster recovery destination, an on-premises data center can also serve as a backup to cloud resources. Depending on where an application commonly resides, **bi-directional replication can protect workloads anywhere**. Sometimes, a web server farm can exist in the cloud, while the customer database and other proprietary or sensitive data can remain safely stored in the corporate data center.

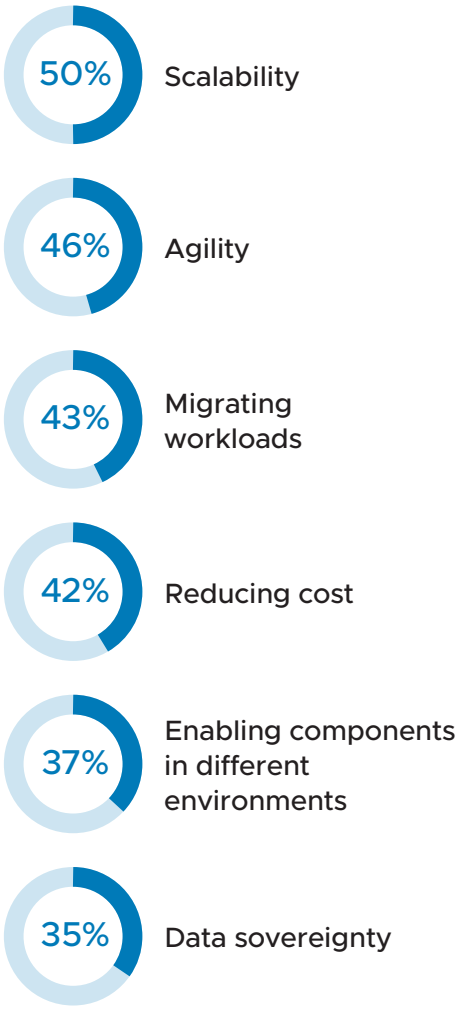
Automated recoveries

VMware Site Recovery Manager™ offers the same protection within Google Cloud VMware Engine as it always has between connected data centers. Not only can it migrate workloads and test application fail-overs, but it can also operate between Google Cloud VMware Engine regions. **A critical application can be replicated from on-premises to the cloud, failed to another region, and transitioned back** in either a planned or unplanned manner.

Integrated partner solutions

VMware has long prided itself on having a rich ecosystem of vendors who provide integrations for security, backup, disaster recovery, and more. Google Cloud VMware Engine extends vendor relationships to the cloud where existing investments in backup or replication technologies can be used in both locations.

Factors driving hybrid/ multi-cloud strategy:[2]



Consideration #3: Data sovereignty

Providing consistency in a rapidly changing world

In our modern era, information technology decision makers face new challenges as businesses expand services to customers worldwide. Beyond the traditional cost and performance considerations, governments are enacting strict regulatory requirements that may affect physical infrastructure deployment factors. Data sovereignty laws, payment processing controls, and privacy regulations such as GDPR are creating an increasingly complex technology landscape.

The need to balance goals such as **compliance, adherence to privacy policies, and general flexibility to architect systems for optimal cost, performance, and customer experience** makes Google Cloud VMware Engine the perfect choice for applications.

Seamless global expansion for VMware vSphere applications

Google Cloud VMware Engine is available in 18+ regions worldwide, including Los Angeles, London, Frankfurt, Mumbai, and other key global population centers. This broad coverage allows Google Cloud VMware Engine infrastructure to be deployed wherever policies or regulations demand. Even when deployed within a single zone, private clouds are eligible for a **99.99%** service level agreement to ensure applications are highly available worldwide. Businesses can use the global footprint to ensure customer data is properly stored in accordance with data sovereignty legal requirements.

Dedicated infrastructure for enhanced security

Every Google Cloud VMware Engine private cloud is based on high-performance dedicated infrastructure — applications and data never comingle with other unrelated customers. This design virtually eliminates threats that may unknowingly come from security breaches impacting shared infrastructure. Although rare, from time to time, certain vulnerabilities that exploit physical components, such as CPUs, have surfaced. Dedicated infrastructure reduces this risk. Attestation of isolated infrastructure may further reduce the burden for compliance officers seeking audits for industry-specific regulatory certifications.

Furthermore, access to VMware NSX® Distributed Firewall™ technology — included with every private cloud worldwide — brings **unmatched application protection capabilities** that would otherwise require significant architectural and operational efforts to achieve.

Frictionless network operations in any region

Google Cloud global networking is unique among major cloud service providers, and Google Cloud VMware Engine is tightly integrated with the **innovative virtual private cloud (VPC) networking**. Communication between Google Cloud regions is simple to manage and offers high performance without configuring or deploying complex gateways or VPNs.

Hybrid cloud connectivity to on-premises data centers is also seamlessly integrated through Cloud Interconnect or Cloud VPN. This capability may be needed when select components of an application must remain in a particular data center to satisfy compliance requirements.

Optimal user experience for global operations

Google Cloud VMware Engine private clouds are typically deployed in under an hour, and the same self-service, on-demand provisioning can be used for all regions consistently. IT staff can quickly meet business requirements without learning different infrastructure deployment procedures or resource management processes. **Infrastructure in any location can be consistently managed through the graphical portal or CLI/API interfaces**. Individual administrator access is controlled through centralized credentials valid in all geographic locations, making it easy to both grant and remove privileges according to changing business requirements and employee turnover.

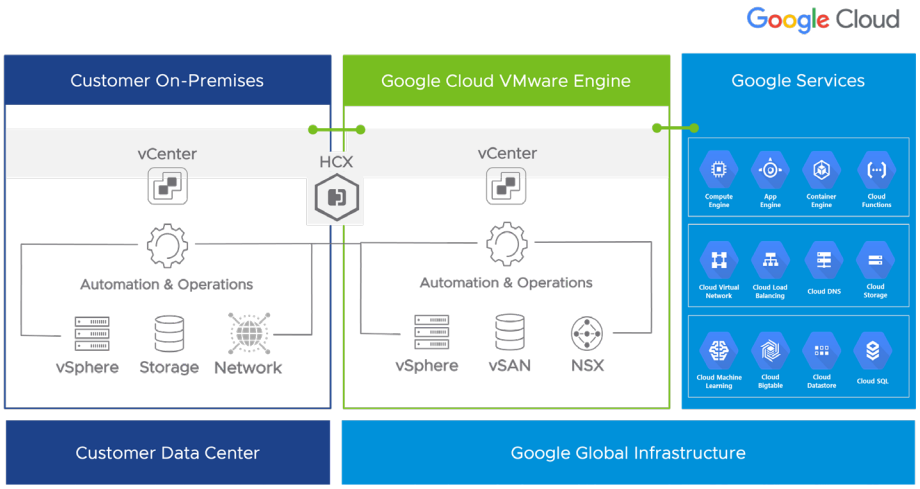


Figure 1: Modernize and Optimize with Google Cloud VMware Engine.

53%

of organizations surveyed report cloud transformation cost overruns > 30%[1]

Organizations reported that the time to effectively migrate a workload to the cloud is as much as[1]

3.75 months

Consideration #4: Modern applications

Pragmatic application transformation

Businesses rely on countless internal and customer-facing applications for their operations, which in some cases may be years or even decades old. Eventually, many applications reach a natural end of life and become obsolete, while other critical services are consistently enhanced and updated. **The opportunity cost to refactor every single enterprise application is too high**, as resources could be better spent on new development to benefit the business. **Customers must factor in the costs associated with re-writing and migrating the applications, as well as the costs of having separate tools and processes**. Architects and decision makers must prioritize their application portfolio lifecycle to ensure the most critical systems take advantage of current technologies for optimal performance, reliability, and customer experience. But many systems will have substantial life remaining and perform adequately with no business justification for major architectural changes. Regardless of the long-term prospective for the existing applications, moving to Google Cloud VMware Engine provides optionality for modernization decisions: sooner, later, or perhaps even never.

Supercharge migrated applications with Google Cloud Services

Traditional applications can take advantage of modern cloud services after migrating to Google Cloud VMware Engine. Google Cloud's immense portfolio of cloud services, such as BigQuery™, can enhance business operations and provide customer insight with advanced big data analytical capabilities. Because **Google Cloud VMware Engine is connected to the innovative global virtual private cloud (VPC) architecture of Google Cloud**, communication between VMware applications and cloud-native applications is secure and high-performance thanks to the private links that do not require transport over the Internet or VPNs.

Rolling modernization

If business requirements point to the public cloud, Google Cloud VMware Engine is a perfect choice for migrating existing vSphere applications. **Having a consistent platform means that existing apps can be moved without modification for minimal disruption**. Moving without making changes to the code can help organizations comply with tight deadlines for cloud initiatives, consolidate hosting environments after acquisitions, and leverage a hardware refresh window to move to the public cloud and gain business value.

Attempting to completely replace an existing application with a cloud-native alternative may prove impossible due to the complexities of traditional monolithic architectures. Instead, consider transforming and modernizing applications on a rolling basis and not as an entire unit.

Learn more about Refactoring a Monolith into Microservices, or the Strangler Fig pattern.

Instead of an "all or nothing" approach, take into account the Strangler Fig pattern, where a monolithic application is incrementally refactored into microservices. Shifting to a cloud-native architecture over time, component by component, may reduce risk and lessen the impact on both internal users and customers.

Consider cloud-native technologies for new initiatives

As engineering skill sets mature and evolve, teams may become better-versed in cloud-native architectures, object storage, containers, serverless, and other cloud-native development techniques. Applications needed for new initiatives may be good candidates for native cloud approaches.

But these new apps are unlikely to be autonomous. Therefore, secure access to existing services, data, and customer account information is still important. **When traditional applications have migrated to Google Cloud VMware Engine, they are adjacent to Google Cloud Platform™ native apps, and they can more seamlessly connect through a consistent, secure, and high-performance network infrastructure**. Having traditional VMware applications and cloud-native apps under the same Google Cloud umbrella offers a comprehensive approach to technical operations.

Enterprise Kubernetes platform

For those customers looking to deploy Kubernetes applications alongside their traditional vSphere workloads, VMware Tanzu® Standard is a supported add-on that provides flexible, scalable, and resilient infrastructure that is optimal for running containerized applications. VMware Tanzu enables consistency between on-premises environments and those running in the cloud with centralized management through VMware Tanzu® Mission Control™.

By running Kubernetes applications adjacent to existing VM-based applications, architects can take advantage of low latency, high bandwidth connections to centralized customer data without relying on wide-area circuits or VPNs. This critical data is often housed in traditional SQL databases that cannot be re-platformed to cloud-native equivalents. Resources can also be monitored and forecasted consistently, as the services all use a common underlying infrastructure.

Consideration #5: Cloud desktop and app virtualization

Virtualizing desktops and applications and then delivering them through the hybrid cloud combines the best of private and public clouds. This hybrid infrastructure provides architecture flexibility, elasticity, and simplified operations.

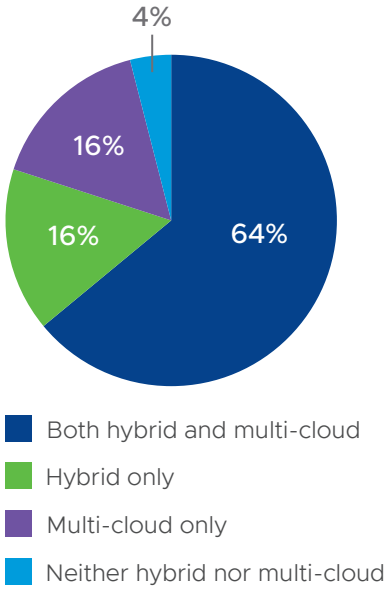
VMware Horizon® on Google Cloud VMware Engine seamlessly delivers an integrated hybrid cloud for virtual desktops and applications as a simple, secure, and scalable solution. **Running Horizon on Google Cloud VMware Engine enables IT to add and extend desktop services to Google Cloud without investing time or capital in additional data center resources**. The solution leverages a unified architecture and lets IT teams use their expertise to manage their cloud-based resources with familiar vSphere and Horizon tools—no need to learn new skills or acquire new tools.

Optimize desktop resource management with a hybrid cloud

With Horizon on Google Cloud VMware Engine, organizations can build their own hybrid virtual desktop and app infrastructure cloud that combines the advantages of solution control and the scalability of the cloud. IT can manage both the on-premises and Google Cloud deployments with the Horizon Console. In addition, the cloud-based Horizon Control Plane and associated software services provide visibility across multiple Horizon environments, whether on-premises or in the cloud, by unifying connected pods into one view. Using an intuitive wizard, admins can manage workflow policy assignments from the Horizon Control Plane, helping reduce errors resulting from using multiple consoles, decreasing deployment time, and improving troubleshooting capabilities.

Leveraging the cloud enables key use cases, such as business continuity, disaster recovery, and burst capacity, with the flexibility to direct users to the site with available capacity. Desktops and applications are always available regardless of delivery method, ensuring a richer end-user experience with no loss of productivity. In addition, an organization's security footprint is improved because virtual machines communicate over Google's private networking, and the customer's at-rest data stays within secure Google data centers. No longer is sensitive data stored on laptop hard drives that can be lost or stolen, and remote communications between employees and desktops are protected by encrypted VPN tunnels. The security envelope is stretched end to end, from your corporate databases that may leverage Cloud SQL or Cloud Spanner, to your middleware that runs within Google Cloud VMware Engine, finally ending in the Horizon environment. The end result provides a significantly easier-to-manage and secure environment that controls your data flow.

Organizations foresee their cloud operating model in two years as:[2]



Enable the remote workforce and ensure continuity

Realize business outcomes with Horizon on Google Cloud VMware Engine to enable:

- **Workspaces everywhere** — Quickly provision capacity in the Google Cloud Platform for remote desktop and application access, enabling employees to work anywhere, anytime
- **Disaster recovery** — Ensure desktop and app continuity and employee productivity by quickly redirecting users to alternative desktops running on Google Cloud VMware Engine while recovering desktops in the data center
- **Cloud migration** — Migrate desktops and applications to take advantage of cloud services and a subscription-based model
- **Burst capacity** — Extend desktop workloads between on-premises and Google Cloud VMware Engine to provide desktop and application capacity as needed to enable remote staff, contractors, and seasonal workers

Conclusion

As organizations continue in their multi-cloud journeys, they may need to choose between Google Cloud VMware Engine and native public cloud services. Customers should take a use case-based approach to determine the right cloud solution for the workloads in each use case. Before making decisions, organizations should consider how to leverage their existing investments in on-premises infrastructure and skill sets, understand the possible challenges in migrating to the cloud, analyze the TCO, and evaluate capabilities such as bi-directional workload mobility, consistent operations, and data sovereignty.

Google Cloud VMware Engine supports VMware infrastructure for traditional applications plus Kubernetes containers for modern cloud-native applications. The solution enables customers to move or extend their workloads to the public cloud fast with less effort and time, lower total cost of ownership, and without requiring refactoring or recoding of their critical business applications. Whether the use case is to migrate select applications or entire data centers to the cloud, extend capacity for seasonal demands or temporary needs, provide disaster recovery protection, modernize applications, and add or co-locate virtual desktops in the cloud, Google Cloud VMware Engine helps customers realize business value fast.

1. Enterprise Strategy Group, a division of TechTarget, Inc. eBook, Trends in Organizations' Hybrid and Multi-cloud Strategies, December 2022
2. 451 Research, part of S&P Global Market Intelligence - Voice of the Enterprise: Cloud, Hosting & Managed Services, Hybrid/Multicloud 2022
3. 2022 TCO Assessment Studies over 18-Month Horizon, VMware Cloud Economics Team and 2022 Google Cloud Internal Customer Studies
4. IDC: Worldwide Digital Infrastructure Customer Perspectives on Ecosystem and Sourcing Strategies, Q1 2023 (IDC #US49979923)

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