

VMware Multi-Cloud Architecture: Enabling Choice and Flexibility

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VMware Cloud Services*

START



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Welcome to the World of Multi-Cloud

In the world as we used to know it, when Amazon sold books and Microsoft software came in a box stuffed full of floppy disks, enterprise applications typically ran in a central, on-premises data center. Fast forward 25 years to a time when application growth is unprecedented and enterprise applications run from a wide range of cloud endpoints - some public, some private, some via SaaS delivery, some managed by you, some managed by others and so forth. Welcome to the world of multi-cloud.

Currently, every industry trend report identifies multi-cloud as a key strategy for most large organizations. However, as you already know or will soon come to know, this operating model brings with it a wide range of new challenges that must be addressed by IT leaders if this application delivery model is going to prove sustainable.

So why are businesses adopting this strategy, and, as illustrated in Figure 1 below, why does hybrid cloud represent the most desired end state for so many organizations? To answer these questions, let's start by taking a look at why organizations are increasingly using multiple private and public clouds in combination to deploy their applications.



ABOUT THE AUTHOR

Martin Hosken is the Worldwide Chief Technologist for VMware Cloud Services. Martin works at the intersection of IT Architecture, Solution Architecture and Software Development. His primary focus is on cutting edge solutions that are part of today's complex cloud market. He works with customers and partners to help them make the most of the opportunities presented by emerging technology and software development practices. Martin is part of the VMware Office of the CTO, Global Field team, a double VMware Certified Design Expert (VCDX Number 117) in Data Center Virtualization and Cloud Management and Automation, an established vExpert, and is the author of three books, dozens of papers, blogs and articles based on VMware and other technologies.

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Multi-Cloud Drivers

While there is a school of thought that believes the only true way to deliver next-gen applications is to take advantage of a cloud provider's higher-level services, for many organizations cloud provider lock-in is a key concern. The desire to avoid becoming locked into a specific public cloud provider's proprietary services and pricing model often drives organizations to look at how they can diversify their use of cloud environments.

This motivation, avoiding lock-in, is also present when it comes to considerations about where to build cloud native services based on containers, microservices and Kubernetes. While these technologies are based on open sourced components and designed to be portable, they are also being implemented by public cloud providers in ways that try to make their platform 'sticky.'

Type of Hybrid Cloud Strategy

% of enterprise respondents with hybrid strategy

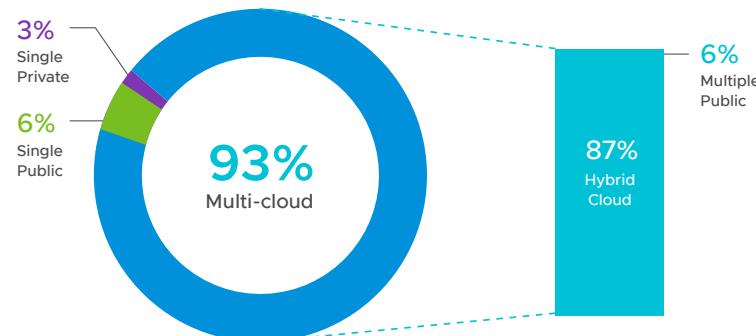


FIGURE 1. Multi-cloud growth

Source: Flexera 2020 State of the Cloud Report

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WHY ARE ORGANIZATIONS ADOPTING A HYBRID CLOUD STRATEGY?

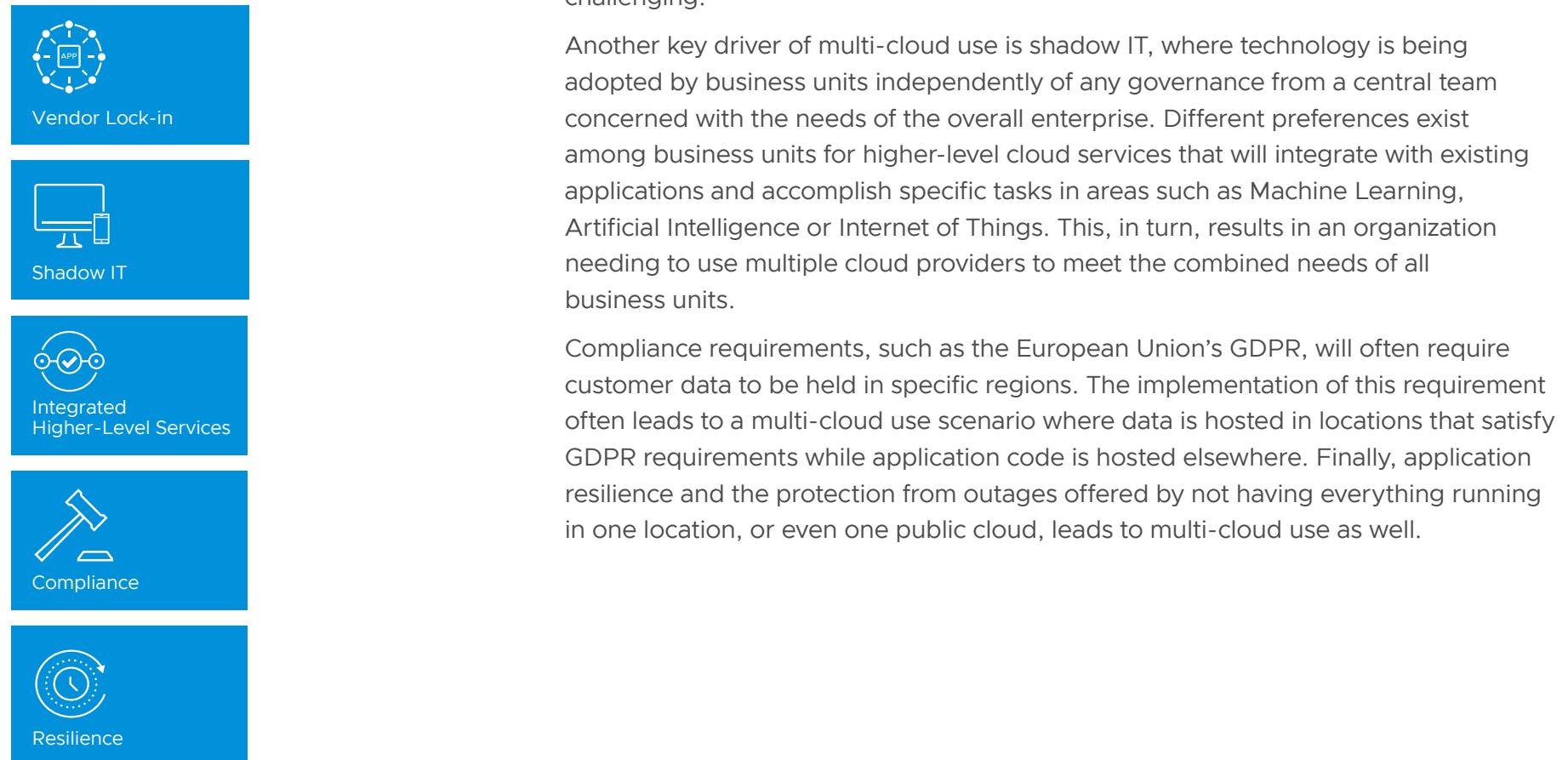


FIGURE 2. Reasons for adopting a hybrid cloud strategy

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Multi-Cloud Operations Means Tackling Significant Complexity

As mentioned earlier, a multi-cloud strategy brings with it a range of management headaches and several difficult challenges for organizations. Each public cloud embodies a unique interaction model with different ways for end users to authenticate and to then to consume, request or modify a service or application. Each cloud also comes with a unique set of API surfaces. For most businesses this becomes a balancing act of weighing up the benefits of adopting multi-cloud technologies versus the burden of supporting them.

These challenges are exacerbated by a lack of comprehensive multi-cloud tooling, meaning that most of the management tools used by cloud operational teams are provided by the public cloud provider that is hosting the application. While these tools work well for a single public cloud endpoint, they typically cannot address operational use cases that run across multiple public clouds.

Another key challenge for organizations who consume multiple public clouds is the operational overhead associated with maintaining common governance, security and compliance models across this complex multi-cloud environment. This is such an important aspect of running a modern business, many organizations are realizing that they would like a single, more unified approach to meet the need for these often legally required controls.

Maintaining skill sets in the fast-changing world of cloud, and the ability to train teams to operate multiple public clouds, puts a lot of pressure on teams. In addition to this, simply onboarding a new team member and getting them up to speed on the diverse sets of required skills takes longer, is harder, and adds significant risk to the day-to-day operations each time a cloud is added to the mix.

Hybrid Cloud is Motivated by Multi-Cloud Complexity

To simplify multi-cloud complexity, organizations are beginning to adopt a hybrid cloud model. Before we go too far with this topic, it is important to ensure we are aligned on terminology and the differences between multi-cloud and hybrid cloud.

As illustrated in figure 3, multi-cloud is a strategy which aims to describe how organizations use multiple cloud providers to meet diverse technical and business requirements. The term hybrid-cloud is generally used to describe the combination of private and public cloud infrastructure, where private is either on-premises or hosted in a colocation facility, and public cloud infrastructure is provided by one or more hyperscaler clouds. In a hybrid cloud scenario, common management and orchestration tools are used to deploy workloads and maintain the balance between the two as well.

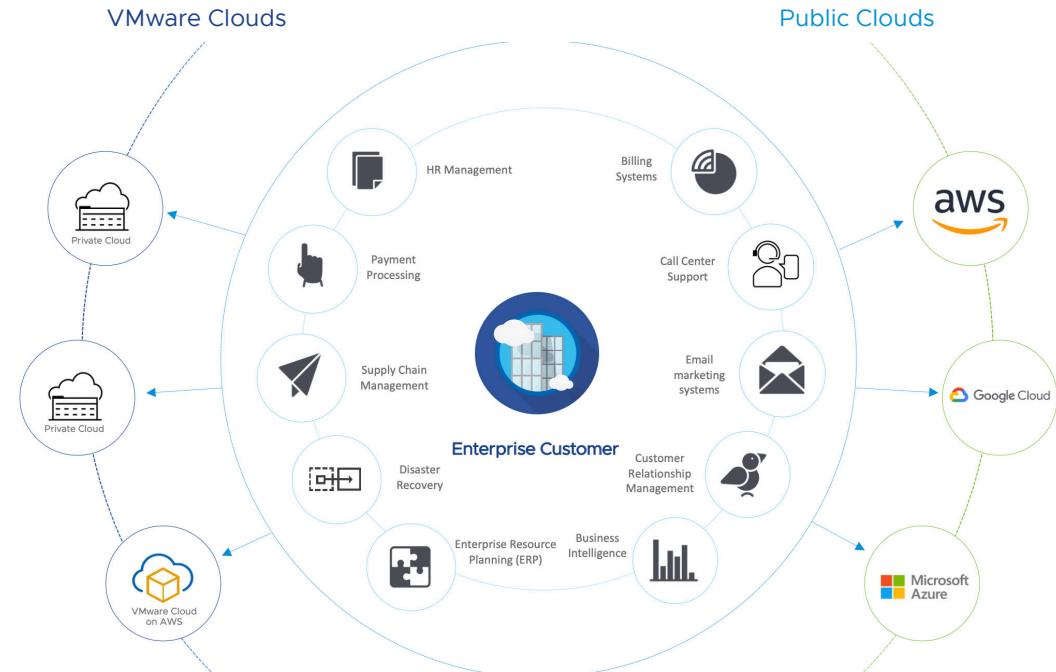


FIGURE 3. Enterprise customer multi-cloud strategy

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Hybrid cloud is attractive because many businesses would really like to modernize at their own pace and be able to find a way to do so starting with their own data center. They would rather do this than be under pressure to move everything to the public cloud as quickly as possible, which can be very risky from multiple perspectives. Also, many organizations are looking for a more granular step-by-step journey towards modernizing applications while gaining many of the benefits of running in the cloud and also maintaining workloads under a single governance model.

A hybrid cloud delivers on this idea by creating a bridge between your own on-premises environment and one or more public or hosted cloud environments. This model often includes employing public cloud resources for regular or occasional bursts of compute and/or storage capacity, for instance adding capacity on-demand to provide additional resources for end-of-quarter batch processing or seasonal bursts in website utilization.



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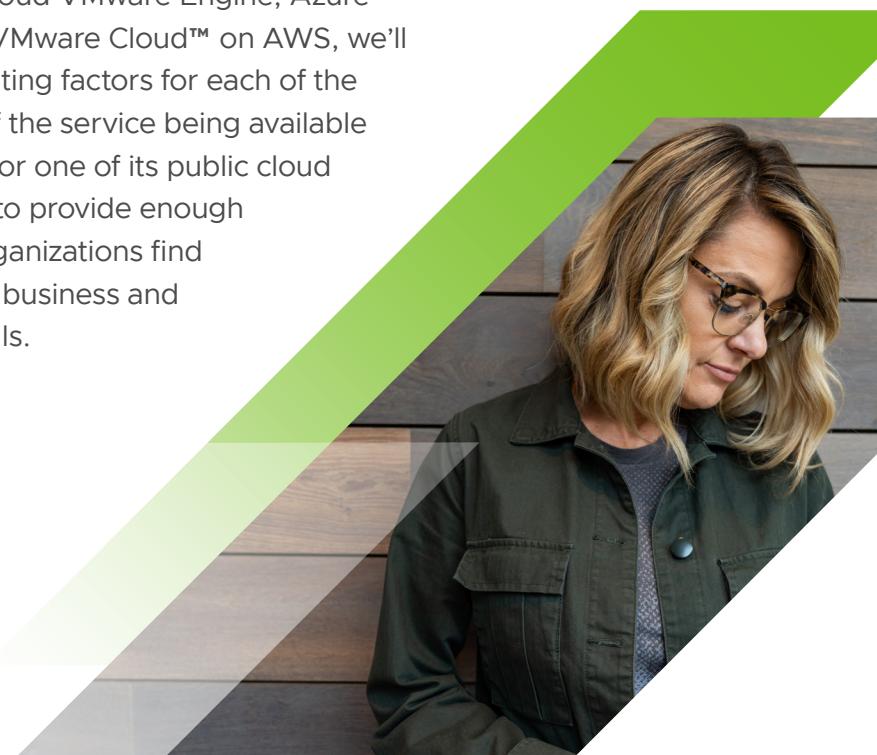
What Does Hybrid Cloud Mean to Your Organization?

There is no doubt that the term *hybrid cloud* is one of the most overused phrases related to modern infrastructure technology, and can be, and often is, used to describe many different scenarios that can mean different things to different organizations.

What I know is this: there is a common desire amongst organizations of all sizes to run applications in the most appropriate setting for that application type and to have the flexibility to move applications should a business or technical reason arise.

While flexibility and choice are key for businesses, we now appear to live in an age of overloaded terms and ambiguity when it comes to technology areas such as the cloud. Every vendor in the industry is keen to promise a utopian vision of an easy path towards cloud or digital transformation. So how can businesses separate reality from hype, and how can they maintain a grounded approach that supports smart decision making as it relates to executing strategies around application modernization and multi-cloud use?

The goal for the remainder of this eBook is to help customers navigate and better understand the options available by leveraging VMware Cloud. As illustrated in Figure 4 on the next page, in this seemingly ever-evolving world of hybrid cloud, the options for customers appear to be endless. So, whether it's Google Cloud VMware Engine, Azure VMware Solutions or VMware Cloud™ on AWS, we'll address the differentiating factors for each of the options. Regardless of the service being available directly from VMware or one of its public cloud partners, I am aiming to provide enough information to help organizations find the correct fit for their business and strategic technical goals.



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As illustrated in figure four, VMware Cloud offers a wide range of hybrid cloud options through two different delivery models. VMware Cloud™ on AWS is sold and operated by VMware while all the others shown are built, sold and operated by VMware cloud partners. What makes these solutions a hybrid cloud is their ability to blur the lines between applications, infrastructure, hardware resources, support operations and management. The primary aim of any hybrid cloud should be to:

- Simplify access to resources
- Provide the business faster time to market
- Offer more geographic options faster
- Create a global architecture and treat it like any other physical location

Having a hybrid cloud that is based on a common platform provides a wide range of additional benefits, which can include seamless application mobility, common networking, transparent management and governance. This in turn gives us a far simpler state of consistent operations and automation for both virtual machines and containers, and is the desired end state for most organizations.

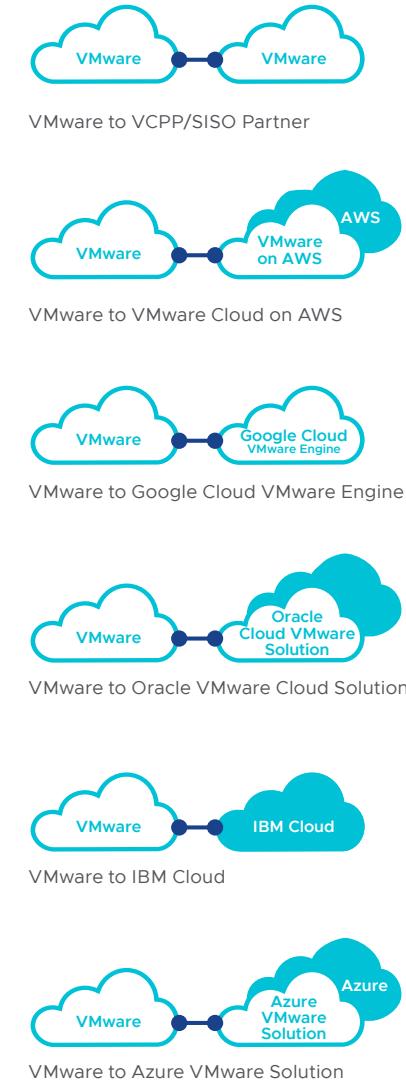


FIGURE 4. The choice of hybrid cloud solutions

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Benefits of a Homogeneous Approach

A homogeneous hybrid cloud based on VMware Cloud provides the native form of the model by delivering a service that is a natural extension to a customers' existing data centers. In this architecture we are talking about the same platform that you use for on-premises being extended for use as a hybrid cloud, through the consumption of resources on public cloud.

Through the use of VMware Cloud Foundation™, a core part of VMware Cloud, customers can implement a network integration scheme that allows you to move workloads from private to public and back with ease. The aim is that the public cloud is simply another deployment target within your "virtual" data center. This has the key advantage of not requiring applications to be modified when moved into the public cloud and the ability to deploy new and existing apps on the same common platform. In addition, because the entire hybrid cloud is built on vSphere®, it can take advantage of support for over 90 different guest operating systems and more than 500 applications, not something seen natively on the hyperscale public clouds.

This hybrid cloud experience also includes the ability to extend networking rules from on-premises to public cloud. By providing a common management and orchestration platform there is no need to learn a whole new skillset. You can continue to use the same tools with which your operators are already familiar. This can also help address the gap between the business and IT. IT can remain in control by using the same procedures and management processes they have worked with previously, and the line of business can get to the cloud faster without having to re-architect the application. This approach to cloud facilitates far better control of data and simplifies a wide range of operational factors, such as access, performance, availability, security, data protection and governance.

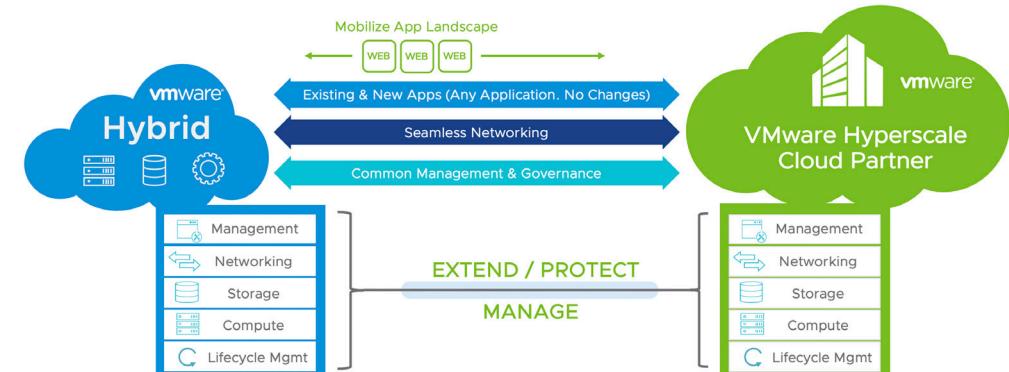


FIGURE 5. Cloud architecture

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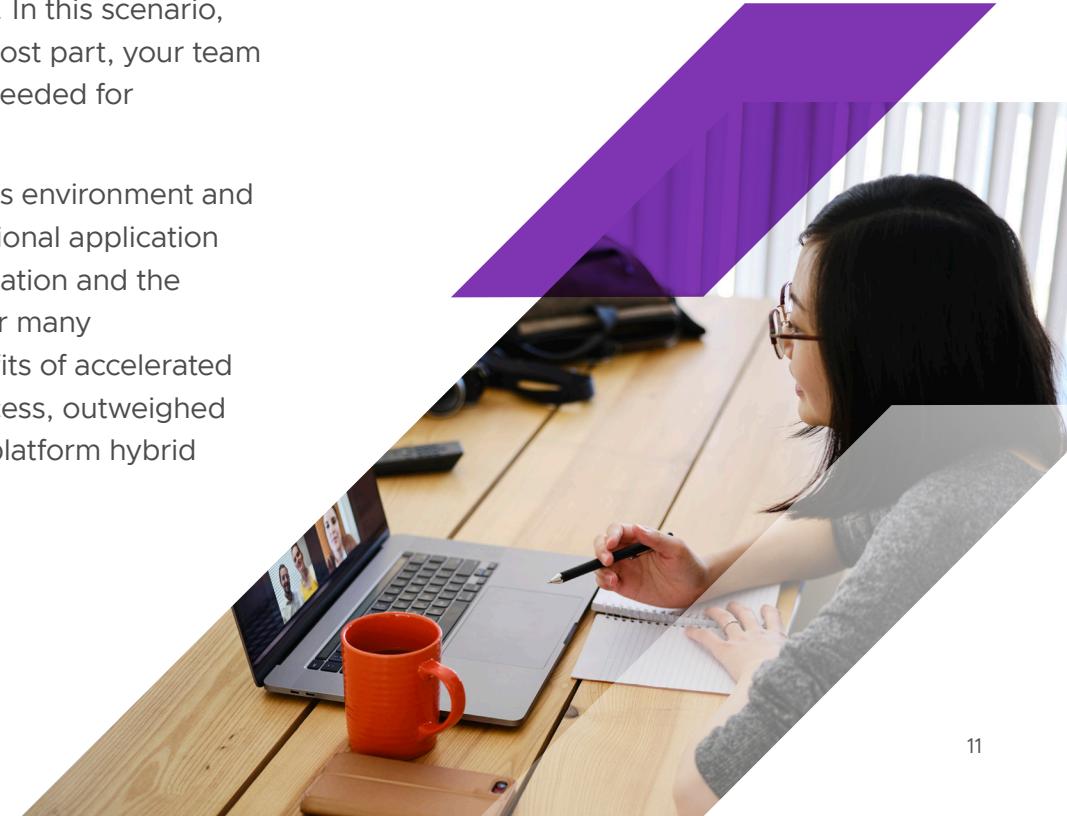
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Bringing Together the Best of Two Worlds

Before 2017, there were, broadly speaking, two options available to achieve a hybrid cloud scenario. Organizations could build a VMware hybrid cloud by working with one of the 4,000+ VMware Cloud Partners across the globe to build a homogeneous solution. This solution offered multiple benefits – everything from the consistent tooling and skills to security policy consistency and governance. The downside to this strategy was that you couldn't take direct advantage of the massive innovation in cloud services that were available on public clouds like AWS, Azure or Google Cloud.

Alternatively, you could architect a solution across an on-premises environment (likely built on VMware) and a hyper-scaler public cloud provider. In this scenario, you could get access to cloud provider innovation, but, for the most part, your team was on the hook for building out any interconnectivity that was needed for applications to interact across a mixed platform environment.

This is because the core infrastructure between your on-premises environment and the public cloud were different. You couldn't easily move a traditional application between environments due to dependencies between the application and the infrastructure it was deployed on. Even with these challenges, for many organizations, access to innovative cloud services, and the benefits of accelerated time to market and the increased agility that flowed from this access, outweighed the operational challenges brought about by this type of mixed platform hybrid cloud solution.





Then in 2017, VMware blurred the lines between these two distinct options by giving customers the ability to take advantage of a solution that could deliver both models in a single architecture. VMware Cloud on AWS was the first joint VMware and Public Cloud provider partnership focused on delivering a homogeneous infrastructure that at the same time simplified access to public cloud cloud services.

With many VMware customers wanting to extend their IT base into one or more public clouds, the AWS partnership delivered a co-developed service that runs VMware Cloud Foundation (compute, storage, networking and management) natively on AWS bare metal infrastructure. This was the first in a new class of hybrid cloud solutions. The solution was revolutionary in its architecture, simple delivery model, and close proximity to AWS native services.

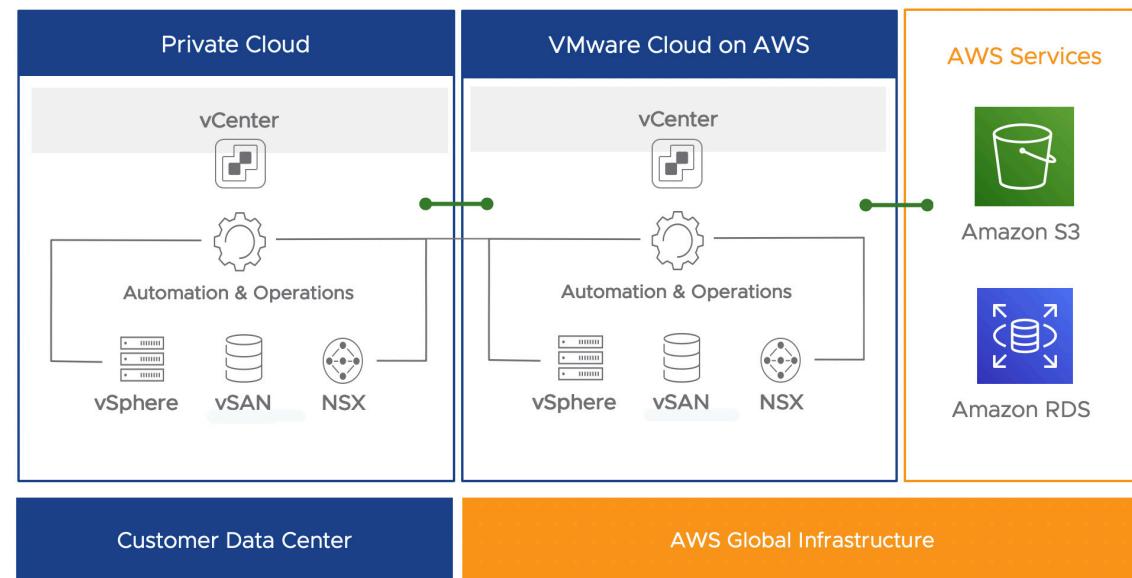


FIGURE 6. Anatomy of VMware Cloud on AWS

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So, what is VMware Cloud on AWS and why is it so important? Consider VMware Cloud on AWS as a VMware Software-Defined Data Center (SDDC) deployed on AWS bare metal hardware “for rent.” More specifically, it is an Infrastructure-as-a-Service (IaaS) cloud that is owned and operated by VMware and built using the SDDC model. It brings together the best of both private and public cloud by enabling organizations to deploy workloads on AWS while being able to manage both clouds using the same operational processes they use in their own data centers.

To be clear, VMware Cloud on AWS is a cloud offering that is managed, operated and supported by VMware. The service provides dedicated SDDC instances that are hosted in AWS facilities with hardware that is owned and managed by Amazon. The service is dedicated, with hardware that is solely assigned to that customer SDDC. It delivers a private cloud operating experience with high-speed, low-latency access to AWS native services.

The VMware service is built on top of AWS on-demand billing and is therefore based on actual consumption. It allows VMware to offer flexible consumption models with elastic resources that can be scaled on demand. Finally, VMware Cloud on AWS can also be consumed and offered as a service through Managed Service Providers (MSP). The MSP model, under the VMware Partner Connect Program, allows partners to leverage various VMware Cloud Services to broaden their portfolio of offerings and provide value added features and functionality to customer-focused managed services.

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Azure VMware Solution

Azure VMware Solution (AVS) represents the next installment of VMware's any cloud expansion. Like VMware Cloud on AWS, AVS allows customers to run VMware workloads natively on the Azure platform. However, in this model, Microsoft owns the service and provides support for the management, networking and back-end infrastructure end-to-end. Microsoft, now a VMware Cloud Provider Partner, works closely with VMware engineering to build, maintain and support the platform.

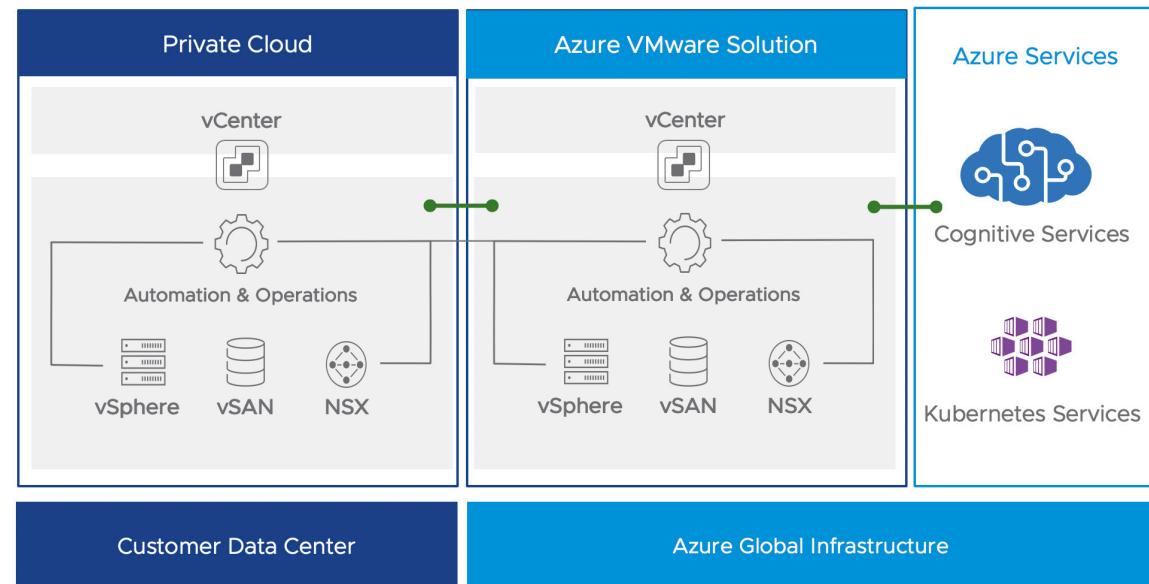


FIGURE 7. Anatomy of Azure VMware solution

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With AVS, customers can deploy and manage VMWare workloads on a dedicated high performance and consistent platform running inside Azure. Organizations can provision, expand and reduce VMware infrastructure as business demands. This allows you to leverage Azure economies of scale without the complexity or cost of re-architecting the applications being migrated, while also maintaining your existing operating models, as illustrated in Figure 7.

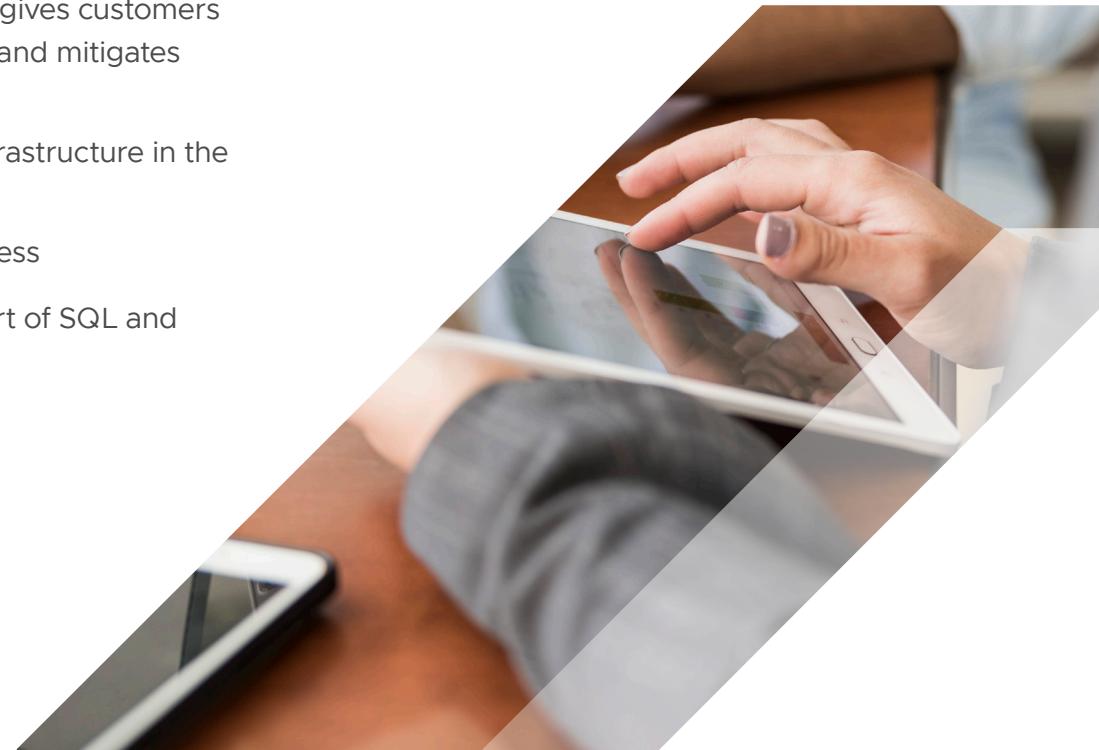
Similar to the VMware Cloud on AWS scenario, with this solution customers can modernize applications at a comfortable pace while also expanding into native Azure services for the deployment of innovative application architectures, such as the zero trust architecture illustrated in Figure 8. This model gives customers flexibility, choice and control over critical business applications and mitigates many of the risks associated with public cloud migration.

Customers get fast, simple deployment of software-defined infrastructure in the cloud with cost-effective, as-a-service cloud consumption:

- Low-latency, high bandwidth Azure public cloud services access
- Qualifies for 3 years of extended security updates and support of SQL and Windows Server 2008R2 after End of Support

OTHER NOTABLE BENEFITS OF AZURE VMWARE SOLUTIONS

- Runs in dedicated environment in Azure data centers across multiple regions
- Engineered and delivered by Microsoft, a VMware Cloud Provider Partner
- Seamless Azure experience through the Azure portal
- Programmable and integrated into Azure management
- Available from Microsoft as an individual service or with Azure Credits (same as any Azure native offering)



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Whether you are decommissioning existing data centers or just need to expand and innovate into AVS, this service is clearly designed for organizations that have standardized IT infrastructure on VMware technology and are looking for the ability to expand and leverage the wide range of high-level services available in Microsoft Azure.

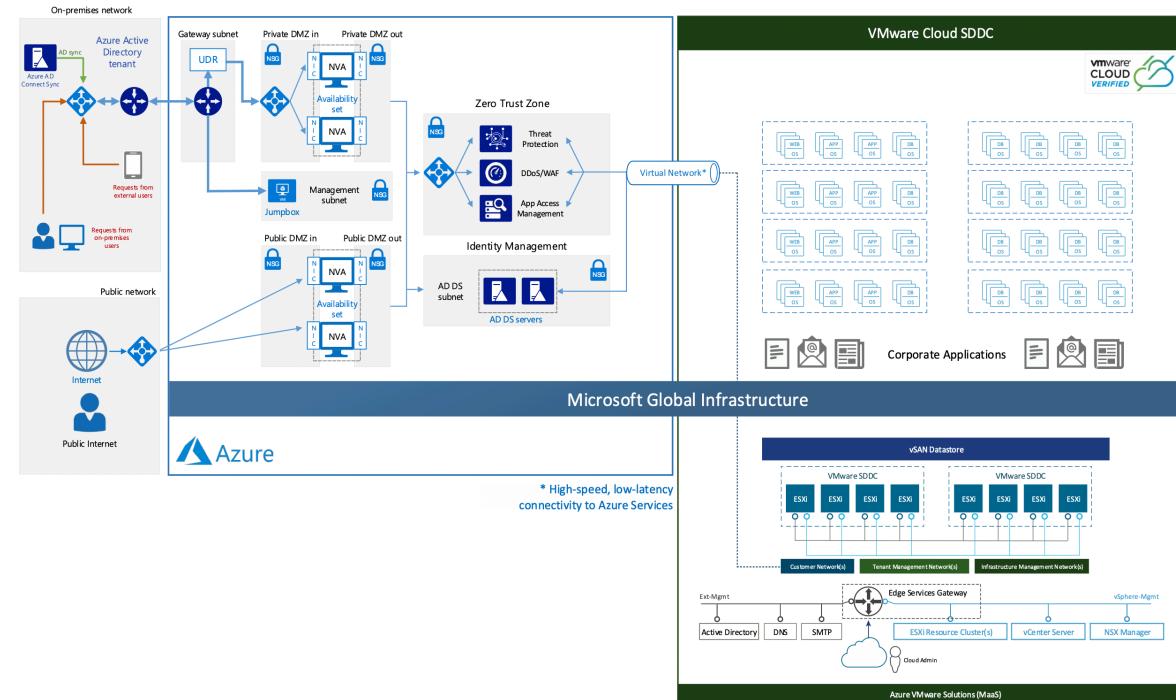


FIGURE 8. Azure VMware solution – sample zero trust security reference architecture

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IBM Cloud

No discussion about hyperscale clouds could be complete without highlighting the father of the hyperscale cloud model – IBM. IBM and VMware have a long-standing relationship to accelerate hybrid cloud innovation and adoption across global enterprises. IBM makes it easy for enterprises of all sizes to securely move VMware workloads to the cloud and leverage open technologies to modernize business operations. The IBM public cloud helps customers across a wide range of vertical industries meet security, resiliency, performance and global deployment requirements. IBM Cloud clients gain access to a range of enterprise-grade IaaS and PaaS services that allow developers to leverage innovative cloud service capabilities from IBM.

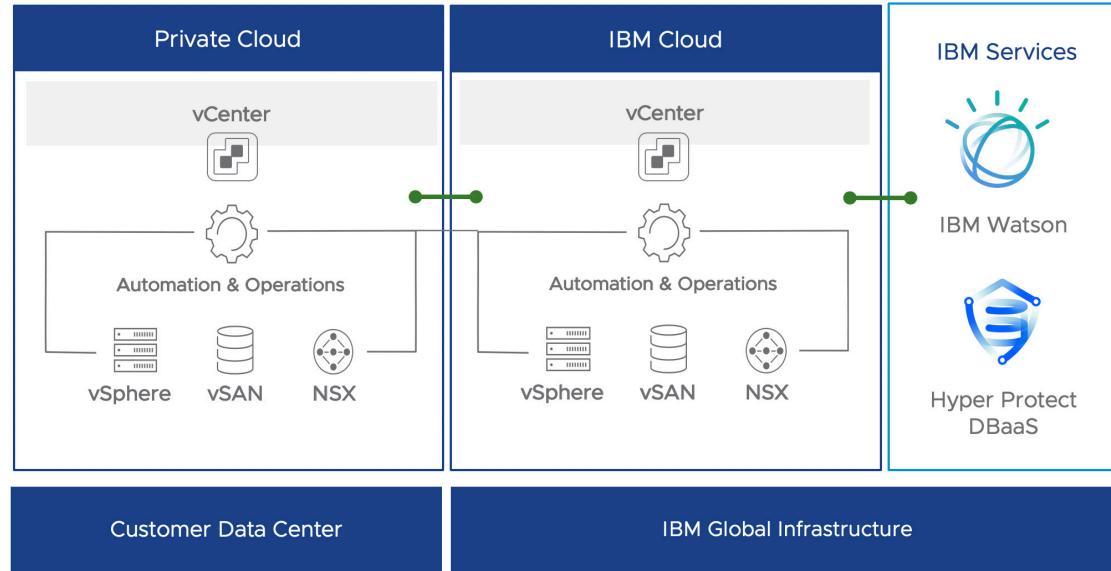


FIGURE 9. Anatomy of IBM Cloud

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Google Cloud VMware Engine

Officially made generally available June of 2020, Google Cloud VMware Engine (GCVE) delivers a fully integrated, native VMware experience on Google Cloud. GCVE provides high levels of performance and reliability to support production enterprise workloads from within Google Cloud data centers.

Just as we have seen with the previously discussed hybrid cloud solutions, with this service you can migrate or extend your on-premises workloads to Google Cloud in minutes, connecting to a dedicated VMware environment directly through the Google Cloud Console.

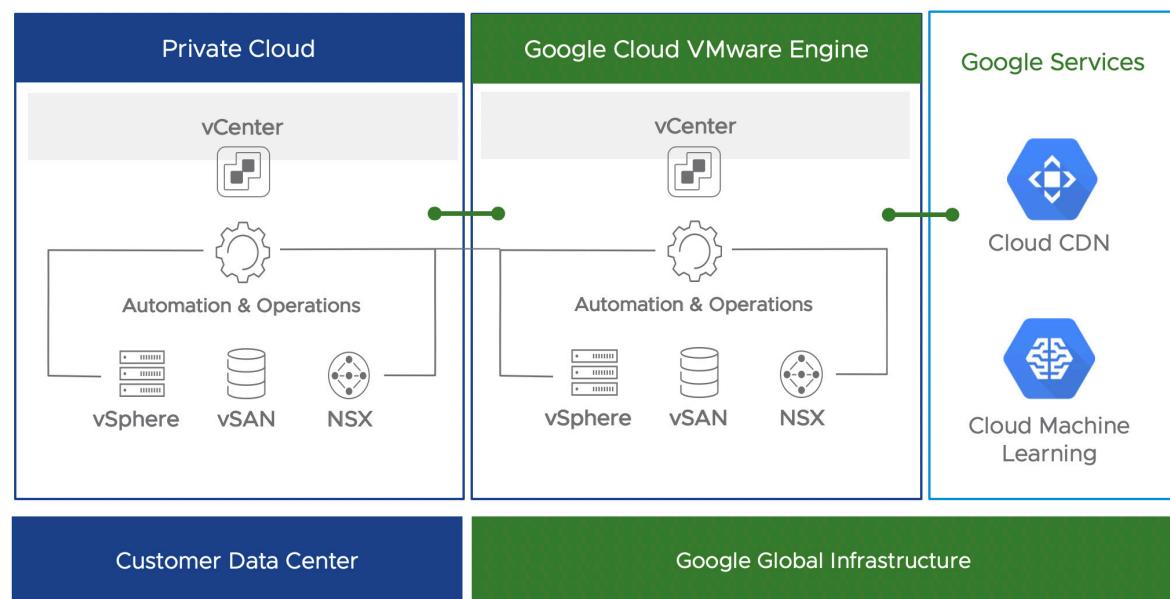


FIGURE 10. Anatomy of Google Cloud VMware engine

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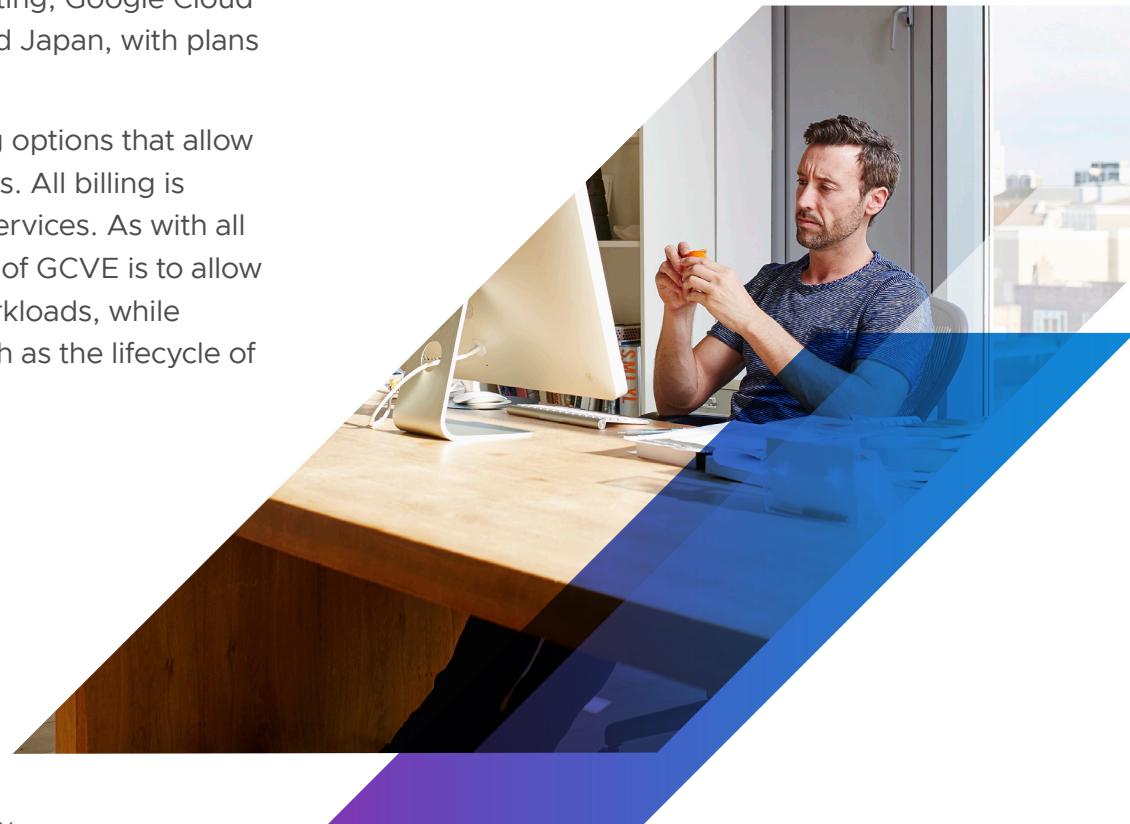
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For customers who are strategically aligned with Google Cloud Platform, GCVE provides everything you need to run your VMware environment natively in Google Cloud. The solution delivers a fully managed VMware Cloud platform that includes VMware vSphere, VMware vCenter®, VMware vSAN™, VMware NSX®, and VMware HCX. These technologies are deployed as a dedicated environment on Google Cloud Platform infrastructure. With this service you can extend or migrate workloads without changes to Google Cloud process in minutes using HCX.

Google Cloud VMware Engine is a Google first-party solution, fully owned, operated and supported by Google Cloud. At the time of writing, Google Cloud VMware Engine is available in US-East, US-West, Europe and Japan, with plans to add eight more regions by the end of 2020.

GCVE offers 99.99% availability to customers and has pricing options that allow on-demand consumption as well as 1- or 3-year commitments. All billing is addressed through the same Google Cloud used for native services. As with all of the hybrid cloud solutions discussed in this series, the aim of GCVE is to allow customers to focus on applications and their underlying workloads, while Google Cloud SRE teams manage other service aspects, such as the lifecycle of VMware SDDC technologies.



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Oracle Cloud VMware Solution

Next up is Oracle, which brought Oracle Cloud VMware Solution (OCVS) to market. The solution enables customers to run VMware Cloud Foundation on Oracle's Generation 2 cloud infrastructure while retaining full VMware administrative access and compatibility with VMware vCenter. The key differentiator for OCVS is the fact that the customer has full control to build and manage their cloud VMware environment as if it ran in their own data center.

Again, the migration of VMware workloads without re-architecture or modification of tools and processes is key to the value of this service. However, Oracle is the only VMware hyper-scale cloud offering that allows customers to migrate existing vSphere environments to the cloud while retaining total control over lifecycle management, such as updates, patches, and validation of integrated third-party tools, for all VMware components.

The capabilities offered by OCVS allows joint VMware and Oracle customers to easily integrate with Oracle's cloud native services, including Oracle Autonomous Database, Oracle Exadata, VMs, or other bare metal compute instances, all of which run in close proximity in the same cloud data centers, on the same virtual cloud networks, accessible through the same OCI user interface and APIs.

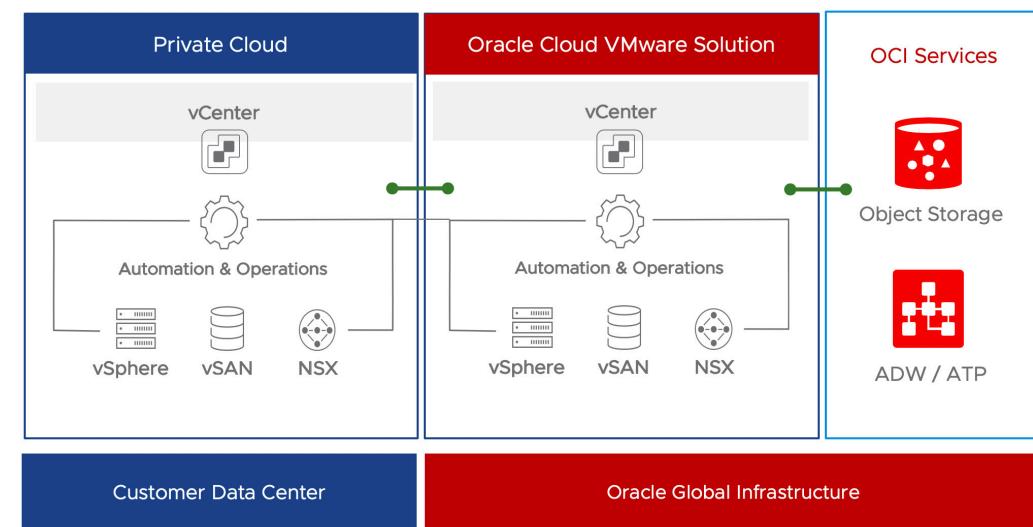


FIGURE 11. Anatomy of Oracle Cloud VMware solution

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Comparing native public cloud services with a VMware software-defined data center running within that same public cloud is not easy and is a bit like comparing apples with oranges or beer and wine. Quite simply, a lot of it comes down to what your priorities are and what your end goals need to be from a business perspective. While it might be possible to do both a commercial and technical comparison between workloads running on AWS EC2 or Azure VM with those running on VMware, that data alone is unlikely to be the major influencer of decisions around your multi-cloud strategy.

So, what it comes down to is business tactical and strategic priorities. For instance, if flexibility, choice and control are key requirements when it comes to workload placement, then VMware, as we have shown throughout this series, offers a compelling set of options.

Another key concern for many companies moving to the cloud is vendor lock-in (Figure 12). Organizations can be weary of a scenario where it is easy to move into a cloud infrastructure but difficult to leave without incurring large costs, risk and complexity. This is due to the proprietary nature of public cloud technologies. This is another reason why a common VMware SDDC across all the major cloud providers is appealing to many customers.

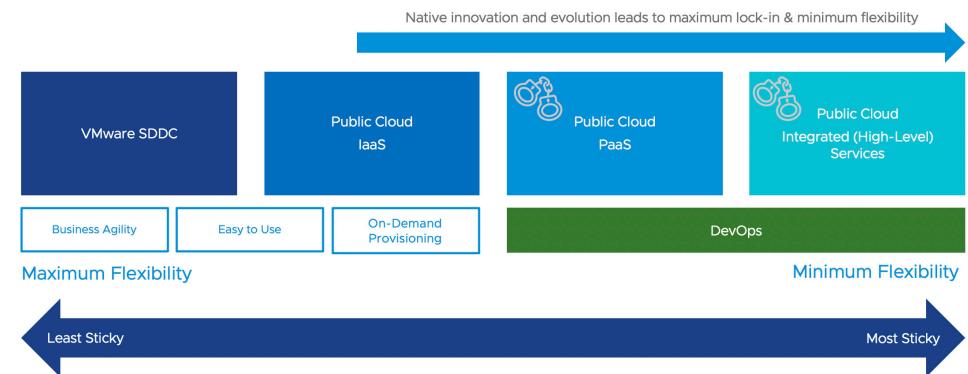


FIGURE 12. Understanding public cloud lock-in

Consider Cloud Economics

Now let's turn to the question of cloud economics. Cloud native IaaS will typically benefit from the cloud economic model, where you pay per second for VM capacity. Under the VMware model you pay per host, which, despite the move from Capex to Opex, is the same economic model as on-premises.

Similar to on-premises environments, consolidation ratio is a key driver of cost. The cost of a cloud native IaaS workload is consistent. It doesn't change based on how many workloads you deploy. However, in the VMware model, as the host cost is fixed, the cost per workload decreases as you consolidate more workloads onto a single host (Figure 13).

Other factors, such as automation, can also impact the cost of cloud operations. In some cases, cloud native IaaS can provide richer automation across the entire public cloud ecosystem (on a single cloud) whereas a VMware solution might require additional cloud management or automation tooling to create this more deeply integrated capability.

Another consideration might be ISV integrated tools. For instance, Microsoft has an Azure Backup solution that integrates directly with Azure native IaaS, therefore, it is likely that a separate solution for VMware in Azure would be required. However, you could also turn this on its head and consume the same backup solution in AVS as you deploy on-premises, simplifying the overall data protection capabilities across all cloud environments.

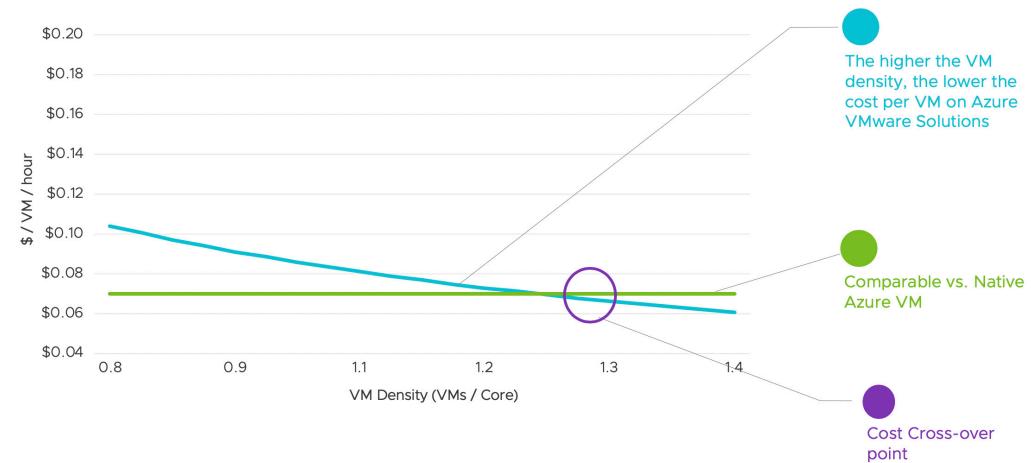


FIGURE 13. IaaS cloud cost model comparison (illustration purposes only)

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Multi-Cloud Drivers
Multi-Cloud Complexity

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Multi-Cloud Complexity
What Does Hybrid Cloud Mean
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Benefits of a
Homogeneous Approach
Bringing Together the Best
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Wrapping Up

In this eBook, I have looked at VMware Cloud's unique approach to delivering a multi-cloud architecture with a focus on the '*One Platform, Any Cloud*' approach taken by VMware. There are, as we have seen, many considerations around the consumption of these platforms and why you would elect to deploy one option over another.

Extending or migrating an on-premises infrastructure to the public cloud using a non-VMware approach can be time consuming, costly and fraught with complex cloud migration, implementation processes and challenges. In this scenario, customers must contend with differences in skill sets and tools required to manage these environments, typically leading to cloud silos.

In addition, separate access, security and networking policies, leading to inconsistencies in control, can make it extremely difficult to deliver on enterprise-level SLAs that promise consistent availability and performance across on-premises and public cloud applications.

In contrast, migrating from VMware on-premises to VMware in the cloud lets you seamlessly move workloads without the cost or complexity of refactoring applications. This approach allows you to manage workloads consistently across all environments.

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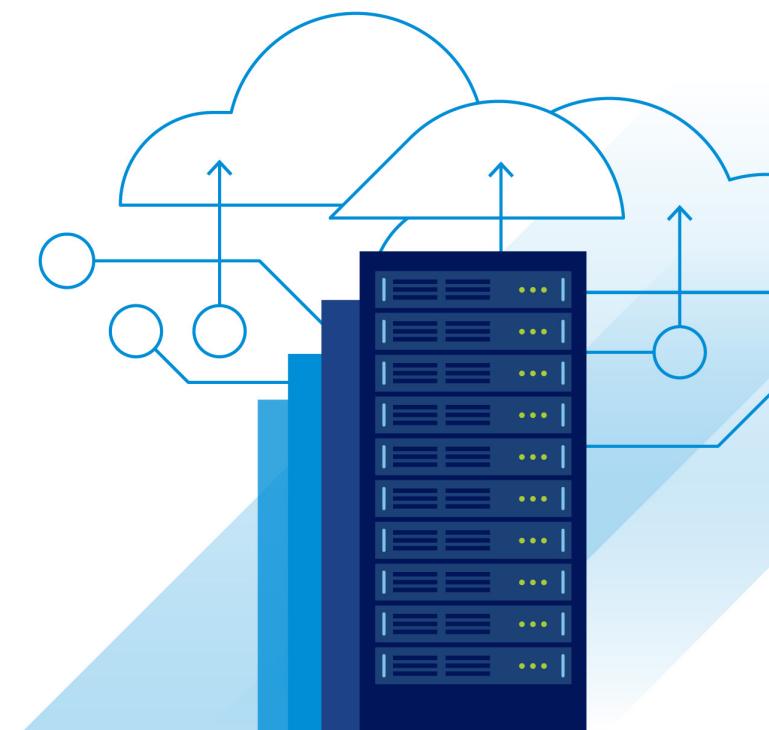
Public cloud IaaS vs. Running
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VMware is committed to creating a public cloud experience that is simply about consumption and aims to make cloud complexity invisible to the customer, thereby allowing organizations more time to focus on transforming their business. Leveraging VMware across cloud environments can reduce your operational burden by moving to an on-demand, self-service model while maintaining continuity with your existing tools, processes and skill sets. At the same time, you can still take advantage of native cloud services to supercharge your application portfolio, integrating emerging technologies such as AI, ML or IOT into existing or new applications.

These VMware on public cloud solutions make Hybrid Application Design a reality. Hybrid Application Design describes an application topology which spans both a VMware Cloud platform and native public services, with a unique solution that delivers a two-way high-bandwidth, low-latency interconnect with native services for hybrid application architectures. This allows customers to gain the benefits of native cloud services by incorporating them into application designs – in other words, binding VMware IaaS with public cloud services on a per-workload or application basis.

As we have looked at these different hybrid cloud solutions, hopefully you have seen that there is a lot of similarity across all of them. At the same time, each solution has key differentiating factors. For instance, VMware Cloud on AWS is the only solution designed, operated and sold by VMware. You may also have noticed that Microsoft with Azure VMware Solution has some key licensing advantages not available to any other public cloud vendor, and Oracle's offer differentiates by providing full customer management capabilities.

But the most important thing to keep in mind is this: They all deliver the flexibility, simplicity and control that many enterprise customers want to take with them to the public cloud.



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VMware Can Help You Architect a Successful Strategy

For help architecting a future state that accelerates your application modernization efforts, engage your local VMware team or one of the many thousands of partners that support VMware technologies. Working side by side with you, we can help architect an approach to application modernization that provides your organization with the best combination of choice, flexibility and operational simplicity.

About VMware Cloud

Redefine the foundation of IT with cloud capabilities, modern architectures, and consistent operations in the data center, any cloud, and edge for all applications. VMware Cloud transforms private data centers, hyperscalers, and remote sites into a unified and elastic multi-cloud platform with integrated compute, network, storage, security, Kubernetes, and cloud management optimized to securely and reliably deliver any application, everywhere.

About VMware Cloud Universal

VMware Cloud Universal is a flexible subscription that delivers enterprise-class multi-cloud infrastructure and operations combining compute, storage, networking, management, and modern app services with customer entitlements to flexibly deploy VMware Cloud across a customer-managed private cloud, a fully managed local cloud, or fully managed public cloud.



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