

VMware for Public Cloud

NetApp Solutions

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VMware for Public Cloud

Overview of NetApp Hybrid Multicloud with VMware

Most IT organizations follow the hybrid cloud-first approach. These organizations are in a transformation phase and customers are evaluating their current IT landscape and then migrating their workloads to the cloud based on the assessment and discovery exercise.

The factors for customers migrating to the cloud can include elasticity and burst, data center exit, data center consolidation, end-of-life scenarios, mergers, acquisitions, and so on. The reason for this migration can vary based on each organization and their respective business priorities. When moving to the hybrid cloud, choosing the right storage in the cloud is very important in order to unleash the power of cloud deployment and elasticity.

VMware Cloud options in Public Cloud

This section describes how each of the cloud providers support a VMware Software Defined Data Center (SDDC) and/or VMware Cloud Foundation (VCF) stack within their respective public cloud offerings.

Azure VMware Solution



Azure VMware Solution is a hybrid cloud service that allows for fully functioning VMware SDDCs within the Microsoft Azure public cloud. Azure VMware Solution is a first-party solution fully managed and supported by Microsoft, verified by VMware leveraging Azure infrastructure. This means that when Azure VMware Solution is deployed, customer's get VMware's ESXi for compute virtualization, vSAN for hyper-converged storage, and NSX for networking and security, all while taking advantage of Microsoft Azure's global presence, class-leading data center facilities and proximity to the rich ecosystem of native Azure services and solutions.

VMware Cloud on AWS



VMware Cloud on AWS brings VMware's enterprise-class SDDC software to the AWS Cloud with optimized access to native AWS services. Powered by VMware Cloud Foundation, VMware Cloud on AWS integrates VMware's compute, storage, and network virtualization products (VMware vSphere, VMware vSAN, and VMware NSX) along with VMware vCenter Server management, optimized to run on dedicated, elastic, bare-metal AWS infrastructure.

Google Cloud VMware Engine



Google Cloud VMware Engine is an infrastructure-as-a-service (laaS) offering built on Google Cloud's highly

performant scalable infrastructure and VMware Cloud Foundation stack – VMware vSphere, vCenter, vSAN, and NSX-T. This service enables a fast path to the cloud, seamlessly migrating or extending existing VMware workloads from on-premises environments to Google Cloud Platform without the cost, effort ,or risk of rearchitecting applications or retooling operations. It is a service sold and supported by Google, working closely with VMware.



SDDC private cloud and NetApp Cloud Volumes colocation provides the best performance with minimal network latency.

Did you know?

Regardless of the cloud used, when a VMware SDDC is deployed, the initial cluster includes the following products:

- VMware ESXi hosts for compute virtualization with a vCenter Server appliance for management
- VMware vSAN hyper-converged storage incorporating the physical storage assets of each ESXi host
- · VMware NSX for virtual networking and security with an NSX Manager cluster for management

Storage configuration

For customers planning to host storage-intensive workloads and scale out on any cloud-hosted VMware solution, the default hyper-converged infrastructure dictates that the expansion should be on both the compute and storage resources.

By integrating with NetApp Cloud Volumes, such as Azure NetApp Files, Amazon FSx for NetApp ONTAP, Cloud Volumes ONTAP (available in all three major hyperscalers), and Cloud Volumes Service for Google Cloud, customers now have options to independently scale their storage separately, and only add compute nodes to the SDDC cluster as needed.

Notes:

- VMware does not recommend unbalanced cluster configurations, hence expanding storage means adding more hosts, which implies more TCO.
- Only one vSAN environment is possible. Therefore, all storage traffic will compete directly with production workloads.
- There is no option to provide multiple performance tiers to align application requirements, performance, and cost.
- It is very easy to reach the limits of storage capacity of vSAN built on top of the cluster hosts. Use NetApp Cloud Volumes to scale storage to either host active datasets or tier cooler data to persistent storage.

Azure NetApp Files, Amazon FSx for NetApp ONTAP, Cloud Volumes ONTAP (available in all three major hyperscalers), and Cloud Volumes Service for Google Cloud can be used in conjunction with guest VMs. This hybrid storage architecture consists of a vSAN datastore that holds the guest operating system and application binary data. The application data is attached to the VM through a guest-based iSCSI initiator or the NFS/SMB mounts that communicate directly with Amazon FSx for NetApp ONTAP, Cloud Volume ONTAP, Azure NetApp Files and Cloud Volumes Service for Google Cloud respectively. This configuration allows you to easily overcome challenges with storage capacity as with vSAN, the available free space depends on the slack space and storage policies used.

Let's consider a three-node SDDC cluster on VMware Cloud on AWS:

- The total raw capacity for a three-node SDDC = 31.1TB (roughly 10TB for each node).
- The slack space to be maintained before additional hosts are added = 25% = (.25 x 31.1TB) = 7.7TB.
- The usable raw capacity after slack space deduction = 23.4TB
- The effective free space available depends on the storage policy applied.

For example:

- RAID 0 = effective free space = 23.4TB (usable raw capacity/1)
- RAID 1 = effective free space = 11.7TB (usable raw capacity/2)
- RAID 5 = effective free space = 17.5TB (usable raw capacity/1.33)

Thus, using NetApp Cloud Volumes as guest-connected storage would help in expanding the storage and optimizing the TCO while meeting the performance and data protection requirements.



In-guest storage was the only available option at the time this document was written. As supplemental NFS datastore support becomes available, additional documentation will be available here.

Points to Remember

- In hybrid storage models, place tier 1 or high priority workloads on vSAN datastore to address any specific latency requirements because they are part of the host itself and within proximity. Use in-guest mechanisms for any workload VMs for which transactional latencies are acceptable.
- Use NetApp SnapMirror® technology to replicate the workload data from the on-premises ONTAP system to Cloud Volumes ONTAP or Amazon FSx for NetApp ONTAP to ease migration using block-level mechanisms. This does not apply to Azure NetApp Files and Cloud Volumes Services. For migrating data to Azure NetApp Files or Cloud Volumes Services, use NetApp XCP, BlueXP Copy and Sync, rysnc or robocopy depending on the file protocol used.
- Testing shows 2-4ms additional latency while accessing storage from the respective SDDCs. Factor this additional latency into the application requirements when mapping the storage.
- For mounting guest-connected storage during test failover and actual failover, make sure iSCSI initiators are reconfigured, DNS is updated for SMB shares, and NFS mount points are updated in fstab.
- Make sure that in-guest Microsoft Multipath I/O (MPIO), firewall, and disk timeout registry settings are configured properly inside the VM.



This applies to guest connected storage only.

Benefits of NetApp cloud storage

NetApp cloud storage offers the following benefits:

- Improves compute-to-storage density by scaling storage independently of compute.
- Allows you to reduce the host count, thus reducing the overall TCO.
- Compute node failure does not impact storage performance.
- The volume reshaping and dynamic service-level capability of Azure NetApp Files allows you to optimize cost by sizing for steady-state workloads, and thus preventing over provisioning.
- The storage efficiencies, cloud tiering, and instance-type modification capabilities of Cloud Volumes

ONTAP allow optimal ways of adding and scaling storage.

- Prevents over provisioning storage resources are added only when needed.
- Efficient Snapshot copies and clones allow you to rapidly create copies without any performance impact.
- Helps address ransomware attacks by using quick recovery from Snapshot copies.
- Provides efficient incremental block transfer-based regional disaster recovery and integrated backup block level across regions provides better RPO and RTOs.

Assumptions

- SnapMirror technology or other relevant data migration mechanisms are enabled. There are many connectivity options, from on-premises to any hyperscaler cloud. Use the appropriate path and work with the relevant networking teams.
- In-guest storage was the only available option at the time this document was written. As supplemental NFS datastore support becomes available, additional documentation will be available here.



Engage NetApp solution architects and respective hyperscaler cloud architects for planning and sizing of storage and the required number of hosts. NetApp recommends identifying the storage performance requirements before using the Cloud Volumes ONTAP sizer to finalize the storage instance type or the appropriate service level with the right throughput.

Detailed architecture

From a high-level perspective, this architecture (shown in the figure below) covers how to achieve hybrid Multicloud connectivity and app portability across multiple cloud providers using NetApp Cloud Volumes ONTAP, Cloud Volumes Service for Google Cloud and Azure NetApp Files as an additional in-guest storage option.



NetApp Solutions for VMware in Hyperscalers

Learn more about the capabilities that NetApp brings to the three (3) primary hyperscalers - from NetApp as a guest connected storage device or a supplemental NFS datastore to migrating workflows, extending/bursting to the cloud, backup/restore and disaster recovery.

Pick your cloud and let NetApp do the rest!



(i)

To see the capabilities for a specific hyperscaler, click on the appropriate tab for that hyperscaler.

Jump to the section for the desired content by selecting from the following options:

- VMware in the Hyperscalers Configuration
- NetApp Storage Options
- NetApp / VMware Cloud Solutions

VMware in the Hyperscalers Configuration

As with on-premises, planning a cloud based virtualization environment is critical for a successful productionready environment for creating VMs and migration.

AWS / VMC

This section describes how to set up and manage VMware Cloud on AWS SDDC and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP to AWS VMC.

The setup process can be broken down into the following steps:

- Deploy and Configure VMware Cloud for AWS
- Connect VMware Cloud to FSx ONTAP

View the detailed configuration steps for VMC.

Azure / AVS

This section describes how to set up and manage Azure VMware Solution and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP to Azure VMware Solution.

The setup process can be broken down into the following steps:

- · Register the resource provider and create a private cloud
- · Connect to a new or existing ExpressRoute virtual network gateway
- · Validate the network connectivity and access the private cloud

View the detailed configuration steps for AVS.

GCP / GCVE

This section describes how to set up and manage GCVE and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP and Cloud Volumes Services to GCVE.

The setup process can be broken down into the following steps:

- · Deploy and Configure GCVE
- Enable Private Access to GCVE

View the detailed configuration steps for GCVE.

NetApp Storage Options

NetApp storage can be utilized in several ways - either as guest connected or as a supplemental NFS datastore - within each of the 3 major hyperscalers.

Please visit Supported NetApp Storage Options for more information.

AWS / VMC

AWS supports NetApp storage in the following configurations:

- · FSx ONTAP as guest connected storage
- Cloud Volumes ONTAP (CVO) as guest connected storage
- FSx ONTAP as a supplemental NFS datastore

View the detailed guest connect storage options for VMC. View the detailed supplemental NFS datastore options for VMC.

Azure / AVS

Azure supports NetApp storage in the following configurations:

- Azure NetApp Files (ANF) as guest connected storage
- Cloud Volumes ONTAP (CVO) as guest connected storage
- Azure NetApp Files (ANF) as a supplemental NFS datastore

View the detailed guest connect storage options for AVS. View the detailed supplemental NFS datastore options for AVS.

GCP / GCVE

Google Cloud supports NetApp storage in the following configurations:

- Cloud Volumes ONTAP (CVO) as guest connected storage
- · Cloud Volumes Service (CVS) as guest connected storage
- · Cloud Volumes Service (CVS) as a supplemental NFS datastore

View the detailed guest connect storage options for GCVE.

Read more about NetApp Cloud Volumes Service datastore support for Google Cloud VMware Engine (NetApp blog) or How to use NetApp CVS as datastores for Google Cloud VMware Engine (Google blog)

NetApp / VMware Cloud Solutions

With NetApp and VMware cloud solutions, many use cases are simple to deploy in your hyperscaler of choice. VMware defines the primary cloud workload use-cases as:

- Protect (includes both Disaster Recovery and Backup / Restore)
- Migrate
- Extend

AWS / VMC Browse the NetApp solutions for AWS / VMC
Azure / AVS Browse the NetApp solutions for Azure / AVS
GCP / GCVE Browse the NetApp solutions for Google Cloud Platform (GCP) / GCVE

Supported Configurations for NetApp Hybrid Multicloud with VMware

Understanding the combinations for NetApp storage support in the major hyperscalers.

	Guest Connected	Supplemental NFS Datastore
AWS	CVO FSx ONTAP Details	FSx ONTAP Details
Azur e	CVO ANF Details	ANF Details
GCP	CVO CVS Details	CVS Details

Configuring the virtualization environment in the cloud provider

Details for how to configure the virtualization environment in each of the supported hyperscalers are covered here.

AWS / VMC

This section describes how to set up and manage VMware Cloud on AWS SDDC and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP to AWS VMC.

The setup process can be broken down into the following steps:

- Deploy and Configure VMware Cloud for AWS
- Connect VMware Cloud to FSx ONTAP

View the detailed configuration steps for VMC.

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This section describes how to set up and manage Azure VMware Solution and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP to Azure VMware Solution.

The setup process can be broken down into the following steps:

- Register the resource provider and create a private cloud
- · Connect to a new or existing ExpressRoute virtual network gateway
- · Validate the network connectivity and access the private cloud

View the detailed configuration steps for AVS.

GCP / GCVE

This section describes how to set up and manage GCVE and use it in combination with the available options for connecting NetApp storage.



In-guest storage is the only supported method of connecting Cloud Volumes ONTAP and Cloud Volumes Services to GCVE.

The setup process can be broken down into the following steps:

- Deploy and Configure GCVE
- Enable Private Access to GCVE

View the detailed configuration steps for GCVE.

Deploy and configure the Virtualization Environment on AWS

As with on-premises, planning VMware Cloud on AWS is critical for a successful production-ready environment for creating VMs and migration.

This section describes how to set up and manage VMware Cloud on AWS SDDC and use it in combination with the available options for connecting NetApp storage.



In-guest storage is currently the only supported method of connecting Cloud Volumes ONTAP (CVO) to AWS VMC.

The setup process can be broken down into the following steps:

VMware Cloud on AWS provides for a cloud native experience for VMware based workloads in the AWS ecosystem. Each VMware Software-Defined Data Center (SDDC) runs in an Amazon Virtual Private Cloud (VPC) and provides a full VMware stack (including vCenter Server), NSX-T software-defined networking, vSAN software-defined storage, and one or more ESXi hosts that provide compute and storage resources to your workloads.

This section describes how to set up and manage VMware Cloud on AWS and use it in combination with Amazon FSx for NetApp ONTAP and/or Cloud Volumes ONTAP on AWS with in-guest storage.



In-guest storage is currently the only supported method of connecting Cloud Volumes ONTAP (CVO) to AWS VMC.

The setup process can be broken down into three parts:

Register for an AWS Account

Register for an Amazon Web Services Account.

You need an AWS account to get started, assuming there isn't one created already. New or existing, you need administrative privileges in the account for many steps in this procedure. See this link for more information regarding AWS credentials.

Register for a My VMware Account

Register for a My VMware account.

For access to VMware's cloud portfolio (including VMware Cloud on AWS), you need a VMware customer account or a My VMware account. If you have not already done so, create a VMware account here.

After the VMware account is configured and proper sizing is performed, deploying a Software-Defined Data Center is the obvious next step for using the VMware Cloud on AWS service. To create an SDDC, pick an AWS region to host it, give the SDDC a name, and specify how many ESXi hosts you want the SDDC to contain. If you don't already have an AWS account, you can still create a starter configuration SDDC that contains a single ESXi host.

1. Log into the VMware Cloud Console using your existing or newly created VMware credentials.

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VMware Cloud Services	
Sign in with your VMware account	
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userrume@email.com	
HEST.	
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CREATE YOUR VMWARE ACCOUNT	
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2. Configure the AWS region, deployment, and host type and the SDDC name:

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C Launchped	v 1. SDDC Properties	Give your SDDC a name, choose a size, and specify the AWS region where it will be created.			
Subscriptions Activity Log Tools Oeveloper Center	AWS Region Deployment Host Type SDDC Name Number of Hosts Host Capacity Total Capacity SHOW ADVANCED CONF	US West (Oregon)			
(DAR4	2 Connect to AWS	Specify the AWS account that you want to connect your SDDC with.			

3. Connect to the desired AWS account and execute the AWS Cloud Formation stack.

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Single-host configuration is used in this validation.

4. Select the desired AWS VPC to connect the VMC environment with.

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5. Configure the VMC Management Subnet; this subnet contains VMC-managed services like vCenter, NSX, and so on. Do not choose an overlapping address space with any other networks that need connectivity to the SDDC environment. Finally, follow the recommendations for CIDR size notated below.

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	Specify a private subnet range (Choose a range that will not ove Minimum CDR sizes: /23 for up 1 Reserved CDRs: 10.0.0.075, 172 Management Subnet ODB B Default: 11 NEXT	NPC 1918) to be used for vCenter Server, NSX Manager, and ESX hosts. riap with other networks or SDDC group members that connect to this SDDC. to 27 hosts, /20 for up to 251 hosts, /16 for up to 4091 hosts. .310.0/16.				
	5. Review and Acknowledge	Review and acknowledge cost before deployment				

6. Review and acknowledge the SDDC configuration, and then click deploy the SDDC.



The deployment process typically takes approximately two hours to complete.



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To connect VMware Cloud to FSx ONTAP, complete the following steps:

 With VMware Cloud deployment completed and connected to AWS VPC, you must deploy Amazon FSx for NetApp ONTAP into a new VPC rather than the original connected VPC (see the screenshot below). FSx (NFS and SMB floating IPs) is not accessible if it is deployed in the connected VPC. Keep in mind that ISCSI endpoints like Cloud Volumes ONTAP work just fine from the connected VPC.



2. Deploy an additional VPC in the same region, and then deploy Amazon FSx for NetApp ONTAP into the new VPC.

Configuration of an SDDC group in the VMware Cloud console enables the networking configuration options required to connect to the new VPC where FSx is deployed. In step 3, verify that "Configuring VMware Transit Connect for your group will incur charges per attachment and data transfers" is checked, and then choose Create Group. The process can take a few minutes to complete.



umm VMware Cloud		Ω ③ ^{Will Stowe} ∽
6.	< Create SDDC Group	
6. Launchpad		
SDDC1	1. Name and Description Name: sddcgroup01	
C Subscriptions	2. Membership Members 1	
= Activity Log	3. Acknowledgement	
i Tools - Developer Center	Please confirm that you are aware of the following before creating this SDDC Group. Configuring VMwere Transit Connect for your group will incur charges per attachment and deta transfers.	
	Create frewall rules to establish connectivity between the SDDCs in the group.	
C DADA		

3. Attach the newly created VPC to the just created SDDC group. Select the External VPC tab and follow the instructions for attaching an External VPC to the group. This process can take 10 to 15 minutes to complete.

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4. As part of the external VPC process, you are prompted through the AWS console to a new shared resource via the Resource Access Manager. The shared resource is the AWS Transit Gateway managed by VMware Transit Connect.

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5. Create the Transit Gateway Attachment.

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Details		
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Attachment type info		
VPC		
VPC attachment		
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VPC ID Select the VPC to attach to the trenkil ordeway		
une 0d1c754bcc405a805 (umcfex2 une)		

6. Back on the VMC Console, Accept the VPC attachment. This process can take approximately 10 minutes to complete.

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- 7. While in the External VPC tab, click the edit icon in the Routes column and add in the following required routes:
 - A route for the floating IP range for Amazon FSx for NetApp ONTAP floating IPs.
 - A route for the floating IP range for Cloud Volumes ONTAP (if applicable).
 - A route for the newly created external VPC address space.

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8. Finally, allow bidirectional traffic firewall rules for access to FSx/CVO. Follow these detailed steps for compute gateway firewall rules for SDDC workload connectivity.

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9. After the firewall groups are configured for both the Management and Compute gateway, the vCenter can be accessed as follows:

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The next step is to verify that Amazon FSx ONTAP or Cloud Volumes ONTAP is configured depending on your requirements and that the volumes are provisioned to offload storage components from vSAN to optimize the deployment.

Deploy and configure the Virtualization Environment on Azure

As with on-premises, planning Azure VMware Solution is critical for a successful production-ready environment for creating VMs and migration.

This section describes how to set up and manage Azure VMware Solution and use it in combination with the available options for connecting NetApp storage.

The setup process can be broken down into the following steps:

To use Azure VMware Solution, first register the resource provider within the identified subscription:

- 1. Sign in to the Azure portal.
- 2. On the Azure portal menu, select All Services.
- 3. In the All Services dialog box, enter the subscription and then select Subscriptions.
- 4. To view, select the subscription from the subscription list.
- 5. Select Resource Providers and enter Microsoft.AVS into the search.
- 6. If the resource provider is not registered, select Register.

Home > Subscriptions >					
Subscriptions « NetApp (cloudcontrolproduction.com)	Subscription		Resource providers		×
+ Add 📋 Manage Policies	P Search (Ctrl+/)		< Register 🏷 Unregister 🕐 Refresh		
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Provider	Status
Microsoft.OperationsManagement	Registered
Microsoft.Compute	Registered
Microsoft.ContainerService	📀 Registered
Microsoft.ManagedIdentity	Ø Registered
Microsoft.AVS	Registered
Microsoft.OperationalInsights	Registered
Microsoft.GuestConfiguration	Registered

- 7. After the resource provider is registered, create an Azure VMware Solution private cloud by using the Azure portal.
- 8. Sign in to the Azure portal.
- 9. Select Create a New Resource.
- 10. In the Search the Marketplace text box, enter Azure VMware Solution and select it from the results.
- 11. On the Azure VMware Solution page, select Create.
- 12. From the Basics tab, enter the values in the fields and select Review + Create.

Notes:

- For a quick start, gather the required information during the planning phase.
- Select an existing resource group or create a new resource group for the private cloud. A resource group is a logical container in which the Azure resources are deployed and managed.
- Make sure the CIDR address is unique and does not overlap with other Azure Virtual Networks or onpremises networks. The CIDR represents the private cloud management network and is used for the cluster management services, such as vCenter Server and NSX-T Manager. NetApp recommends using a /22 address space. In this example, 10.21.0.0/22 is used.

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Project details		
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CIDR address block		
Provide IP address for private cloue	d for cluster management. Make sure these are uniqu itworks.	e and do not overlap with an
other Azure vnets or on-premise n		

The provisioning process takes approximately 4–5 hours. After the process is complete, verify that the deployment was successful by accessing the private cloud from the Azure portal. A status of Succeeded is displayed when the deployment is complete.

An Azure VMware Solution private cloud requires an Azure Virtual Network. Because Azure VMware Solution doesn't support on-premises vCenter, additional steps are required to integrate with an existing on-premises environment. Setting up an ExpressRoute circuit and a virtual network gateway is also required. While waiting for the cluster provisioning to complete, create a new virtual network or use an existing one to connect to Azure VMware Solution.



To create a new Azure Virtual Network (VNet), select the Azure VNet Connect tab. Alternatively, you can create one manually from the Azure portal by using the Create Virtual Network wizard:

- 1. Go to Azure VMware Solution private cloud and access Connectivity under the Manage option.
- 2. Select Azure VNet Connect.
- 3. To create a new VNet, select the Create New option.

This feature allows a VNet to be connected to the Azure VMware Solution private cloud. The VNet enables communication between workloads in this virtual network by automatically creating required components (for example, jump box, shared services such as Azure NetApp Files, and Cloud Volume ONTAP) to the private cloud created in Azure VMware Solution over ExpressRoute.

Note: The VNet address space should not overlap with the private cloud CIDR.

🔎 Search (Ctrl+/)	×	🗄 Save 🕐 Refresh			
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Activity log					
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Tags		Jumpbox) to the private cloud create	d in Azure VMware	Solution over ExpressRoute. Onl	y a vNet with a valid
Diagnose and solve problems		address space does not overlap with network.	your private cloud	CIDR. Learn more about adding	a subnet in a virtual
Settings		Virtual network			~
A Locks			Create new		
Manage		Address block for vnet	*		
🔶 Connectivity		Address block for private cloud	10.21.0.0/2	22	Q
Identity					
Clusters					

4. Provide or update the information for the new VNet and select OK.

This virtual network enab Azure VMware Solution o default address range an 172.16.0.0/16). Step 2: Ad (e.g. 172.16.1.0/24). Lean	les the communication between workloads in this virtual n wer an Express route. A default address range and a subne d subnet of this virtual network, follow these steps. Step 1: Id a subnet under "Subnets" with the name as "GatewaySu i more about virtual networks ⊡"	etwork (e.g. a Jumphost) to the private cloud crea t is selected for this virtual network. For changing Change the "Address Range" to desired range (e.a bnet" and provide subnet's address range in CIDR	ted in the g. notation
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	(0 Addresses)	None	
Subnets			
The subnet's address ran	ge in CIDR notation (e.g. 10.0.0.0/24). It must be contained	by the address space of the virtual network.	
	Address sange	Addresses	
Subnet name	Houreastunge		
Subnet name	172.24.0.0/24	172.24.0.4 - 172.24.0.254 (251 addresses)	Ē

The VNet with the provided address range and gateway subnet is created in the designated subscription and resource group.

If you create a VNet manually, create a virtual network gateway with the appropriate SKU and ExpressRoute as the gateway type. After the deployment is complete, connect the ExpressRoute connection to the virtual network gateway containing Azure VMware Solution private cloud using the authorization key. For more information, see Configure networking for your VMware private cloud in Azure.

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Validate the network connect and access to Azure VMware Solution private cloud

Azure VMware Solution does not allow you to manage a private cloud with on-premises VMware vCenter. Instead, jump host is required to connect to the Azure VMware Solution vCenter instance. Create a jump host in the designated resource group and sign in to the Azure VMware Solution vCenter. This jump host should be a Windows VM on the same virtual network that was created for connectivity and should provide access to both vCenter and the NSX Manager.

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After the virtual machine is provisioned, use the Connect option to access RDP.

Virtual machine	st …
	▲ To improve security, enable just-in-time access on this VM, \rightarrow
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Sign in to vCenter from this newly created jump host virtual machine by using the cloud admin user . To access the credentials, go to the Azure portal and navigate to Identity (under the Manage option within the private cloud). The URLs and user credentials for the private cloud vCenter and NSX-T Manager can be copied from here.

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Placement policies (preview)	Ad	Imin password 💿		
+ Add-ons	Ce	ertificate thumbprint 🛈	B2B722EA683958283EE159007246D5166D0509D3	Ð

In the Windows virtual machine, open a browser and navigate to the vCenter web client URL (https://10.21.0.2/) and use the admin user name as **cloudadmin@vsphere.local** and paste the copied password. Similarly, NSX-T manager can also be accessed using the web client URL (https://10.21.0.3/) and use the admin user name and paste the copied password to create new segments or modify the existing tier gateways.



The web client URLs are different for each SDDC provisioned.



The Azure VMware Solution SDDC is now deployed and configured. Leverage ExpressRoute Global Reach to connect the on-premises environment to Azure VMware Solution private cloud. For more information, see Peer on-premises environments to Azure VMware Solution.

Deploy and configure the Virtualization Environment on Google Cloud Platform (GCP)

As with on-premises, planning Google Cloud VMware Engine (GCVE) is critical for a successful production-ready environment for creating VMs and migration.

This section describes how to set up and manage GCVE and use it in combination with the available options for connecting NetApp storage.

The setup process can be broken down into the following steps:

To configure a GCVE environment on GCP, login to the GCP console and access the VMware Engine portal.

Click on the "New Private Cloud" button and enter the desired configuration for the GCVE Private Cloud. On "Location", make sure to deploy the private cloud in the same Region/Zone where CVS/CVO is deployed, to ensure the best performance and lowest latency.

Pre-requisites:

- Setup VMware Engine Service Admin IAM role
- Enable VMWare Engine API access and node quota
- Make sure that the CIDR range doesn't overlap with any of your on-premises or cloud subnets. The CIDR range must be /27 or higher.

Ê	Private Cloud name *	
Home	NiMoGCVE	
esources	Location *	
A	us-east4 > v-zone-a > VE Placement Group 2	•
4etwork	Node type *	
A	ve1-standard-72	
hativity (C).	2x2.6 GHz, 36 Cores (72 HT), 768 GB RAM 19.2 TB Raw, 3.2 TB Cache (All-Flash)	
Account	Node count *	
	3	
	(3to3)	
	vSphere/vSAN subnets CIDR range *	
	192.168.100.0	/ 22 •
	IP Range: 192.168.100.0 - 192.168.103.255	
	HCX Deployment Network CIDR range	
	192.168.104.0	/ 26 •
	IP Range: 192.168.104.0 - 192.168.104.63	
Once the Private Cloud is provisioned, configure private access to the Private Cloud for high-throughput and low-latency data-path connection.

This will ensure that the VPC network where Cloud Volumes ONTAP instances are running is able to communicate with the GCVE Private Cloud. To do so, follow the GCP documentation. For the Cloud Volume Service, establish a connection between VMware Engine and Cloud Volumes Service by performing a one-time peering between the tenant host projects. For detailed steps, follow this link.

Tenant P 👫 🗍 🌲	Service	÷	Region	\$ Routing Mode	÷	Peered Project ID 👙	Peered VPC	$\frac{A}{T}$	VPC Peering Sta ≑	Region Status
ke841388caa56b	VPC Network		europe-west3	Global		cv-performance-te	cloud-volumes-vpc		 Active 	 Connected
jbd729510b3ebbf	NetApp CVS		europe-west3	Global		y2b6c17202af6dc	netapp-tenant-vpc		Active	Connected

Sign in to vcenter using the CloudOwner@gve.local user. To access the credentials, go to the VMware Engine portal, Go to Resources, and select the appropriate private cloud. In the Basic info section, click the View link for either vCenter login info (vCenter Server, HCX Manager) or NSX-T login info (NSX Manager).



In a Windows virtual machine, open a browser and navigate to the vCenter web client URL (https://10.0.16.6/) and use the admin user name as CloudOwner@gve.local and paste the copied password. Similarly, NSX-T manager can also be accessed using the web client URL (https://10.0.16.11/) and use the admin user name and paste the copied password to create new segments or modify the existing tier gateways.

For connecting from an on-premises network to VMware Engine private cloud, leverage cloud VPN or Cloud Interconnect for appropriate connectivity and make sure the required ports are open. For detailed steps, follow this link.



Deploy NetApp Cloud Volume Service supplemental datastore to GCVE

Refer Procedure to deploy supplemental NFS datastore with NetApp CVS to GCVE

NetApp Storage options for Public Cloud Providers

Explore the options for NetApp as storage in the three major hyperscalers.

AWS / VMC

AWS supports NetApp storage in the following configurations:

- FSx ONTAP as guest connected storage
- Cloud Volumes ONTAP (CVO) as guest connected storage
- FSx ONTAP as a supplemental NFS datastore

View the detailed guest connect storage options for VMC. View the detailed supplemental NFS datastore options for VMC.

Azure / AVS

Azure supports NetApp storage in the following configurations:

- Azure NetApp Files (ANF) as guest connected storage
- Cloud Volumes ONTAP (CVO) as guest connected storage
- Azure NetApp Files (ANF) as a supplemental NFS datastore

View the detailed guest connect storage options for AVS. View the detailed supplemental NFS datastore options for AVS.

GCP / GCVE

Google Cloud supports NetApp storage in the following configurations:

- Cloud Volumes ONTAP (CVO) as guest connected storage
- Cloud Volumes Service (CVS) as guest connected storage
- · Cloud Volumes Service (CVS) as a supplemental NFS datastore

View the detailed guest connect storage options for GCVE.

Read more about NetApp Cloud Volumes Service datastore support for Google Cloud VMware Engine (NetApp blog) or How to use NetApp CVS as datastores for Google Cloud VMware Engine (Google blog)

TR-4938: Mount Amazon FSx for ONTAP as a NFS datastore with VMware Cloud on AWS

Niyaz Mohamed, NetApp

Introduction

Every successful organization is on a path of transformation and modernization. As part of this process, companies typically use their existing VMware investments to leverage cloud benefits and exploring how to migrate, burst, extend, and provide disaster recovery for processes as seamlessly as possible. Customers migrating to the cloud must evaluate the use cases for elasticity and burst, data-center exit, data-center consolidation, end-of-life scenarios, mergers, acquisitions, and so on.

Although VMware Cloud on AWS is the preferred option for the majority of the customers because it delivers unique hybrid capabilities to a customer, limited native storage options have restricted its usefulness for organizations with storage-heavy workloads. Because storage is directly tied to hosts, the only way to scale storage is to add more hosts, which can increase costs by 35-40% or more for storage intensive workloads.

These workloads need additional storage and segregated performance, not additional horsepower, but that means paying for additional hosts. This is where the recent integration of FSx for ONTAP comes in handy for storage and performance intensive workloads with VMware Cloud on AWS.

Let's consider the following scenario: a customer requires eight hosts for horsepower (vCPU/vMem), but they also have a substantial requirement for storage. Based on their assessment, they require 16 hosts to meet storage requirements. This increases the overall TCO because they must buy all that additional horsepower when all they really need is more storage. This is applicable for any use case, including migration, disaster recovery, bursting, dev/test, and so on.

This document walks you through the steps necessary to provision and attach FSx for ONTAP as a NFS datastore for VMware Cloud on AWS.



This solution is also available from VMware. Please visit the VMware Cloud Tech Zone for more information.

Connectivity options

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VMware Cloud on AWS supports both multi-AZ and single-AZ deployments of FSx for ONTAP.

This section describes the high-level connectivity architecture along with the steps needed to implement the solution to expand the storage in a SDDC cluster without the need for adding additional hosts.



The high-level deployment steps are as follows:

- 1. Create Amazon FSx for ONTAP in a new designated VPC.
- 2. Create an SDDC group.
- 3. Create VMware Transit Connect and a TGW attachment.

- 4. Configure routing (AWS VPC and SDDC) and security groups.
- 5. Attach an NFS volume as a datastore to the SDDC cluster.

Before you provision and attach FSx for ONTAP as a NFS datastore, you must first set up a VMware on Cloud SDDC environment or get an existing SDDC upgraded to v1.20 or above. For more information, see the Getting Started With VMware Cloud on AWS.



FSx for ONTAP is not currently supported with stretched clusters.

Conclusion

This document covers the steps necessary to configure Amazon FSx for ONTAP with VMware cloud on AWS. Amazon FSx for ONTAP provides excellent options to deploy and manage application workloads along with file services while reducing the TCO by making data requirements seamless to the application layer. Whatever the use case, choose VMware Cloud on AWS along with Amazon FSx for ONTAP for rapid realization of cloud benefits, consistent infrastructure, and operations from on-premises to AWS, bidirectional portability of workloads, and enterprise-grade capacity and performance. It is the same familiar process and procedures used to connect storage. Remember, it is just the position of the data that changed along with new names; the tools and processes all remain the same, and Amazon FSx for ONTAP helps to optimize the overall deployment.

To learn more about this process, feel free to follow the detailed walkthrough video.

Amazon FSX for Ontap VMware Cloud

NetApp Guest Connected Storage Options for AWS

AWS supports guest connected NetApp storage with the native FSx service (FSx ONTAP) or with Cloud Volumes ONTAP (CVO).

FSx ONTAP

Amazon FSx for NetApp ONTAP is a fully managed service that provides highly reliable, scalable, highperforming, and feature-rich file storage built on NetApp's popular ONTAP file system. FSx for ONTAP combines the familiar features, performance, capabilities, and API operations of NetApp file systems with the agility, scalability, and simplicity of a fully managed AWS service.

FSx for ONTAP provides feature-rich, fast, and flexible shared file storage that's broadly accessible from Linux, Windows, and macOS compute instances running in AWS or on premises. FSx for ONTAP offers high-performance solid state drive (SSD) storage with submillisecond latencies. With FSx for ONTAP, you can achieve SSD levels of performance for your workload while paying for SSD storage for only a small fraction of your data.

Managing your data with FSx for ONTAP is easier because you can snapshot, clone, and replicate your files with the click of a button. In addition, FSx for ONTAP automatically tiers your data to lower-cost, elastic storage, lessening the need for you to provision or manage capacity.

FSx for ONTAP also provides highly available and durable storage with fully managed backups and support for cross-Region disaster recovery. To make it easier to protect and secure your data, FSx for ONTAP supports popular data security and antivirus applications.

Configure Amazon FSx for NetApp ONTAP with VMware Cloud on AWS

Amazon FSx for NetApp ONTAP files shares and LUNs can be mounted from VMs that are created within the VMware SDDC environment at VMware Cloud at AWS. The volumes can also be mounted on the Linux client and mapped on the Windows client using the NFS or SMB protocol, and LUNS can be accessed on Linux or Windows clients as block devices when mounted over iSCSI. Amazon FSx for the NetApp ONTAP file system can be set up quickly with the following steps.



Amazon FSx for NetApp ONTAP and VMware Cloud on AWS must be in the same availability zone to achieve better performance and avoid data transfer charges between availability zones.

To create and mount Amazon FSx for NetApp ONTAP file system, complete the following steps:

- 1. Open the Amazon FSx console and choose Create file system to start the file system creation wizard.
- 2. On the Select File System Type page, choose Amazon FSx for NetApp ONTAP, and then choose Next. The Create File System page appears.

Step 1 Select file system type	Select file system type			
Step 2 Specify file	File system options			
system details Ship 3 Review and create	Amazon F5x for NetApp ONTAP	C Amazon FSx for Windows File Server FSX Amazon FSx for Windows File Server	Amazon FSx for Lustre	
		Select file system type		

1. In the Networking section, for Virtual Private Cloud (VPC), choose the appropriate VPC and preferred subnets along with the route table. In this case, vmcfsx2.vpc is selected from the dropdown.

eation method	
 Quick create Use recommended best-practice configurations. Most configuration options can be changed after the file system is created. 	Standard create You set all of the configuration options, including specifying performance, networking, security, backups, and maintenance.

1. For the creation method, choose Standard Create. You can also choose Quick Create, but this document uses the Standard create option.

File system name - optional Inf	D	
vmcfsxval2		=
Maximum of 256 Unicode letters, whit	espace, and numbers, plus + - = : /	
SSD storage capacity Info		
1024 0		
Minimum 1024 GB; Maximum 192 TB.		
Provisioned SSD IOPS Amazon FSx provides 3 IOPS per GB of needed.	storage capacity. You can also provision additional SSD IOPS as	5
Automatic (3 IOPS per GB of	SSD storage)	
O User-provisioned		
Throughput capacity Info The sustained speed at which the file s	erver hosting your file system can serve data. The file server can me.	1 also

1. In the Networking section, for Virtual Private Cloud (VPC), choose the appropriate VPC and preferred subnets along with the route table. In this case, vmcfsx2.vpc is selected from the dropdown.

Virtual Private Cloud (VPC) Info	
vmcfsx2.vpc / vpc-0d1c764bcc495e805	
VPC Security Groups Info Specify VPC Security Groups to associate with your file system's network interface.	
Choose VPC security group(s)	v
sg-018896ea218164ccb (default) ×	
Preferred subnet Info Specify the preferred subnet for your file system.	
subnet02.sn subnet-013675849a5b99b3c (us-west-2b)	
Standby subnet	
subnet01.sn subnet-0ef956cebf539f970 (us-west-2a)	
VPC route tables Specify the VPC route tables associated with your file system.	
VPC's default route table	
Select one or more VPC route tables	
Endpoint IP address range Specify the IP address range in which the endpoints to access your file system will be created	
No preference	
Select an IP address range	



In the Networking section, for Virtual Private Cloud (VPC), choose the appropriate VPC and preferred subnets along with the route table. In this case, vmcfsx2.vpc is selected from the dropdown.

1. In the Security & Encryption section, for the Encryption Key, choose the AWS Key Management Service (AWS KMS) encryption key that protects the file system's data at rest. For the File System Administrative Password, enter a secure password for the fsxadmin user.

MCryption key Into WS Key Management Service (KMS) encryption key that protects	your file system data at re	st.
aws/fsx (default)		•
Description	Account	KMS key ID
Default master key that protects my FSx resources when no other key is defined	139763910815	72745367-7bb0-499c- acc0-4f2c0a80e7c5
ile system administrative password assword for this file system's "fsxadmin" user, which you can use t	to access the ONTAP CLI o	r REST API.
ile system administrative password assword for this file system's "fsxadmin" user, which you can use t) Don't specify a password	to access the ONTAP CLI o	r REST API.
ile system administrative password assword for this file system's "fsxadmin" user, which you can use 1) Don't specify a password) Specify a password	to access the ONTAP CLI o	r REST API.
ile system administrative password assword for this file system's "fsxadmin" user, which you can use t Don't specify a password Specify a password assword	to access the ONTAP CLI o	r REST API.
ile system administrative password assword for this file system's "fsxadmin" user, which you can use t Don't specify a password Specify a password assword	to access the ONTAP CLI o	r REST API.
ile system administrative password assword for this file system's "fsxadmin" user, which you can use t) Don't specify a password Specify a password assword ••••••• onfirm password	to access the ONTAP CLI o	r REST API.

 In virtual machine and specify the password to use with vsadmin for administering ONTAP using REST APIs or the CLI. If no password is specified, a fsxadmin user can be used for administering the SVM. In the Active Directory section, make sure to join Active Directory to the SVM for provisioning SMB shares. In the Default Storage Virtual Machine Configuration section, provide a name for the storage in this validation, SMB shares are provisioned using a self-managed Active Directory domain.

Storage virtual machine name	
vmcfsxval2svm	
SVM administrative password Password for this SVM's "vsadmin" user which you can use to access the ONTAP CLL or REST API.	
O Don't specify a password	
O Specify a password	
Password	
•••••	
Confirm password	

Active Directory	
 Do not join an Active Directory 	
Join an Active Directory	

1. In the Default Volume Configuration section, specify the volume name and size. This is an NFS volume. For Storage Efficiency, choose Enabled to turn on the ONTAP storage efficiency features (compression, deduplication, and compaction) or Disabled to turn them off.

Volume name	
vol1	
Maximum of 203 alphanumeric characters, plus	
Junction path	
/vol1	
The location within your file system where your volume will be mounted.	
Volume size	
1024	0
Minimum 20 MiB; Maximum 104857600 MiB	
Storage efficiency Select whether you would like to enable ONTAP storage efficiencies on your volume: deduplication compression, and compaction.	he i
 Enabled (recommended) 	
O Disabled	
Capacity pool tiering policy You can optionally enable automatic tiering of your data to lower-cost capacity pool storage.	
Auto	v

- 1. Review the file system configuration shown on the Create File System page.
- 2. Click Create File System.

ile systems	File system	ns (3)			C Attach	Actions 👻 🔽	reate file syste
ackups	O Eller Bl	in the second se					0.15
INTAP	C Phile In	- spanoriji					N . 7
torage virtual machines iolumes	File syste name	m File system I		File system type ⊽	Status	© Deployment type ⊽	Storage type ⊽
vindows File Server	O fsxnt	fs-014c2839	9be9c1f9f	ONTAP	O Available	Multi-AZ	SSD
ata repository tasks	O vmcf	sxval2 fs-040eacc5c	d0ac31017	ONTAP	⊘ Available	Multi-AZ	SSD
Sx on Service Quotas	O fsont	apsql d	ebd6082aa	ONTAP	⊘ Available	Multi-AZ	SSD
letwork & security Adn	ministration	Storage virtua	l machines	Volu	mes Backu	ps Tags	
torage virtual machin Q Find storage virtual mach	nes (SVMs) (a	2)	C	Acti	ons 🔻 Cr	eate storage virtua	al machine
SVM name 🔻	SVM ID	~	Status 🛡	Crea	ation time	▲ Active	Directory
fsxsmbtesting01	svm-075dcfbe	2cfa2ece9	⊘ Created	202 +01:	1-10-19 15:17:08 00	UTC FSXTE	STING.LOC
vmcfsxval2svm	svm-095db07	6341561212	⊘ Created	202 +01:	1-10-15 15:16:54 :00	UTC -	
 vmcfsxval2svm Storage virtual machines csmbtesting01 cummary 	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2	© ^{Created}	202 +01: :e9)	1-10-15 15:16:54 00	Delete	Updat
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vmcfsxval2svm Storage virtual machines csmbtesting01 summary VM ID vm-075dcfbe2cfa2ece9	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15:	© Created cfa2ec	202 +01:	1-10-15 15:16:54 00 Active Di FSXTEST	Pelete Pelete	Updat
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vmcfsxval2svm Storage virtual machines xsmbtesting01 Gummary VM ID vm-075dcfbe2cfa2ece9 VM name sxsmbtesting01 Gumpary	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15: Lifecycle state O Created Subtype	© Created	202 +01:	Active Di FSXTEST Net BIOS FSXSMB1 Fully qua	Pelete Delete rectory ING.LOCAL name rESTING01 Ilified domain name	Updat
vmcfsxval2svm Storage virtual machines csmbtesting01 cummary VM ID vm-075dcfbe2cfa2ece9 vM name sxsmbtesting01 UID a50e659-30e7-11ec-ac4f-	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15: Lifecycle state O Created Subtype DEFAULT	© Created	202 +01:	Active Di FSXTEST Fully qua FSXTEST	EUTC - Delete Petere Petere ING.LOCAL Ename RESTINGO1 Nified domain name ING.LOCAL	Updat
vmcfsxval2svm Storage virtual machines xsmbtesting01 summary VM ID vm-075dcfbe2cfa2ece9 vM name sxsmbtesting01 UID a50e659-30e7-11ec-ac4f- 3ad92a6a735	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15: Lifecycle state O Created Subtype DEFAULT	© Created	202 +01:	Active Di FSXTEST Net BIOS FSXSMB1 Fully qua FSXTEST Service a	EUTC - Delete Delete ING.LOCAL iname IESTINGO1 Ilified domain name ING.LOCAL ING.LOCAL	Updat
vmcfsxval2svm Storage virtual machines xsmbtesting01 Summary VM ID vm-075dcfbe2cfa2ece9 VM name sxsmbtesting01 JUID a50e659-30e7-11ec-ac4f- 3ad92a6a735 ile system ID	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15: Lifecycle state O Created Subtype DEFAULT	⊘ Created	202 +01:	1-10-15 15:16:54 00 Active Di FSXTEST Net BIOS FSXSMB1 Fully qua FSXTEST Service a administ	EUTC - Pelete Pelete Pelete ING.LOCAL Sename RESTINGO1 Niffied domain name ING.LOCAL ING.LOCAL ING.LOCAL ING.LOCAL	Updat
vmcfsxval2svm Storage virtual machines xsmbtesting01 ummary VM ID vm-075dcfbe2cfa2ece9 VM name sxsmbtesting01 uD a50e659-30e7-11ec-ac4f- 3ad92a6a735 ile system ID :040eacc5d0ac74017	svm-095db07 s > svm-075c (svm-07	6341561212 Icfbe2cfa2ece9 75dcfbe2c Creation time 2021-10-19T15: Lifecycle state O Created Subtype DEFAULT	© Created	202 +01:	Active Di FSXTEST Net BIOS FSXSMB1 Fully qua FSXTEST Service a administ	EUTC - Delete Delete ING.LOCAL in name IESTINGO1 Nified domain name ING.LOCAL incount username rator	Updat

For more detailed information, see Getting started with Amazon FSx for NetApp ONTAP.

After the file system is created as above, create the volume with the required size and protocol.

- 1. Open the Amazon FSx console.
- 2. In the left navigation pane, choose File systems, and then choose the ONTAP file system that you want to create a volume for.
- 3. Select the Volumes tab.
- 4. Select the Create Volume tab.
- 5. The Create Volume dialog box appears.

For demo purposes, an NFS volume is created in this section that can be easily mounted on VMs running on VMware cloud on AWS. nfsdemovol01 is created as depicted below:

	2
File system	
fs-040eacc5d0ac31017 vmcfsxval2	
Storage virtual machine	
svm-095db076341561212 vmcfsxval2svm	
Volume name	
nfsdemovol01	
Maximum of 203 alphanumeric characters, plus	
Junction path	
/nfsdemovol01	
The location within your file system where your volume will be mounted.	
Volume size	
1024	(0
Minimum 20 Mill; Maximum 104857600 Mill	
Storage efficiency	r volume: deduplication,
Select whether you would like to enable ONTAP storage efficiencies on you compression, and compaction.	
Select whether you would like to enable ONTAP storage efficiencies on you compression, and compaction. C Enabled (recommended)	
Select whether you would like to enable ONTAP storage efficiencies on you compression, and compaction. C Enabled (recommended) Disabled	
Select whether you would like to enable ONTAP storage efficiencies on you compression, and compaction. Enabled (recommended) Disabled Capacity pool tiering policy You can optionally enable automatic tiering of your data to lower-cost capa	city pool starage.

To mount the FSx ONTAP volume created in the previous step. from the Linux VMs within VMC on AWS SDDC, complete the following steps:

- 1. Connect to the designated Linux instance.
- 2. Open a terminal on the instance using Secure Shell (SSH) and log in with the appropriate credentials.
- 3. Make a directory for the volume's mount point with the following command:

```
$ sudo mkdir /fsx/nfsdemovol01
```

4. Mount the Amazon FSx for NetApp ONTAP NFS volume to the directory that is created in the previous step.

```
sudo mount -t nfs nfsvers=4.1,198.19.254.239:/nfsdemovol01
/fsx/nfsdemovol01
```

roat@ubuntu01:/fsx/nfsdemovol01# mount -t nfs 198.19.254.239:/nfsdemovol01 /fsx/nfsdemovol01

1. Once executed, run the df command to validate the mount.

🚱 vSphere - ubuntu01 - Summary ×	ubuntu01 ×	< +	0
$\leftarrow \rightarrow \mathbf{C}$	O A ≓ https://vcenter.sddc-5	52-37-127-104 vmwarevmc.com/ui/webconsole.html?vmld=vm-1003&vmName=ubuntu01&sen	
👲 Getting Started 🔋 EC2 Manager	nent Con 🝓 New Tab		
ubuntu01	root@ubuntu01:/fsx/ Filesystem tmofs /dev/mapper/ubuntu- tmofs tmofs tmofs tmofs tmofs tmofs 102.16.0.2:/mfsdemo 190.19.254.239:/mfs root@ubuntu01:/fsx/ root@ubuntu01:/fsx/	Chrisdemovol01# df IX-blacks Used Available Use% Hounted on 814396 1176 013220 1% /run vg-ubuntuiv 15412160 3666428 10943132 268 / 4071960 0 4071960 0% /run/lock 4096 0 4071960 0% /run/lock 4096 0 4096 0% /run/lock 4096 0 4096 0% /run/lock 814392 4 614398 1% /run/vser/1000 09561472 424175 5713660 43% /faxcortest ing0/nfsdemovol01 396160 512 395648 1% /fsx/nfsdemovol01 /ristdemovol01# cd /fax/nfsdemovol01/	View Fullscreen

Mount FSx ONTAP volume on Linux client

To manage and map file shares on an Amazon FSx file system, the Shared Folders GUI must be used.

- 1. Open the Start menu and run fsmgmt.msc using Run As Administrator. Doing this opens the Shared Folders GUI tool.
- 2. Click Action > All tasks and choose Connect to Another Computer.
- 3. For Another Computer, enter the DNS name for the storage virtual machine (SVM). For example, FSXSMBTESTING01.FSXTESTING.LOCAL is used in this example.



Tp find the SVM's DNS name on the Amazon FSx console, choose Storage Virtual Machines, choose SVM, and then scroll down to Endpoints to find the SMB DNS name. Click OK. The Amazon FSx file system appears in the list for the Shared Folders.

Management IP address

198.19.254.9

198.19.254.9

SMB IP address

198.19.254.9

iSCSI IP addresses

10.222.2.224, 10.222.1.94

NFS IP address

Endpoints

Management DNS name

svm-075dcfbe2cfa2ece9.fs-040eacc5d0ac31017.fsx.us-

west-2.amazonaws.com

NFS DNS name

svm-075dcfbe2cfa2ece9.fs-040eacc5d0ac31017.fsx.us-

west-2.amazonaws.com

SMB DNS name

FSXSMBTESTING01.FSXTESTING.LOCAL

iSCSI DNS name

iscsi.svm-075dcfbe2cfa2ece9.fs-040eacc5d0ac31017.fsx.us-

west-2.amazonaws.com	D
	Barrent

1. In the Shared Folders tool, choose Shares in the left pane to see the active shares for the Amazon FSx file system.

	2241 0000				
 Computer Management (FSXSMBTESTING01.FSXTESTING.LOCAL) System Tools Task Scheduler Event Viewer Shared Folders Shared Folders Sessions Open Files & Local Users and Groups M Performance Device Manager Storage Windows Server Backup Disk Management Services and Applications 	Share Name	Folder Path C:\ C:\smbdernovol01 C:\testnimvol	Type Windows Windows Windows	# Client Connections 0 1 1 0	Descriptio
1. Now choose a new share and complete	the Create	a Shared Fol	der wizar	d.	
Create A Shared Folder Wizard				×	
Name, Description, and Settings	đ			2	

Type information about the share for users. To modify how people use the content while offline, click Change.

hare path:	VFSXSMBTESTING01.FSXTESTING.LOCAL (nimtestsm	b01
escription:		
ffine setting:	Selected files and programs available offline	Change

reate A Shared Folder Wizard		×
	Sharing was Successful	
	Status:	
32	You have successfully completed the Share a Folder Wizard.	
	Summary:	<u> </u>
	You have selected the following share settings on \ \FSXSMBTESTING01.FSXTESTING.LOCAL: Folder path: C:\nimtestsmb01 Share name: nimtestsmb01 Share path: \FSXSMBTESTING01.FSXTESTING.LOCAL \nimtestsmb01	~
	When I click Finish, run the wizard again to share and folder	ther
	To dose this wizard, dick Finish.	
	Finish	ncel

To learn more about creating and managing SMB shares on an Amazon FSx file system, see Creating SMB Shares.

1. After connectivity is in place, the SMB share can be attached and used for application data. To accomplish this, Copy the share path and use the Map Network Drive option to mount the volume on the VM running on VMware Cloud on the AWS SDDC.

WMware Cloud Services - Log In ×	🕝 vSphere - vmcdc	01 - Summary ×	vmcdc01	×	Sign out	×	+		0	- 0
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😸 Getting Started 🥫 EC2 Manageme	ent Con 🥶 New Tal	έl.								C Other Bookma
vmcdc01								Enforce US 8	ayboard Layeut View	Fallstream Sand Ctrl+Alt+De
F Community Management File Action View Help		Hana Triev	Manage United	www.610.01186.01823438(2%)				- 0	×.	~ 0
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Connect a FSx for NetApp ONTAP LUN to a host using iSCSI

iSCSI traffic for FSx traverses the VMware Transit Connect/AWS Transit Gateway via the routes provided in the previous section. To configure a LUN in Amazon FSx for NetApp ONTAP, follow the documentation found here.

On Linux clients, make sure that the iSCSI daemon is running. After the LUNs are provisioned, refer to the detailed guidance on iSCSI configuration with Ubuntu (as an example) here.

In this paper, connecting the iSCSI LUN to a Windows host is depicted:

- 1. Access the NetApp ONTAP CLI using the management port of the FSx for the ONTAP file system.
- 2. Create the LUNs with the required size as indicated by the sizing output.

FsxId040eacc5d0ac31017::> lun create -vserver vmcfsxval2svm -volume
nimfsxscsivol -lun nimofsxlun01 -size 5gb -ostype windows -space
-reserve enabled

In this example, we created a LUN of size 5g (5368709120).

1. Create the necessary igroups to control which hosts have access to specific LUNs.

```
FsxId040eacc5d0ac31017::> igroup create -vserver vmcfsxval2svm -igroup
winIG -protocol iscsi -ostype windows -initiator ign.1991-
05.com.microsoft:vmcdc01.fsxtesting.local
FsxId040eacc5d0ac31017::> igroup show
Vserver
       Igroup Protocol OS Type Initiators
_____ ____
_____
vmcfsxval2svm
        ubuntu01 iscsi
                          linux iqn.2021-
10.com.ubuntu:01:initiator01
vmcfsxval2svm
        winIG
                   iscsi
                           windows iqn.1991-
05.com.microsoft:vmcdc01.fsxtesting.local
```

Two entries were displayed.

1. Map the LUNs to igroups using the following command:

FsxId040e /vol/nimf	acc5d0ac31017::> lun map -vserve sxscsivol/nimofsxlun01 -igroup w	r vmcfsx inIG	val2svm -	path
FsxId040e	acc5d0ac31017::> lun show			
Vserver Size	Path	State	Mapped	Туре
vmcfsxval	2svm			
5gb	/vol/blocktest01/lun01	online	mapped	linux
vmcfsxval	2svm			
5gb	/vol/nimfsxscsivol/nimofsxlun01	online	mapped	windows

Two entries were displayed.

1. Connect the newly provisioned LUN to a Windows VM:

To connect the new LUN tor a Windows host residing on VMware cloud on AWS SDDC, complete the following steps:

- a. RDP to the Windows VM hosted on the VMware Cloud on AWS SDDC.
- b. Navigate to Server Manager > Dashboard > Tools > iSCSI Initiator to open the iSCSI Initiator Properties dialog box.
- c. From the Discovery tab, click Discover Portal or Add Portal and then enter the IP address of the iSCSI target port.
- d. From the Targets tab, select the target discovered and then click Log On or Connect.
- e. Select Enable Multipath, and then select "Automatically Restore This Connection When the Computer Starts" or "Add This Connection to the List of Favorite Targets". Click Advanced.



The Windows host must have an iSCSI connection to each node in the cluster. The native DSM selects the best paths to use.

	New York Contraction of the Cont		And the second	
Quick Conne	ect		ptatus	
To discover DNS name of	r and log on to a target usin of the target and then dick	g a basic connection, type Quick Connect.	Quick Connect	:
Target:	10.222.2.221		Targets that are available for com- provided are listed below. If multip	ection at the IP address or DNS name that you le targets are available, you need to connect
Discovered	targets		to each target individually.	
			Connections made here will be add	ed to the list of Favorite Targets and an attempt
			to restore them will be made every	time this computer restarts.
Name		Sta		
ign. 1992-0	08.com.netapp:sn.264efe8	32dd911eca951d5f Co	Discovered targets	
			Name	Status
			m 1997-08 com netacours für	00xf3dr611aracaf Connerted
T		dente a terioret and there.		
To connect	using advanced options, si	slect a target and then	Progress report	
To connect click Conne To complete then click D	using advanced options, si ct. ely disconnect a target, sei isconnect.	elect a target and then	Progress report Login Succeeded.	
To connect dick Conne To complete then dick D For target ; select the t	using advanced options, so ct. ely disconnect a target, sel isconnect. properties, including configuraget and click Properties.	elect a target and then ect the target and iration of sessions,	Progress report Login Succeeded.	

LUNs on the storage virtual machine (SVM) appear as disks to the Windows host. Any new disks that are added are not automatically discovered by the host. Trigger a manual rescan to discover the disks by completing the following steps:

- 1. Open the Windows Computer Management utility: Start > Administrative Tools > Computer Management.
- 2. Expand the Storage node in the navigation tree.
- 3. Click Disk Management.
- 4. Click Action > Rescan Disks.

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Computer Management Basel	Volume == 700 == Rien Volume (E == System Reserves = System Reserves	ut pve (b)	Lagent 1 Sergie Re Sergie Re Sergie Re Sergie Re	er FARSystem is NTFS is NTFS is UDP is NTFS	n Boha Heathy (Boot, Pege Tila, Casto Dumy, Prinney Parkbon Heathy (Prinney Parkbon) Heathy (Navel Parkbon) Heathy (System, Active, Prinney Parkbon)	Capacity 89.45 GB 5.95 GB 4.92 GB 540 MB	7129 GB 7129 GB 9.95 GB 9.96 9.96 9.96 9.98 9.98 9.98 9.98 9.98	55 Free 2015 100 % 2015 2115			
	Dea 1 Basic 8.95 GB Online	New Volume 9.00 (d) NTF5 Healthy (Frie	dia wy Partita								
	en Disk Basic 405.55 CB	499.9tt Gill									2 MB Unafie
	Online										

When a new LUN is first accessed by the Windows host, it has no partition or file system. Initialize the LUN and, optionally, format the LUN with a file system by completing the following steps:

- 1. Start Windows Disk Management.
- 2. Right-click the LUN, and then select the required disk or partition type.
- 3. Follow the instructions in the wizard. In this example, drive F: is mounted.

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Cloud Volumes ONTAP (CVO)

Cloud volumes ONTAP, or CVO, is the industry-leading cloud data management solution built on NetApp's ONTAP storage software, available natively on Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP).

It is a software-defined version of ONTAP that consumes cloud-native storage, allowing you to have the same storage software in the cloud and on-premises, reducing the need to retrain you IT staff in all-new methods to

manage your data.

CVO gives customers the ability to seamlessly move data from the edge, to the data center, to the cloud and back, bringing your hybrid cloud together — all managed with a single-pane management console, NetApp Cloud Manager.

By design, CVO delivers extreme performance and advanced data management capabilities to satisfy even your most demanding applications in the cloud

Cloud Volumes ONTAP (CVO) as guest connected storage

Cloud Volumes ONTAP shares and LUNs can be mounted from VMs that are created in the VMware Cloud on AWS SDDC environment. The volumes can also be mounted on native AWS VM Linux Windows clients, and LUNS can be accessed on Linux or Windows clients as block devices when mounted over iSCSI because Cloud Volumes ONTAP supports iSCSI, SMB, and NFS protocols. Cloud Volumes ONTAP volumes can be set up in a few simple steps.

To replicate volumes from an on-premises environment to the cloud for disaster recovery or migration purposes, establish network connectivity to AWS, either using a site-to-site VPN or DirectConnect. Replicating data from on-premises to Cloud Volumes ONTAP is outside the scope of this document. To replicate data between on-premises and Cloud Volumes ONTAP systems, see Setting up data replication between systems.



Use the Cloud Volumes ONTAP sizer to accurately size the Cloud Volumes ONTAP instances. Also, monitor on-premises performance to use as inputs in the Cloud Volumes ONTAP sizer.

1. Log into NetApp Cloud Central; the Fabric View screen is displayed. Locate the Cloud Volumes ONTAP tab and select Go to Cloud Manager. After you are logged in, the Canvas screen is displayed.



1. On the Cloud Manager home page, click Add a Working Environment and then select AWS as the cloud and the type of the system configuration.

Cloud Ma	nager					Account Network		Workspace ~ doud,heroes	Connector ~ haven/connectio_	۵	6)	0	8
Canwas	Replication	Backup & Restore	KBs	Data Sense	File Cache	Compute	Sync	All Services (+8) ~					
Add Work	ting Environme	nt											×
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		Clou	ad Volumes O	NTAP	Cloud Volumes	ONTAP HA	Amazon	FSx for ONTAP					
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					Next	a 👔							Ŀ

1. Provide the details of the environment to be created including the environment name and admin credentials. Click Continue.

Previous Step	Instance Profile 139763910815 Credential Name Account ID	netapp.com-cloud-volumes Marketplace Subscription	Edit Credentials
	Details	Credentials	
	Working Environment Name (Cluster Name)	User Name	
	fsxcvotesting01	admin	
		Password	
	Add Tags Optional Field Up to four tags	******	
		Confirm Password	

1. Select the add-on services for Cloud Volumes ONTAP deployment, including BlueXP Classification, BlueXP backup and recovery, and Cloud Insights. Click Continue.

~		
Data Sense & Compliance	-	~
Backup to Cloud	-0	~
(III) Monitoring	-	~

1. On the HA Deployment Models page, choose the Multiple Availability Zones configuration.



1. On the Region & VPC page, enter the network information and then click Continue.

	US West Oregon US West Oregon Node 1: Availability Zone US:west-22	•	vpc-0d1c764bcc495e805 10.222.0.0/16	j. •		
	Availability Zone				Use a generated security grou	up +
	Availability Zone		Node 2:		Mediator:	
	Availability Zone		ETTINC CHILDREN			
	LIS-West-25		Availability Zone		Availability Zone	
	warman-ad	· · · ·	us-west-2b		us-west-2c	•?
	Subnet		Subnet		Subnet	
	10.222.1.0/24		10.222.2.0/24	•	10.222.3.0/24	•
Previous Step	Nodes				Mediator	
	SSH Authenticati	ion Method	0	Security G	roup	
	Password		٠	Use a ge	nerated security group	
				Key Pair N	ame	-
				nimokey	•	•
				Internet C	onnection Method	
				Public IP	address	-

			0		
Previous Step	Floating IP addresses a	re required for cluster and SVM a	ccess and for NFS and CIFS da	ata access. These floating IPs	can migrate betwe
	You mu	st specify IP addresses that are o	utside of the CIDR blocks for a	Il VPCs in the selected AWS r	egion.
					0
		Floating IP address for	cluster management		
		172-1000-1			
		Floating IP address 1 fo	or NFS and CIFS data		
		172.16.0.2			
		Floating IP address 2 fo	or NFS and CIFS data		
		172.16.0.3			
		Floating IP address for	SVM management (Optional)		
		172.16.0.4			
Continue.	invironment	F	Route Tables		
Continue. Create a New Working E Previous Step	invironment Select the route tables th pair. If you lear	at should include routes to the flo	Route Tables ating IP addresses. This enable that are associated with the re	s client access to the Cloud V oute table cannot access the l	olumes ONTAP HA HA pair.
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	onment	Data Encryptic	n				
 Previous Step 	AWS Man	aged Encryption					
	AWS is responsit is handled by AW	AWS is responsible for data encryption and decryption operations. Key managemen is handled by AWS key management services.					
	Default Master K	ey: aws/ebs	ar Change Key				
 Select the license Pay-As-You-Go o 	e option: Pay-As-You-Go or BY0	Continue DL for using an existing I	icense. In this example, the				
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1. On the Review & Approve page, review and confirm the selections. To create the Cloud Volumes ONTAP instance, click Go.

revious Step TSXCvotesting	HA		Show API n	equest
This Cloud Volumes ON	TAP instance will be registered with NetApp support unde	r the NSS Account mchad.		
• I understand that (loud Manager will allocate the appropriate AWS resources	s to comply with my above requirements. Mor	re information >	
Overview	Networking Storage			
Overview Storage System:	Networking Storage Cloud Volumes ONTAP HA	HA Deployment Model:	Multiple Availability Zones	
Overview Storage System: License Type:	Networking Storage Cloud Volumes ONTAP HA Cloud Volumes ONTAP Explore	HA Deployment Model: Encryption:	Multiple Availability Zones AWS Managed	

1. After Cloud Volumes ONTAP is provisioned, it is listed in the working environments on the Canvas page.



1. After the working environment is ready, make sure the CIFS server is configured with the appropriate DNS and Active Directory configuration parameters. This step is required before you can create the SMB volume.

Volumes HA Status Cost Replications			0 0	C	٩	4-	Ξ
Create a CIFS server		+ Advanced					
DNS Primary IP Address	Active Directory Domain	tojain					
192.168.1.3	fixtesting.local						
DNS Secondary IP Address (Optional)	Credentials authorized to	join the domain					
Example: 127.0.0.1	Username	Password					

1. Select the CVO instance to create the volume and click the Create Volume option. Choose the appropriate size and cloud manager chooses the containing aggregate or use advanced allocation mechanism to place on a specific aggregate. For this demo, SMB is selected as the protocol.

Details & Protection			Protocol		
Volume Name:	Size (G8):	0	NFS	CIFS	iSCSI
smbdemovol01	100	-			
			Share name:	Permissions	
Snapshot Policy:			smbdemovol01_share	Full Contro	• Io
default		-			
Default Policy			Users / Groups:		
			Everyone;		
			Valid users and groups separa	ted by a semicolon	

1. After the volume is provisioned, it is availabe under the Volumes pane. Because a CIFS share is provisioned, you should give your users or groups permission to the files and folders and verify that those users can access the share and create a file.

INFO		CAPACITY	
Disk Type	GP2		1.67 MB
Tiering Policy	None	10 GB	EBS Used
Backup	OFF	Allocated	

- 1. After the volume is created, use the mount command to connect to the share from the VM running on the VMware Cloud in AWS SDDC hosts.
- 2. Copy the following path and use the Map Network Drive option to mount the volume on the VM running on the VMware Cloud in AWS SDDC.

(HA) fsxcvotesting01 (Multiple AZs)	AWS
Volumes HA Status Cost Replications	<u>ර</u> එ (@)
Mount Volume smbdemovol01	
Access from inside the VPC using Floating IP	Access from outside the VPC using AWS Private IP
Auto failover between nodes	No auto failover between nodes
The IP address automatically migrates between nodes if failures occur	The IP address does not migrate between nodes if failures occur
Go to your machine and enter this command	To avoid traffic between nodes, mount the volume by using the primary node's IP address:
\\172.16.0.2\smbdemovol01_share	\\10.222.1.100\smbdemovo101_share
	If the primary pode oper offline, mount the volume by using the Mé partner's IP address:



Connect the LUN to a host

To connect the Cloud Volumes ONTAP LUN to a host, complete the following steps:

- 1. On the Cloud Manager Canvas page, double-click the Cloud Volumes ONTAP working environment to create and manage volumes.
- 2. Click Add Volume > New Volume, select iSCSI, and click Create Initiator Group. Click Continue.

	Details & Prote	ction			Protoc	ol		
	Volume Name:		Size (GB):			NFS	CIFS	iscsi
	nimofsxiscsicvo01		500					What about LUNs?
	Snapshot Policy:				Initiator	Group 🛞		
	default			3. • 3	 Map 	Existing Initiate	or Groups	Create Initiator Group
	Default Policy				Operatin	g System Type		_
					Windo	ws		•
					2000000			11100
					Select In	winiG windo	ws	1 (of 3) Groups
						ign.1991-05.co	m.microsoft:vm	cdc01.fsxtestin
→ C Getting Started <mark>©</mark> EC2 Manageme	A ## https://vcenters ent.Con New Tab	sddc-52-37-127-104 vmv	warevmc.com/ui/v	vebconsole.hl	pp Cloud Manager tml?vmld=vm-1(× + 0058cvmName=vr	ncdc01 80% 😭	C den Bo
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Getting Started Getting Started EC2 Management EC2 Management EC2 Management Server Manager • Ec2 Management Server Manager • Ec2 Management Server Manager • Ec2 Management Ec2	A # https://vcenter. ent Con New Tab Dashboard O terves M Out of the o	addc-52-37-127-104.vmv	Andrewine, com//ui/	verboomspile.ht	tmi/hmidison-10	× + 205.5omName -vr E - * * *	necic01 eons 😭	C L Coher Bo
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1. After the volume is provisioned, select the volume, and then click Target IQN. To copy the iSCSI Qualified Name (IQN), click Copy. Set up an iSCSI connection from the host to the LUN.

To accomplish the same for the host residing on the VMware Cloud on AWS SDDC, complete the following steps:

a. RDP to the VM hosted on VMware cloud on AWS.

- b. Open the iSCSI Initiator Properties dialog box: Server Manager > Dashboard > Tools > iSCSI Initiator.
- c. From the Discovery tab, click Discover Portal or Add Portal and then enter the IP address of the iSCSI target port.
- d. From the Targets tab, select the target discovered and then click Log On or Connect.
- e. Select Enable Multipath, and then select Automatically Restore This Connection When the Computer Starts or Add This Connection to the List of Favorite Targets. Click Advanced.



The Windows host must have an iSCSI connection to each node in the cluster. The native DSM selects the best paths to use.

gets Di	scovery Favorite Targets Volumes and Devices R	ADIUS Configuration
uid: Conr	wet	
o discove NS name	er and log on to a target using a basic connection, type of the target and then click Quick Connect.	the IP address or
arget	172-24.2.9	Quick Connect
iscovered	d targets	
		Refresh
Name		SVI
	26	stus
	Pe	shas
'o connec	tusing advanced options, select a target and then ect.	Connect
'o connec lick Conn 'o comple hen click (t using advanced options, select a target and then ect. tely disconnect a target, select the target and Disconnect.	Connect
o connec lick Conne o comple hen click i or target elect the	t using advanced options, select a target and then ect. tely disconnect a target, select the target and Disconnect. (properties, including configuration of sessions, target and click Properties.	Connect Deconnect Propertes

LUNs from the SVM appear as disks to the Windows host. Any new disks that are added are not automatically discovered by the host. Trigger a manual rescan to discover the disks by completing the following steps:

- 1. Open the Windows Computer Management utility: Start > Administrative Tools > Computer Management.
- 2. Expand the Storage node in the navigation tree.
- 3. Click Disk Management.
- 4. Click Action > Rescan Disks.

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When a new LUN is first accessed by the Windows host, it has no partition or file system. Initialize the LUN; and optionally, format the LUN with a file system by completing the following steps:

- 1. Start Windows Disk Management.
- 2. Right-click the LUN, and then select the required disk or partition type.
- 3. Follow the instructions in the wizard. In this example, drive F: is mounted.

VMware Cloud Servi	ices - Log In I	x ØvSphe	ne - vmcdc01 - Summ	ary × vmodc01	× Net	App Cloud Manager	× +	~	- 0	• ×
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On the Linux clients, ensure the iSCSI daemon is running. After the LUNs are provisioned, refer to the detailed guidance on iSCSI configuration for your Linux distribution. For example, Ubuntu iSCSI configuration can be found here. To verify, run lsblk cmd from the shell.

To mount the Cloud Volumes ONTAP (DIY) file system from VMs within VMC on AWS SDDC, complete the following steps:

- 1. Connect to the designated Linux instance.
- 2. Open a terminal on the instance using secure shell (SSH) and log in with the appropriate credentials.
- 3. Make a directory for the volume's mount point with the following command.

\$ sudo mkdir /fsxcvotesting01/nfsdemovol01

4. Mount the Amazon FSx for NetApp ONTAP NFS volume to the directory that is created in the previous step.

sudo mount /fsxcvotes	-t nfs nfsvers=4.1,172.16.0.2:/nfsdemovol01 ting01/nfsdemovol01	
root@ubuntu01:/fs	κ# mount −t nfs 172.16.0.2:/nfsdemovol01 /fsxcvotesting01/nfsdemovo	101_
🕼 vSphere - ubuntu01 - Summary ×	ubuntu01 × +	¢
← → ♂	O A ≠ https://wenter.sddc-52-37-127-104.vmwarevmc.com/ui/webconsole.html?/vmld=vm-10038vmName=ubuntu018isere &	
ubuntu01	Enforce US Keyboard Layout View Fi	uliscreer
	root@ubuntu011/fsx/mfsdemov0101# df Filesystem tmpfs	

Overview of ANF Datastore Solutions

Every successful organization is on a path of transformation and modernization. As part of this process, companies typically use their existing VMware investments while leveraging cloud benefits and exploring how to make migration, burst, extend, and disaster recovery processes as seamless as possible. Customers migrating to the cloud must evaluate the issues of elasticity and burst, data center exit, data center consolidation, end- of- life scenarios, mergers, acquisitions, and so on. The approach adopted by each organization can vary based on their respective business priorities. When choosing cloud-based operations, selecting a low- cost model with appropriate performance and minimal hindrance is a critical goal. Along with choosing the right platform, storage and workflow orchestration is particularly important to unleash the power of cloud deployment and elasticity.

Use Cases

Although the Azure VMware solution delivers unique hybrid capabilities to a customer, limited native storage options have restricted its usefulness for organizations with storage-heavy workloads. Because storage is directly tied to hosts, the only way to scale storage is to add more hosts, which can increase costs by 35-40% or more for storage intensive workloads. These workloads need additional storage, not additional horsepower, but that means paying for additional hosts.

Let's consider the following scenario; a customer requires six hosts for horsepower (vCPU/vMem), but they also have a substantial requirement for storage. Based on their assessment, they require 12 hosts to meet storage requirements. This increases the overall TCO because they must buy all that additional horsepower when all they really need is more storage. This is applicable for any use case, including migration, disaster recovery, bursting, dev/test, and so on.

Another common use case for Azure VMware Solution is disaster recovery (DR). Most organizations do not have a fool- proof DR strategy, or they might struggle to justify running a ghost datacenter just for DR. Administrators might explore zero- footprint DR options with a pilot- light cluster or an on-demand cluster. They could then scale the storage without adding additional hosts, potentially an attractive option.

So, to summarize, the use cases can be classified in two ways:

- · Scaling storage capacity using ANF datastores
- Using ANF datastores as a disaster recovery target for a cost- optimized recovery workflow from onpremises or within Azure regions between the software-defined datacenters (SDDCs). This guide provides insight into using Azure NetApp Files to provide optimized storage for datastores (currently in public preview) along with best-in-class data protection and DR capabilities in an Azure VMware solution, which enables you to offload storage capacity from vSAN storage.



Contact NetApp or Microsoft solution architects in your region for additional information on using ANF datastores.

VMware Cloud options in Azure

Azure VMware Solution

The Azure VMware Solution (AVS) is a hybrid cloud service that provides fully functioning VMware SDDCs within a Microsoft Azure public cloud. AVS is a first-party solution fully managed and supported by Microsoft and verified by VMware that uses Azure infrastructure. Therefore, customers get VMware ESXi for compute virtualization, vSAN for hyper-converged storage, and NSX for networking and security, all while taking advantage of Microsoft Azure's global presence, class-leading data center facilities, and proximity to the rich ecosystem of native Azure services and solutions. A combination of Azure VMware Solution SDDC and Azure NetApp Files provides the best performance with minimal network latency.

Regardless of the cloud used, when a VMware SDDC is deployed, the initial cluster includes the following components:

- VMware ESXi hosts for compute virtualization with a vCenter server appliance for management.
- VMware vSAN hyper-converged storage incorporating the physical storage assets of each ESXi host.
- VMware NSX for virtual networking and security with an NSX Manager cluster for management.

Conclusion

Whether you are targeting all-cloud or hybrid cloud, Azure NetApp files provide excellent options to deploy and
manage the application workloads along with file services while reducing the TCO by making the data requirements seamless to the application layer. Whatever the use case, choose Azure VMware Solution along with Azure NetApp Files for rapid realization of cloud benefits, consistent infrastructure, and operations across on-premises and multiple clouds, bi-directional portability of workloads, and enterprise-grade capacity and performance. It is the same familiar process and procedures used to connect the storage. Remember, it is just the position of the data that changed along with new names; the tools and processes all remain the same, and Azure NetApp Files helps in optimizing the overall deployment.

Takeaways

The key points of this document include:

- You can now use Azure NetApp Files as a datastore on AVS SDDC.
- Boost the application response times and deliver higher availability to provide access workload data when and where it is needed.
- Simplify the overall complexity of the vSAN storage with simple and instant resizing capabilities.
- Guaranteed performance for mission-critical workloads using dynamic reshaping capabilities.
- If Azure VMware Solution Cloud is the destination, Azure NetApp Files is the right storage solution for optimized deployment.

Where to find additional information

To learn more about the information described in this document, refer to the following website links:

• Azure VMware Solution documentation

https://docs.microsoft.com/en-us/azure/azure-vmware/

Azure NetApp Files documentation

https://docs.microsoft.com/en-us/azure/azure-netapp-files/

• Attach Azure NetApp Files datastores to Azure VMware Solution hosts (Preview)

https://docs.microsoft.com/en-us/azure/azure-vmware/attach-azure-netapp-files-to-azure-vmware-solution-hosts?tabs=azure-portal/

NetApp Guest Connected Storage Options for Azure

Azure supports guest connected NetApp storage with the native Azure NetApp Files (ANF) service or with Cloud Volumes ONTAP (CVO).

Azure NetApp Files (ANF)

Azure netApp Files brings enterprise-grade data management and storage to Azure so you can manage your workloads and applications with ease. Migrate your workloads to the cloud and run them without sacrificing performance.

Azure netApp Files removes obstacles, so you can move all of your file-based applications to the cloud. For the first time, you do not

have to re-architect your applications, and you get persistent storage for your applications without complexity.

Because the service is delivered through the Microsoft Azure Portal, users experience a fully managed service as part of their Microsoft enterprise Agreement. World-class support, managed by Microsoft, gives you complete peace of mind. This single solution enables you to quickly and easily add multiprotocol workloads. you can build and deploy both Windows and Linux file-based applications, even for legacy environments.

Azure NetApp Files (ANF) as guest connected storage

Configure Azure NetApp Files with Azure VMware Solution (AVS)

Azure NetApp Files shares can be mounted from VMs that are created in the Azure VMware Solution SDDC environment. The volumes can also be mounted on the Linux client and mapped on the Windows client because Azure NetApp Files supports SMB and NFS protocols. Azure NetApp Files volumes can be set up in five simple steps.

Azure NetApp Files and Azure VMware Solution must be in the same Azure region.

To create and mount Azure NetApp Files volumes, complete the following steps:

1. Log in to the Azure Portal and access Azure NetApp Files. Verify access to the Azure NetApp Files service and register the Azure NetApp Files Resource Provider by using the *az provider register --namespace Microsoft.NetApp –wait* command. After registration is complete, create a NetApp account.

For detailed steps, see Azure NetApp Files shares. This page will guide you through the step-by-step process.

	ources, services, and docs (G+/)		53	Q	P	٢	?	1
Home > Azure NetApp Files >								
Azure NetApp Files « etApp (cloudcontrolproduction.com)	New NetApp account							
🕂 Create 🛛 🕲 Manage view 🗸 …	Name *							
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	Create new							
NetApp accounts to display	Location *							
re NetApp Files makes it easy to migrate and	East US 2	~]					
complex, file-based applications with no code nge. With support for multiple protocols and rated data protection, storage management is simple, fast, and reliable.								
Create NetApp account								
Learn more of	Create Download a template for automation							

2. After the NetApp account is created, set up the capacity pools with the required service level and size.

For more information, see Set up a capacity pool.

Azure NetApp Files « NetApp (cloudcontrolpreduction.com)		mo	Capacity	pools		Name *	
+ Create 🔘 Manage view 🧹 …	,D Search (Ctrl+/)	- 0C	+ Add pool	Refresh		nimcappool	y.
Filter for any field.	Azure NetApp Files	^	D Search recol	1		Service level • 💿	
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m nimoAVSANFdemo ····	Storage service		You don't have	any capacity pools. Click	Add pool to get started	Size (TiB) * 🕜	
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	Storage service add-ons						
	NetApp add-ons						
	Automation						
< Page 1 V of 1 >	R Tasks (preview)					Create Discard	

3. Configure the delegated subnet for Azure NetApp Files and specify this subnet while creating the volumes. For detailed steps to create delegated subnet, see Delegate a subnet to Azure NetApp Files.

nimoayspriv-yp	et Subnets	Add subnet	
Virtual network] « + Subnet -	Name *	
 Overview 	▲	Subnet address range * 💿	
Activity log		172.24.3.0/28	~
Access control (IAM)	Name ↑↓	172.24.3.0 - 172.24.3.15 (11	+ 5 Azure reserved addresses
🧳 Tags	GatewaySubne	Add IPv6 address space 💿	
Diagnose and solve problems	VMSubnet	NAT gateway 💿	
	StorageSubnet	None	~
Settings	<	Network security group	
Address space		None	~
Ø Connected devices		Route table	
Subnets		None	~
ODoS protection			
🛖 Firewall		PERIOD PRODUCTION	
G Security		Save Cancel	

4. Add an SMB volume by using the Volumes blade under the Capacity Pools blade. Make sure the Active Directory connector is configured prior to creating the SMB volume.

Azure NetApp Files « NetApp (cloudcontrolproduction.com)	nimoAVSANFdemo NetApp account	Active Directory connections	Primary DNS* ③
+ Create 🔞 Manage view 🖂 👓	C Search (Ctrl+/)	S Join 🕐 Refresh	172.24.1.5
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Name 1.	Access control (IAM)	No surranthy Joined Arthus Directorian	
nimoAV/SANFdemo ····	Tans	<	AD DNS Domain Name * 💿
	· ings		nimodemo.com
	Settings		AD Site Name ①
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	III Properties		SMB Server (Computer Account) Prefix * 🔘
	🔒 Locks		nimsmb
	Azure NetApp Files		Organizational Unit Path 💿
	Active Directory connections		
	Storage service		
< Page 1 V of 1 >	S Capacity pools		Join

5. Click Review + Create to create the SMB volume.

If the application is SQL Server, then enable the SMB continuous availability.

	mo	Volumes		Create a volume		>
,P Search (Otrl+/)	4	+ Add volume じ Refresh				
Azure NetApp Files	•	prigoscontente contractores and	^	Basics Protocol Tags R	Review + create	
Active Directory connections		Name T ₄ Quota		This page will help you create an A volume from within your virtual net	zure NetApp Files volume in your subscriptio twork. Learn more about Azure NetApp File	on and enable you to access the s
Storage service		You don't have any volumes. Click	Add vo	Volume details		
E Capacity pools		¢	>	Volume name *	ninvoltest1	2
				and the former of the former o		
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🗧 nimoAVSAN	Fdemo	Volumes	459 459										
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Annual March Street Tiller		nimvoltes	1	100 Gi8		1.6 MB/s		NES-3	172.24.3.4./nim	voltest1	Standard		nimcappo

To learn more about Azure NetApp Files volume performance by size or quota, see Performance considerations for Azure NetApp Files.

6. After the connectivity is in place, the volume can be mounted and used for application data.

To accomplish this, from the Azure portal, click the Volumes blade, and then select the volume to mount and access the mount instructions. Copy the path and use the Map Network Drive option to mount the volume on the VM running on Azure VMware Solution SDDC.



File Home S	imbvol ihare	2 View				-		~
> • 🛧 📃	\nims	mb-7c1c.nimodemo.com\nimsmbvol2	~ 0	5	Search nimsmbv	012		۶
		Name	Date modified	Ту	pe	Size		
A Quick access		nimfoo1	8/13/2021 10:21 AM	Fil	e folder			
Desktop	1	nimfoo2	8/13/2021 10:21 AM	Fil	e folder			
Downloads	*	nimfoo1	8/13/2021 10:21 AM	Te	xt Document		0 KB	
Documents	*	nimfoo2	8/13/2021 10:22 AM	Te	xt Document		0 KB	
E Pictures	*							
💻 This PC								
Network								

7. To mount NFS volumes on Linux VMs running on Azure VMware Solution SDDC, use this same process. Use volume reshaping or dynamic service level capability to meet the workload demands.

nimoadminEnimoadmin=virtu	al-machine	S sudo	mount -t	nfs -	o rw.hard.tcp 172.24.
3.4:/nimodemonfsv1 /home/	nimoadmin/	Inodeno	14		
almoadmin@almoadmin-virtu	al-machine	S df			
Filesvstem	1K-blocks	Used	Available	Use%	Mounted on
udev	8168112	0	8168112	6%	/dev
tepfs	1639548	1488	1638060	15	Irun
/dev/sdaS	50824704	7962752	40310496	17%	1
tmpfs	8197728	0	8197728	6%	/dev/shm
trofs	5120	0	5120	0%	/run/lock
tmpfs	8197728		8197728	6%	/sys/fs/cgroup
/dev/loop0	56832	56832	θ	100%	/snap/core18/2128
/dev/loop2	66688	66688	6	100%	/snap/gtk-common-the
nes/1515					
/dev/loop1	224256	224256	8	100%	/snap/gnome-3-34-188
4/72					
/dev/loop3	52224	52224	8	100%	/snap/snap-store/547
/dev/loop4	33152	33152	0	100%	/snap/snapd/12764
/dev/sda1	523248	4	523244	1%	/boot/efi
tnpfs	1639544	52	1639492	1%	/run/user/1000
/dev/sr0	54738	54738	.0	100%	/media/nimoadmin/VMw
are Tools					
172.24.3.4:/nimodemonfsv1	104857600	0	104857600	0%	/home/nimoadmin/nimo
demo11					
ninoadmin@ninoadmin-virtu	al-machine	: \$			

For more information, see Dynamically change the service level of a volume.

Cloud Volumes ONTAP (CVO)

Cloud volumes ONTAP, or CVO, is the industry-leading cloud data management solution built on NetApp's ONTAP storage software, available natively on Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP).

It is a software-defined version of ONTAP that consumes cloud-native storage, allowing you to have the same storage software in the cloud and on-premises, reducing the need to retrain you IT staff in all-new methods to manage your data.

CVO gives customers the ability to seamlessly move data from the edge, to the data center, to the cloud and back, bringing your hybrid cloud together — all managed with a single-pane management console, NetApp Cloud Manager.

By design, CVO delivers extreme performance and advanced data management capabilities to satisfy even your most demanding applications in the cloud

Cloud Volumes ONTAP (CVO) as guest connected storage

Cloud Volumes ONTAP shares and LUNs can be mounted from VMs that are created in the Azure VMware Solution SDDC environment. The volumes can also be mounted on the Linux client and on Windows client because Cloud Volumes ONTAP supports iSCSI, SMB, and NFS protocols. Cloud Volumes ONTAP volumes can be set up in a few simple steps.

To replicate volumes from an on-premises environment to the cloud for disaster recovery or migration purposes, establish network connectivity to Azure, either using a site-to-site VPN or ExpressRoute. Replicating data from on-premises to Cloud Volumes ONTAP is outside the scope of this document. To replicate data between on-premises and Cloud Volumes ONTAP systems, see Setting up data replication between systems.



Use Cloud Volumes ONTAP sizer to accurately size the Cloud Volumes ONTAP instances. Also monitor on-premises performance to use as inputs in the Cloud Volumes ONTAP sizer.

1. Log in to NetApp Cloud Central—the Fabric View screen is displayed. Locate the Cloud Volumes ONTAP tab and select Go to Cloud Manager. After you are logged in, the Canvas screen is displayed.



2. On the Cloud Manager home page, click Add a Working Environment and then select Microsoft Azure as the cloud and the type of the system configuration.

Canvas	Replication	Backup & Restore	K8s Dat	a Sense File Cache	Compute Sync	All Services (+8) 🗢	
Add New	Working Environr	nent				10.0°	>
		0					
	Micros	tt Azure Amazo	aws www.www.www.www.www.www.www.www.www.w	Google Cloud Platform	On-Premises		
	Choose Ty	pe					
		0	(9	(iii)		
		Valumas ONITAD	Cloud Volum		Turo NotAnn Ellor		_

3. When creating the first Cloud Volumes ONTAP working environment, Cloud Manager prompts you to deploy a Connector.



4. After the connector is created, update the Details and Credentials fields.

Managed Service Ide	SaaS Backup Prod	CMCVOSub	
Credential Name	Azure Subscription	Marketplace Subscription	Edit Credentials
Detaile		Credentials	
Working Environment Nam	e (Cluster Name)	User Name	
nimavsCVO	an den en de de de la	admin	
		Password	

5. Provide the details of the environment to be created including the environment name and admin credentials. Add resource group tags for the Azure environment as an optional parameter. After you are done, click Continue.

Details	Credentials
Working Environment Name (Cluster Name)	User Name
nimavsCVO	admin
	Password
Add Resource Group Tags Optional Field	••••••
	Confirm Password

6. Select the add-on services for Cloud Volumes ONTAP deployment, including BlueXP Classification, BlueXP backup and recovery, and Cloud Insights. Select the services and then click Continue.

Data Sense & Compliance	•
Backup to Cloud	-• ~
(iii) Monitoring	

7. Configure the Azure location and connectivity. Select the Azure Region, resource group, VNet, and subnet to be used.

Azure Region		Resource Group
East US 2		Create a new group Use an existing group
Availability Zone	(Optional)	Resource Group Name
Select an Availability Zone		nienassCVO-rg
vNet		
nimoavspriv-vnet NimoAVSDemo	*	Security Group
Subnet		Generated security group Ouse existing security group
172.24.2.0/24	•	
		I have verified network connectivity between the Cloud Manager server and the selected Vhiet.
	Cont	inue
	-	

Cloud Volumes ONTAP Charging Methods	NetApp Support Site Account (Optional)
earn more about our charging methods	Learn more about NetApp Support Site (NSS) accounts
Pay-As-You-Go by the hour	To register this Cloud Volumes ONTAP to support, you should add NetApp Support Site Account.
Bring your own license	Don't have a NetApp Support Site account?Select go to finish deploying this system.After its created, use the

9. Select between several preconfigured packages available for the various types of workloads.

Create a New Working EnvironmentCloud Volumes ONTAP Charging Methods & NSS Account

Select a pre	configured Cloud Volumes ONTAP system that best Preconfigured settings can be n	matches your needs, or create your own o nodified at a later time.	onfiguration. Change Configuration
·•		\$0	.ę.
POC and small workloads	Database and application data production workloads	Cost effective DR	Highest performance production workloads

10. Accept the two agreements regarding activating support and allocation of Azure resources. To create the Cloud Volumes ONTAP instance, click Go.

1			
Azure East US 2			
12 Lunderstand that	t in order to activate cupp	out 1 must first register	r Claud Volumer CAITAD with Notenn Mercia
	citi order to activate supp	urt, i must mst register	Cloud volumes on the with Neodpy. Nore mormation >
I understand that	t Cloud Manager will alloc	cate the appropriate Azi	ure resources to comply with my above requirements. More information >
	(NA)	Storage	

11. After Cloud Volumes ONTAP is provisioned, it is listed in the working environments on the Canvas page.



1. After the working environment is ready, make sure the CIFS server is configured with the appropriate DNS and Active Directory configuration parameters. This step is required before you can create the SMB volume.

(III) nimavsCVO		Agu		1 Azure	warrage	to Encry	parson
Volumes Replications	1	0	Ċ	C	٩	4	Ξ
Create a CIFS server	+ Advanced						
DNS Primary IP Address	Active Directory Domain to join						
172.24.1.5	nimodemo.com						
DN5 Secondary IP Address (Optional)	Credentials authorized to join the domain						
	Construction (Construction (Construction))						

 Creating the SMB volume is an easy process. Select the CVO instance to create the volume and click the Create Volume option. Choose the appropriate size and cloud manager chooses the containing aggregate or use advanced allocation mechanism to place on a specific aggregate. For this demo, SMB is selected as the protocol.

Details & Protection			Protocol		
Volume Name:	Size (GB);	0	NFS	CIFS	iSCSI
nimavssmbvol1	50				
			Share name:	Permissions:	
Snapshot Policy:			nimavssmbvol1_share	Full Control	
default		•			
③ Default Policy			Users / Groups:		
			Everyone;		

3. After the volume is provisioned, it will be availabe under the Volumes pane. Because a CIFS share is provisioned, give your users or groups permission to the files and folders and verify that those users can access the share and create a file. This step is not required if the volume is replicated from an on-premises environment because the file and folder permissions are all retained as part of SnapMirror replication.

lume 50 GB Allocat	ted 1.74 MB Total Used	(1.74 MB in Disk, 0 KB in Blo	b)
	1		
	smbvol1		
INFO		CAPACITY	
	PDEMILINA L PS		1 74 MR
Disk Type	LUCIMUCIAL FUR		- 1.7 4 1915
Disk Type	Auto	50 GB	Disk Used

- 4. After the volume is created, use the mount command to connect to the share from the VM running on the Azure VMware Solution SDDC hosts.
- 5. Copy the following path and use the Map Network Drive option to mount the volume on the VM running on Azure VMware Solution SDDC.

	5	Replic	auons								
) Mo	unt	Volum	e nimav	ssmbvol1							
o to your i	machi	ne and en	ter this con	nmand							
\\172.2/	4.2.8	nimavssn	nbvol1_sha	re		F	Сору				
11112.24											
(11/2.2-											
((1/2.2.	navssmbvo	1_share							-	0	×
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Connect the LUN to a host

To connect the LUN to a host, complete the following steps:

- 1. On the Canvas page, double-click the Cloud Volumes ONTAP working environment to create and manage volumes.
- 2. Click Add Volume > New Volume and select iSCSI and click Create Initiator Group. Click Continue.

Details & Protection		Protocol		
Volume Name:	Size (GB):	NFS	CIFS	iscst
nimavsscsi1	500			What about LUNs? 🕕
Snapshot Policy:		Initiator Group 🚯		
default		Map Existing Init	iator Groups 🢽	Create Initiator Group
Default Policy		Initiator Group		
		avsvmlG		

3. After the volume is provisioned, select the volume, and then click Target IQN. To copy the iSCSI Qualified Name (IQN), click Copy. Set up an iSCSI connection from the host to the LUN.

To accomplish the same for the host residing on Azure VMware Solution SDDC:

- a. RDP to the VM hosted on Azure VMware Solution SDDC.
- b. Open the iSCSI Initiator Properties dialog box: Server Manager > Dashboard > Tools > iSCSI Initiator.
- c. From the Discovery tab, click Discover Portal or Add Portal and then enter the IP address of the iSCSI target port.
- d. From the Targets tab, select the target discovered and then click Log on or Connect.
- e. Select Enable multipath, and then select Automatically Restore This Connection When the Computer Starts or Add This Connection to the List of Favorite Targets. Click Advanced.

Note: The Windows host must have an iSCSI connection to each node in the cluster. The native DSM selects the best paths to use.

To disc DNS no	over and log	g on to a target usin arget and then clock	ng a basic connect Quick Connect.	ion, type the	IP address or
Target	172	1.24.2.9			Quick Connect.
Discove	ared targets	i.		-	
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To con did: Co	nect using a	idvanced options, s	elect a target and	then	Omet
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LUNs on storage virtual machine (SVM) appear as disks to the Windows host. Any new disks that are added are not automatically discovered by the host. Trigger a manual rescan to discover the disks by completing the following steps:

- 1. Open the Windows Computer Management utility: Start > Administrative Tools > Computer Management.
- 2. Expand the Storage node in the navigation tree.
- 3. Click Disk Management.
- 4. Click Action > Rescan Disks.

auchana tuntakentere laarek	Volume	Layout	Type	File System	Status		Capacity	Free Space	% Free	
System Tools	- (C)	Simple	Basic	NTFS	Healthy (Boot, Page File, Cr	rash Dump, Frimary Partition)	39.51 GB	34.99 GB	63 %	
Task Scheduler	SSS_X64FREE_EN4-Q	US_DV9 (Dr) Simple	BADE	U0F.	Healthy (Primary Partition)		6.49 GB	0 MB	0%	
Event Vewee Shared Folders Shared Folders Local Uters and Groups Performance Device Manager Storage Windows Server Backup Disk Management Services and Applications	- System Reserved	Sample	Benc	NTFS	Healthy Oystem, Active, Pr	imary Partition)	50 MB	169 MB	345.	
	- Disk 0 Basic 5 40.00 G8 5 Ordine 9	System Reserved 500 ME NTFS Healthy (System, Act	ive Frim	very Partition)	(ICJ 39.51 GB NTFS Healthy (Boot, Page Fide, C)	rash Dump,	Primary Parti	tion)	

When a new LUN is first accessed by the Windows host, it has no partition or file system. Initialize the LUN; and optionally, format the LUN with a file system by completing the following steps:

1. Start Windows Disk Management. 2. Right-click the LUN, and then select the required disk or partition type. 3. Follow the instructions in the wizard. In this example, drive E: is mounted Computer Management File Action View Help 💠 🔿 🙇 📆 🖬 🖽 📼 Capacity Free Space % Free 1) 39.51 GB 23.95 GB 61 % 499.87 ... 499.73 GB 100 % 9.97 GB 9.93 GB 100 % 0.96 0 MB 0.1% Scomputer Management (Local Volume Layout Type File System Status (C)
 OBdisk (E)
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Google Cloud VMware Engine Supplemental NFS Datastore with NetApp Cloud Volume Service

Overview

Authors: Suresh Thoppay, NetApp

Customers that requires additional storage capacity on their Google Cloud VMware Engine (GCVE) environment can utilize Netapp Cloud Volume Service to mount as supplemental NFS datastore. Storing data on NetApp Cloud Volume Service allows customers to replicate between regions to protect from diaster.



Deployment steps to mount NFS datastore from NetApp CVS on GCVE

Provision CVS-Performance Volume

The NetApp Cloud Volume Service volume can be either provisioned by Using Google Cloud Console Using NetApp BlueXP portal or API To avoid accidental deletion of volume while VM is running, ensure the volume is marked as nondeletable as shown in screenshot below.



Ensure Private Connection on GCVE exists for NetApp CVS Tenant VPC.

To mount NFS Datastore, there should be a private connection exists between GCVE and NetApp CVS project.

For more info, please refer How to setup Private Service Access

For instructions on how to mount NFS datastore on GCVE, please refer How to create NFS datastore with NetApp CVS



As vSphere hosts are managed by Google, you don't have access to install NFS vSphere API for Array Integration (VAAI) vSphere Installation Bundle (VIB). If you need support for Virtual Volumes (vVol), please let us know.

If you like to use Jumbo Frames, please refer Maximum supported MTU sizes on GCP

Savings with NetApp Cloud Volume Service

To learn more about your potential saving with NetApp Cloud Volume Service for your storage demands on GCVE, please check NetApp ROI Calculator

Reference Links

- · Google Blog How to use NetApp CVS as datastores for Google Cloud VMware Engine
- NetApp Blog A better way to migrate your storage-rich apps to Google Cloud

NetApp Storage Options for GCP

GCP supports guest connected NetApp storage with Cloud Volumes ONTAP (CVO) or Cloud Volumes Service (CVS).

Cloud Volumes ONTAP (CVO)

Cloud volumes ONTAP, or CVO, is the industry-leading cloud data management solution built on NetApp's ONTAP storage software, available natively on Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform (GCP).

It is a software-defined version of ONTAP that consumes cloud-native storage, allowing you to have the same storage software in the cloud and on-premises, reducing the need to retrain you IT staff in all-new methods to manage your data.

CVO gives customers the ability to seamlessly move data from the edge, to the data center, to the cloud and back, bringing your hybrid cloud together — all managed with a single-pane management console, NetApp Cloud Manager.

By design, CVO delivers extreme performance and advanced data management capabilities to satisfy even your most demanding applications in the cloud

Cloud Volumes ONTAP (CVO) as guest connected storage

Cloud Volumes ONTAP shares and LUNs can be mounted from VMs that are created in the GCVE private cloud environment. The volumes can also be mounted on the Linux client and on Windows client and LUNS can be accessed on Linux or Windows clients as block devices when mounted over iSCSI because Cloud Volumes ONTAP supports iSCSI, SMB, and NFS protocols. Cloud Volumes ONTAP volumes can be set up in a few simple steps.

To replicate volumes from an on-premises environment to the cloud for disaster recovery or migration purposes, establish network connectivity to Google Cloud, either using a site-to-site VPN or Cloud Interconnect. Replicating data from on-premises to Cloud Volumes ONTAP is outside the scope of this document. To replicate data between on-premises and Cloud Volumes ONTAP systems, see xref:./ehc/Setting up data replication between systems.



Use Cloud Volumes ONTAP sizer to accurately size the Cloud Volumes ONTAP instances. Also monitor on-premises performance to use as inputs in the Cloud Volumes ONTAP sizer.

1. Log in to NetApp Cloud Central—the Fabric View screen is displayed. Locate the Cloud Volumes ONTAP tab and select Go to Cloud Manager. After you are logged in, the Canvas screen is displayed.

 Cloud Ma	nager			Account ~	Workspace cloud_heroes	 Connec fiscawsc 	tor 👻	\$ @ @ 8
Canvas	Replication	Backup & Restore	K8s	Data Sense	File Cache	Compute	Sync	All Services (+8) ~
Canv	as							Go to Canvas View
G Add W	orking Environment							

2. On the Cloud Manager Canvas tab, click Add a Working Environment and then select Google Cloud Platform as the cloud and the type of the system configuration. Then, click Next.

 Cloud Ma	nager				Account ~ Netapp_POC	Workspace cloud_heroer		Connector willnamem		۵	۲	0	8
Canvas	Replication	Backup & Restore	KBS	Data Sense	File Cache	Compute	Sync	All Service	s (+7) 🛩				
Add Work	ing Environme	nt											×
				aws	0	Ĩ							
		Microsoft Asure	Arnaz	an Web Services	Google Cloud Platfo	0řm	On-Premises						
				Choos	e Type								
		0		0		0	9						
		Cloud Volumes ON	TAP	Cloud Volum	PS ONTAP HA	Cloud Volu	mes Service						
		Single Node		Fight Av	illability	High Au	ailability						

3. Provide the details of the environment to be created including the environment name and admin

reate a New Worl	king Environment	Details and Cr	edentials
Previous Step	CV-Performance-Testing	HCLMainBillingAccountSubs	Edit Droject
	Google Cloud Project	Marketplace Subscription	con Project
	Details		Credentials
	Working Environment Name	(Cluster Name)	User Name
	cvogcveva		admin
			Password
	Service Account		
	Notice: A Google Cloud se to use two features: backi	rvice account is required ng up data using Backup	Confirm Password
		Personal Control (Personal Co	

 Select or deselect the add-on services for Cloud Volumes ONTAP deployment, including Data Sense & Compliance or Backup to Cloud. Then, click Continue.

HINT: A verification pop-up message will be displayed when deactivating add-on services. Add-on services can be added/removed after CVO deployment, consider to deselect them if not needed from the beginning to avoid costs.

Data Sense & Compliance	
Backup to Cloud	~
	~
WARNING:By turning off Backup to Cloud, future data recovery will not be possible in case of data corruption or loss	

5. Select a location, choose a firewall policy, and select the checkbox to confirm network connectivity to Google Cloud storage.

Previous Step	Location	Connectivity
	GCP Region	VPC
	europe-west3 •	cloud-volumes-vpc •
	GCP Zone	Subnet
	europe-west3-c •	10.0.6.0/24
		Firewall Policy
	I have verified connectivity between the target VPC and Google Cloud storage.	 Generated firewall policy Use existing firewall policy
Select the liv reemium o Create a New W	cont cense option: Pay-As-You-Go or BYOL for us ption is used. Then, click on Continue. forking Environment Cloud Volumes ONTAP Cha	sing existing license. In this example, arging Methods & NSS Account
Select the live reemium of Create a New W	cont cense option: Pay-As-You-Go or BYOL for us ption is used. Then, click on Continue. forking Environment Cloud Volumes ONTAP Cha	sing existing license. In this example, arging Methods & NSS Account
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7. Select between several preconfigured packages available based on the type of workload that will be deployed on the VMs running on VMware cloud on AWS SDDC.

HINT: Hoover your mouse over the tiles for details or customize CVO components and ONTAP version by clicking on Change Configuration.

Select a pre	configured Cloud Volumes ONTAP system that best	matches your needs, or create your own c	onfiguration.
	Preconfigured settings can be n	nodified at a later time.	Change Configuration
		\$0	
POC and small workloads	Database and application data production workloads	Cost effective DR Up to 500GB of storage	Highest performance production workloads

8. On the Review & Approve page, review and confirm the selections. To create the Cloud Volumes ONTAP instance, click Go.

Create a New Work	ng Environment	Review & Approve		
Previous Step	st3			Show API request
This Cloud Volumes Ol	TAP Instance will be registered with NetApp support u	nder the NSS Account mchad.		
I understand that	Cloud Manager will allocate the appropriate GCP resou	irces to comply with my above requirements. More infe	ormation >	
I understand that Overview	Cloud Manager will allocate the appropriate GCP reso Networking Storage	irces to comply with my above requirements. More info	rmation >	
I understand that Overview Storage System:	Cloud Manager will allocate the appropriate GCP reso Networking Storage Cloud Volumes ONTAP	irces to comply with my above requirements. More info	n2-standard-4	
Verview Overview Storage System: License Type:	Cloud Manager will allocate the appropriate GCP reso Networking Storage Cloud Volumes ONTAP Cloud Volumes ONTAP Freemlum	cloud Volumes ONTAP runs on: Encryption:	nZ-standard-4 Google Cloud Managed	

9. After Cloud Volumes ONTAP is provisioned, it is listed in the working environments on the Canvas page.

 Cloud Ma	inager				Account ~ Netapp_POC	Workspace cloud,heroes		Connector		۵	۲	0	8
Canvas	Replication	Backup & Restore	K8s	Data Sense	File Cache	Compute	Sync	All Servic	es (+7) ~				
Canverage	vas									E	Go to	Tabular	View
Add W	Vorking Environment						Worki	ng Environr	nents				
	cvogcve01			DatacenterDude			0	1 cloc 43.0	ud Volumes 5 GIB: Pravi	ONTAP	Capacity		
	Cloud Volumes ONTA	0		Azure NetApp File 31 9.71 Volumes Capa	ta ta		0	1 F5x 08 Pr	for ONTAP ovisioned ((High-Ar Capacity	vailability	0	
								1 Azu 9,71	re NetApp I TiB Provisio	Files oned Ca	pacity		

1. After the working environment is ready, make sure the CIFS server is configured with the appropriate DNS and Active Directory configuration parameters. This step is required before you can create the SMB volume.

HINT: Click on the Menu Icon (°), select Advanced to display more options and select CIFS setup.

Construction (construction) (constru		GCP Managed Encryption
Volumes Replications		<mark>⊚</mark> ∪ c ⊙ ≁ ∃
Create a CIFS server	+ Advanced	
DNS Primary IP Address	Active Directory Domain to join	
192.168.0.16	nimgoveval.com	
DN5 Secondary IP Address (Optional)	Credentials authorized to join the domain	
Example: 127.0.0.1	administrator	

2. Creating the SMB volume is an easy process. At Canvas, double-click the Cloud Volumes ONTAP working environment to create and manage volumes and click on the Create Volume option. Choose the appropriate size and cloud manager chooses the containing aggregate or use advanced allocation mechanism to place on a specific aggregate. For this demo, CIFS/SMB is selected as the protocol.

Volume Name: Size (GB): NFS CIFS ISCSI cvogcvesmbvol01 10 Share name: Permissions: Snapshot Policy: cvogcvesmbvol01_share Full Control default • Users / Groups:	Volume Name: Size (GB): NFS CIFS iSCS1 cvogcvesmbvol01 10 Share name: Permissions: Snapshot Policy: cvogcvesmbvol01_share Full Control •
cvogcvesmbvol01 10 Snapshot Policy: cvogcvesmbvol01_share default • Default Policy Users / Groups:	cvogcvesmbvol01 10 Snapshot Policy: Share name: default •
Share name: Permissions: Shapshot Policy: cvogevesmbvol01_share Full Control default Default Policy Users / Groups:	Share name: Permissions: Snapshot Policy: cvogcvesmbvol01_share Full Control default •
Snapshot Policy: cvogcvesmbvol01_share Full Control default Default Policy Users / Groups:	Snapshot Policy: cvogcvesmbvol01_share Full Control •
default	default •
Default Policy Users / Groups:	Sector and the sector
	Default Policy Users / Groups:
Everyone;	Everyone;
Valid users and groups separated by a semicolon	Valid users and groups separated by a semicolon

3. After the volume is provisioned, it will be availabe under the Volumes pane. Because a CIFS share is provisioned, give your users or groups permission to the files and folders and verify that those users can access the share and create a file. This step is not required if the volume is replicated from an on-premises environment because the file and folder permissions are all retained as part of SnapMirror replication.

HINT: Click on the volume menu (°) to display its options.

INFO		CAPACITY	
Disk Type	PD-SSD		■ 1.84 MB
Tiering Policy	None	10 GB	Disk Used

4. After the volume is created, use the mount command to display the volume connection instructions, then connect to the share from the VMs on Google Cloud VMware Engine.

Volu	imes Repli	ications				
	Mount Volum	ne cvogcvesmbv	ol01			
o to yo	our machine and e	nter this command				
\\10.	.0.6.251\cvogcve	esmbvol01_share		6	Сору	
py the	e following path a	and use the Map Net	work Drive	option to mo	unt the vo	lume on the VM
py the ning c	e following path a on the Google C	and use the Map Net loud VMware Engine	work Drive	option to mo	unt the vo	lume on the VN
py the nning c	e following path a on the Google C e drive letter for the co	and use the Map Net loud VMware Engine onnection and the folder that	work Drive t you want to c	option to mo	unt the vo	lume on the VM
py the ming c becify the	e following path a on the Google C e drive letter for the co Y:	and use the Map Net loud VMware Engine onnection and the folder that	work Drive t you want to c	option to mo	unt the vo	lume on the VN
py the nning c pecify the rive: older:	e following path a on the Google C e drive letter for the co Y: \\10.0.6.251\cvog	and use the Map Net loud VMware Engine onnection and the folder that	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VM
py the nning c pecify the rive:	e following path a on the Google Cl e drive letter for the co Y: \\\10.0.6.251\cvog Example: \\server\	and use the Map Net loud VMware Engine onnection and the folder that v gcvesmbvol01_share share	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VN
py the nning c pecify the rive: older:	e following path a on the Google Cl e drive letter for the co Y: \\10.0.6.251\cvog Example: \\server\ ☑ Reconnect at si	and use the Map Net loud VMware Engine onnection and the folder that v gcvesmbvol01_share share gn-in	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VN
py the nning c pecify the rive: older:	e following path a on the Google Cl e drive letter for the co Y: \\10.0.6.251\cvog Example: \\server\ Reconnect at si Connect using	and use the Map Net loud VMware Engine onnection and the folder that v gcvesmbvol01_share share gn-in different credentials	work Drive	option to mo	unt the vo	lume on the VN
py the nning c pecify the rive:	e following path a on the Google Cl e drive letter for the co Y: \\\10.0.6.251\cvog Example: \\server\ Reconnect at si Connect using <u>Connect to a Web</u>	and use the Map Net loud VMware Engine onnection and the folder that v gcvesmbvol01_share share gn-in different credentials site that you can use to store	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VN
py the ming c becify the rive: older:	e following path a on the Google Cl e drive letter for the co Y: \\\10.0.6.251\cvog Example: \\server\ Reconnect at si Connect using <u>Connect to a Web</u>	and use the Map Net loud VMware Engine onnection and the folder that v gcvesmbvol01_share share gn-in different credentials site that you can use to stor	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VN
py the ning c ecify the ive	e following path a on the Google Cl e drive letter for the co Y: \\10.0.6.251\cvog Example: \\server\ Reconnect at si Connect using <u>Connect to a Web</u>	and use the Map Net loud VMware Engine onnection and the folder that w pcvesmbvol01_share share gn-in different credentials site that you can use to stor	work Drive	option to mo onnect to: Browse	unt the vo	lume on the VM

Once mapped, it can be easily accessed, and the NTFS permissions can be set accordingly. 💣 | 🛃 📗 = | Network - 🗆 X 🗌 👎 🛫 l 📴 📒 🖛 l cvogcvesmbvol01_share (\\10.0.6.251) (Y:) × 4 Home Share View 0 ÷ ↑ 👳 > This PC ⇒ cvogcvesmbvol01_share (\\10.0.6.251) (Y:) > ✓ Ŏ Search cvogcvesmbvol01_sha... , P 7 1 Net 6 Name Date modified Type Size # Quick access foo1 11/9/2021 10:59 AM File folder Desktop foo2 11/9/2021 10:59 AM File folder Downloads 1 Documents A Pictures 1 This PC

To connect the cloud volumes ONTAP LUN to a host, complete the following steps:

- 1. On the Canvas page, double-click the Cloud Volumes ONTAP working environment to create and manage volumes.
- 2. Click Add Volume > New Volume and select iSCSI and click Create Initiator Group. Click Continue.

	Details & Pr	otection				Protocol			
	Volume Name:			Size (GB):	0	NFS	CIFS	iscsi	
	cvogcvescsilur	:01		10				What about LUN	2.0
	Snapshot Policy					Initiator Group 🛞			
	default					Map Existing In	tlator Groups 🛛 💿	Create Initiator G	oup
	Default Policy					Initiator Group			
						WinIG			
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						Windows			*
VMware Cloud - ntap-fi	or demo X 🕝 VSphe	we - vmcdc01 - Su https://vcen	mmary × vm ter.sddc-52-37-	odd01 127-104 vmwaren	× wnc.com/uv/web	NetApp Cloud Manager	× + IovmName=vmcdc01 (Enforce 05 Ke	2016 : 슈가	- d Other Bo
VMware Cloud - ntap-fi Getting Started Gotting Started Set Ver: M	ia-demo X 🕜 VSphe C A = 2 Management Con (lanager • Dashbolan	re + vmcdc01 - Su # Tittps://vcen Wew Tab	tersddc-52-37-	n27-184 vmwares	x mc.com/u/web	NetApp Cloud Manager	× + SomName=vmcdc01 (Enforce US Ke	verse	- 0 Other 8c Sent Orl+A
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VMware Cloud - ntap-fi Getting Started © Cotting Started Cotting Started Cotting Started Cotting Started Lat Server Lat Server A AD 5 A OHS Cotting Server + Cotting	In demo X	Free + vmcdc01 - Sk Thttps://vcen New Tab New Tab Out of the second s	ter sddc-52-37-	127-104 vmwaret 127-104 vmwaret storester enternet storester ternet (11,14,2) (2) (2) (3) (3) (3) (3) (3) (3) (3) (3	** *** *** ************************	NetApp Cloud Manager	x + SomName = vmcdc01 (Enforce US Ke - 0 x - 0		- D Other Bo

3. After the volume is provisioned, select the volume menu (°), and then click Target iQN. To copy the iSCSI Qualified Name (iQN), click Copy. Set up an iSCSI connection from the host to the LUN.

To accomplish the same for the host residing on Google Cloud VMware Engine:

- a. RDP to the VM hosted on Google Cloud VMware Engine.
- b. Open the iSCSI Initiator Properties dialog box: Server Manager > Dashboard > Tools > iSCSI Initiator.
- c. From the Discovery tab, click Discover Portal or Add Portal and then enter the IP address of the iSCSI target port.

- d. From the Targets tab, select the target discovered and then click Log on or Connect.
- e. Select Enable multipath, and then select Automatically Restore This Connection When the Computer Starts or Add This Connection to the List of Favorite Targets. Click Advanced.



The Windows host must have an iSCSI connection to each node in the cluster. The native DSM selects the best paths to use.

Car Sor	iSCSE Initiato	r Properties			5
Ser Ser	Targets De	scovery Pavorite Targets Volumes and D	Devices RAD	0.5 Configuration	
Dashboard	Quick Conn To discove DNS name	ect r and log on to a target using a basic conne of the target and then click Quick Connect.	ection, type th	e ≫ address or	
All Servers	Target:	10.0.6.250		Quick Connect	I
AD DS	Discovered	targets		Refresh	i
Ele and Storage Ser	Name		Statu	6	Í.
	To connect dick Conne To complet	t using advanced options, select a target a act.	nd then	Carried	
	then dick (tely disconnect a target, select the target a Xisconnect.	nd	Demect	1
	then click & For target select the For configu the target	tely disconnect a target, select the target a Sisconnect. properties, including configuration of sessi- target and click Properties. uration of devices associated with a target, and then click Devices.	ind ons, select	Disconvect Properties - Devotes -	
	then dick 0 For target select the For configu the target	tely decennect a target, select the target a xisconnect. properties, including configuration of sesses target and cick Properties. uration of devices associated with a target, and then cick Devices.	nd ors, select	Deserved Properties Deservet	

LUNs on storage virtual machine (SVM) appear as disks to the Windows host. Any new disks that are added are not automatically discovered by the host. Trigger a manual rescan to discover the disks by completing the following steps:

- 1. Open the Windows Computer Management utility: Start > Administrative Tools > Computer Management.
- 2. Expand the Storage node in the navigation tree.
- 3. Click Disk Management.
- 4. Click Action > Rescan Disks.



When a new LUN is first accessed by the Windows host, it has no partition or file system. Initialize the LUN; and optionally, format the LUN with a file system by completing the following steps:

- 5. Start Windows Disk Management.
- 6. Right-click the LUN, and then select the required disk or partition type.
- 7. Follow the instructions in the wizard. In this example, drive F: is mounted.



On the Linux clients, ensure the iSCSI daemon is running. Once the LUNs are provisioned, refer to the detailed guidance on iSCSI configuration with Ubuntu as an example here. To verify, run Isblk cmd from the shell.

ntyaz@	ntmubu01	:-\$	lsblk	i.			
NAME	MAJ:MIN	RM	SIZE	RO	TYPE	MOUNTPOINT	
loop0	7:0		55.4M	1	loop	/snap/core18/2128	
Loop1	7:1	Θ	219M	1	loop	/snap/gnome-3-34-1804/72	
LoopZ	7:2		65.1M	1	loop	/snap/gtk-common-themes/1515	
loop3	7:3	Θ	51M	1	loop	/snap/snap-store/547	
loop4	7:4	e	32.3M	1	loop	/snap/snapd/12704	
loop5	7:5	0	32.5M	1	loop	/snap/snapd/13640	
10006	7:6	θ	55.SM	1	loop	/snap/core18/2246	
Loop7	7:7	0	4K	1	loop	/snap/bare/5	
Loop8	7:8	0	65.2M	1	loop	/snap/gtk-common-themes/1519	
sda	8:0	θ	16G	0	disk		
-sda1	8:1	0	512M	. 0	part	/boot/eft	
-sda2	8:2	0	1K	0	part		
-sda5	8:5	e	15.56	e	part		
sdb	8:16	Ø	16	0	disk		

incyazin chubuo.			10 A		
Filesystem	Stze	Used	Avail	Use%	Mounted on
udev	1.9G	0	1.96	0%	/dev
tmpfs	394M	1.5M	392M	1%	/run
/dev/sda5	16G	7.6G	6.9G	53%	7
tmpfs	2.0G	0	2.00	0%	/dev/shm
tmpfs	5.0M	0	5.0M	0%	/run/lock
tmpfs	2.0G	0	2.06	0%	/sys/fs/cgroup
/dev/loop1	219M	219M	θ	100%	/snap/gnome-3-34-1804/72
/dev/loop2	66M	66M	0	166%	/snap/gtk-common-themes/1515
/dev/loop3	51M	51M	0	100%	/snap/snap-store/547
/dev/loop0	56M	56M	0	100%	/snap/core18/2128
/dev/loop4	33M	33M	.8	100%	/snap/snapd/12704
/dev/sda1	511M	4.0K	511M	1%	/boot/efi
tmpfs	394M	64K	394M	1%	/run/user/1000
/dev/loop5	33M	33M	0	100%	/snap/snapd/13640
/dev/loop6	56M	56M	6	100%	/snap/core18/2246
/dev/loop7	128K	128K	0	100%	/snap/bare/5
/dev/loop8	66M	66M	0	166%	/snap/gtk-common-themes/1519
/dev/sdb	976M	2.6M	987M	1%	/mnt

To mount the Cloud Volumes ONTAP (DIY) file system from VMs within Google Cloud VMware Engine, follow the below steps:

Provision the volume following the below steps

- 1. In the Volumes tab, click Create New Volume.
- 2. On the Create New Volume page, select a volume type:

Esso cvogcver	nfsvol01		
INFO		CAPACITY	
Disk Type	PD-SSD		■ 6.08 GB
Tiering Policy	None	11.05 GB Allocated	Disk Used
In the Volumes tab, place Mount Command.	e your mouse cursor o	over the volume, select the	menu icon (°), and then clic
Volumes	Replications		
Mount V	olume cvogc	venfsvol01	
Go to your Linux ma	olume cvogc	venfsvol01 his mount command	
So to your Linux me mount 10.0.6.2	olume cvogc achine and enter t 51:/cvogcvenfsv	venfsvol01 his mount command ol01 <dest_dir></dest_dir>	Сору
Mount V Go to your Linux m mount 10.0.6.2 Click Copy.	olume cvogc achine and enter t 51:/cvogcvenfsv	venfsvol01 his mount command ol01 <dest_dir></dest_dir>	Сору
Mount V Go to your Linux m mount 10.0.6.2 Click Copy. Connect to the designate	olume cvogc achine and enter t 51:/cvogcvenfsv	venfsvol01 his mount command ol01 <dest_dir></dest_dir>	Copy

\$ sudo mkdir /cvogcvetst

root@nimubu01:~# sudo mkdir cvogcvetst

8. Mount the Cloud Volumes ONTAP NFS volume to the directory that is created in the previous step.

```
sudo mount 10.0.6.251:/cvogcvenfsvol01 /cvogcvetst
root@nimubu01:~# sudo mount -t nfs 10.0.6.251:/cvogcvenfsvol01 cvogcvetst
nimubu01
                                                                                      Enforce US Keyboard Layout View Fullscreen Send Ctrl+Alt+De
                                       Terminal •
                                                                  Nov 16 12:42
                                                                                               A # 0 .
                                                                root@nimubu01: -
                                     oot@ninubu01:-# df
ilesysten
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                                                               523248
                                                            515010816
                                                                     42016812
                                                                                             e/nlyaz/cvs1
                                                                                         /snap/snapd/13831
                                                            43264
                                                                       43264
                                                                                     100N
                                                                     8577536
                                                                              4622016
                                                     afsvol01
```

Cloud Volumes Service (CVS)

Cloud Volumes Services (CVS) is a complete portfolio of data services to deliver advanced cloud solutions. Cloud Volumes Services supports multiple file access protocols for major cloud providers (NFS and SMB support).

Other benefits and features include: data protection and restore with Snapshot; special features to replicate, sync and migrate data destinations on-prem or in the cloud; and consistent high performance at the level of a dedicated flash storage system.

Cloud Volumes Service (CVS) as guest connected storage

Configure Cloud Volumes Service with VMware Engine

Cloud Volumes Service shares can be mounted from VMs that are created in the VMware Engine environment. The volumes can also be mounted on the Linux client and mapped on the Windows client because Cloud Volumes Service supports SMB and NFS protocols. Cloud Volumes Service volumes can be set up in simple steps.

Cloud Volume Service and Google Cloud VMware Engine private cloud must be in the same region.

To purchase, enable and configure NetApp Cloud Volumes Service for Google Cloud from the Google Cloud Marketplace, follow this detailed guide.
To create and mount NFS volumes, complete the following steps:

1. Access Cloud Volumes from Partner Solutions within the Google cloud console.

ŧ	C console.cloud	google o	om/bame/dashboard?	project.»cv-performance-testing		🕸 🕁 🙆 Incogni	o (3) Update
=	Google Cloud Platfo	orm i	CV-Performance-Te	sting 👻 🛛 🔍 Search products and resources		v 🖬 9	• 1 6
ñ	Home	>	OMMENDATIONS				CUSTOMIZ
*	Pins appear here	×		Compute Engine	÷	Google Cloud Platform status	
PART	NER SOLUTIONS			CPU (N)	•	All services normal	•
	Redis Enterprise				102%	-> Go to Cloud status dashboard	
-	Apache Kafka on Co				115		
	Datablicks				40%	Billing	1000 00 00
4	Elasticsearch Service		Volumes		20%	For the billing period starting Nov 1, 2021	1100 00100
	MongoDB Atlas		Backups	12:15 12:30 12:45 1.96 Instance/cpu/utilization: 3:30%		Issue Take a tour of billing	
n	Neo4j Aura Professi_		Active Directories	→ Go to Compute Engine		View detailed charges	
0	Cloud Volumes	>	Volume Replication		_	Monitoring	I

2. In the Cloud Volumes Console, go to the Volumes page and click Create.

	Google Cloud Platform	Se cv	Perto	rmance Testing	9	Search prodi	icts and reso	urces		~	2.	0) Ba	1
9	Cloud Volumes	Volur	nes	CREAT	TE 🖀 DELE	ΤE									
	Volumes	Quick r	eferer	nce for Cloud Volum	es Private Servic	e Access 🖾 AP	112 Shared VPC	support [2 Granular permi	ssions 🗠						
	Backups	Ŧ	Filter	Search for volume	is by name, ID, re	gion, etc.							0	ш	
Ð	Snapshots			ID	Name	Region	Zone	Zone Redundancy	Life Cycle	Billi	ng Label		State	e Detail	8
	Active Directories Volume Replication	D	0	Dac8a83d- 03d8-c9db- 2aba- 189c7535445b	testnfsds01	europe- west3			available				Avai	lable fo	ar s
			0	330f35e2- b0c6-98b3- ec7a- 8dd4ea7ba00e	gcp-ve-ds4	europe- west3			available				Avai	lable fo	N.C
			0	7d0a6f0d- 3e0a-50c3- 5295- 5152040681fc	gcp-ve-ds3	europe- west3			available				Avai	table fo	or a
			0	8cae6850- 0919-4eaf- af47-	gcve-ds-2	europe- west3			available				Avai	lable fo	яз

3. On the Create File System page, specify the volume name and billing labels as required for chargeback mechanisms.

Cloud Volumes	← Create File System
2 Volumes	
Backups	Volume Name
Snapshots	nimCVNFSvol01
Active Directories	A human readable name used for display purposes.
Volume Replication	Billing Labels
	Label your volumes for billing reports, queries. Supported with CVS-Performance service type; can be set with CVS service type but not available for billing at this time.
	+ ADD LABEL

4. Select the appropriate service. For GCVE, choose CVS-Performance and desired service level for improved latency and higher performance based on the application workload requirements.

0	Cloud Volumes	← Create File System
	Volumes	Service Type
	Backups	Cloud Volumes Service is offered as two service types: CVS and CVS-Performance. Select the service type that matches your workload needs. Region availability [2] varies by
0	Snapshots	service type. Learn note E
0	Active Directories	O CVS Offers volumes created with zonal high availability.
٥	Volume Replication	 CVS-Performance Offers 3 performance levels and improved latency to address higher performance application requirements.
		Volume Replication
		 Secondary Select to create volume as a destination target for volume replication. Applicable only to CVS-performance volumes.

5. Specify the Google Cloud region for the volume and volume path (The volume path must be unique across all of cloud volumes in the project)



6. Select the level of performance for the volume.



7. Specify the size of the volume and the protocol type. In this testing, NFSv3 is used.



HINT: If VPC peering has not been done, a pop-up button will be displayed to guide you through the peering commands. Open a Cloud Shell session and execute the appropriate commands to peer your VPC with Cloud Volumes Service producer. In case you decide to prepare VPC peering in beforehand, refer to these instructions.

9	Cloud Volumes	← Create File System
	Volumes	Network Details
	Backups	Provide the host project name when deploying in a shared VPC service project.
0	Snapshots	VPC Network Name *
0	Active Directories	Select the VPC Network from which the volume will be accessible. This cannot be changed later.
	Volume Replication	Use Custom Address Range
		Reserved Address range netapp-addresses

9. Manage the Export policy rules by adding the appropriate rules and Select the checkbox for the corresponding NFS version.

Note: Access to NFS volumes won't be possible unless an export policy is added.



Before preparing to mount the NFS volume, ensure the peering status of private connection is listed as Active. Once status is Active, use the mount command.

To mount an NFS volume, do the following:

- 1. In the Cloud Console, go to Cloud Volumes > Volumes.
- 2. Go to the Volumes page
- 3. Click the NFS volume for which you want to mount NFS exports.
- 4. Scroll to the right, under Show More, click Mount Instructions.

To perform the mounting process from within the guest OS of the VMware VM, follow the below steps:

- 1. Use SSH client and SSH to the virtual machine.
- 2. Install the nfs client on the instance.
 - a. On Red Hat Enterprise Linux or SuSE Linux instance:

sudo yum install -y nfs-utils

b. On an Ubuntu or Debian instance:

sudo apt-get install nfs-common

3. Create a new directory on the instance, such as "/nimCVSNFSol01":

```
sudo mkdir /nimCVSNFSol01
```

Ubuntu-20.04-00		Enforce US Keyboard Layout	View Euliscreen	Send Ctrl+Ait+Delete
Activities 🖸 Terminal •	Nov 3 06:22			A 4 0
Tipedeligionsi - 5 sudo mkdir /nimcvskFsolei	floadmin@vm1: -			a e (

4. Mount the volume using the appropriate command. Example command from the lab is below:

```
sudo mount -t nfs -o rw,hard,rsize=65536,wsize=65536,vers=3,tcp
10.53.0.4:/nimCVSNFSol01 /nimCVSNFSol01
```

	alt - Na och e	ilized.	August 2 shifts	ileas.	Nounted on	
ccesyscen	IN-OLOCKS	USEQ	Avactable	USEA	nounced on	
dev	10409952		10409952	0.8	/dev	
npts	3288328	1580	3286748	18	/run	
dev/sdb5	61145932	19231356	38778832	.34%		
npfs	16441628	6	16441628	0%	/dev/shn	
npfs	5120	6	SSS 5120	6%	/run/lock	
npfs	16441628	C	16441628	0%	/sys/fs/cgroup	
dev/loop0	128	128	0	100%	/snap/bare/5	
dev/loop1	56832	56832	Ġ	100%	/snap/core18/2128	
dev/loop2	66688	66688	.0	100%	/snap/gtk-common-themes/1515	
dev/loop4	66816	66816	0	100%	/snap/gtk-connon-thenes/1519	
dev/loop3	52224	52224	0	100%	/snap/snap-store/S47	
dev/loop5	224256	224256		166%	/snap/gnone-3-34-1804/72	
dev/sdb1	523248	and the second second	523244	1%	/boot/efi	
nofs	3288324	28	3288296	1%	/run/user/1000	
0.53.0.4:/ocve-ds-1	107374182400	1136086016	106238096384	2%	/base	
dev/mapper/nfsprdvol-prod01	419155968	55384972	363778996	14%	/datastore1	
dev/loop8	33280	33280		100%	/spap/spapd/13276	
dev/loopó	33280	31280	ă	1005	/span/spand/13648	
day (loop7	56832	56882		1004	Ispan/core18/2246	
0 51 0 4: (alactichesa) 01	187174182488	36600	187374183144	110	Inimplemental Al	
or SSIG. 4. THENEVSAF SOLOI	101314182400	250	10/3/4102144	-	Autor and and a con	

For SMB volumes, make sure the Active Directory connections is configured prior to creating the SMB volume.

Acti	ve D	irectory conn	ections	CREATE	DELETE						
Creat	e a W	indows Active Dire	ctory connection to yo	our existing AD :	server. This is a prerequisite	step before creating vol	umes with the SMB pro	tocol type. Learn	more (2		
										-	1.000
Ŧ	Filte	r Search for Acti	ve Directory connectio	ins by ID, usern	ame, DNS, netBIOS, region, e	tc.				0	ш
-	• Filte	r Search for Acti Username	ve Directory connectio	ns by ID, usern DNS Servers	ame, DNS, netBIOS, region, e NetBIOS Prefix	OU Path	AD Server Name	KDC IP	Region	6 Stat	III 25

Once the AD connection is in place, create the volume with the desired service level. The steps are like creating NFS volume except selecting the appropriate protocol.

- 1. In the Cloud Volumes Console, go to the Volumes page and click Create.
- 2. On the Create File System page, specify the volume name and billing labels as required for chargeback mechanisms.



Volume Name

Name * ---

nimCVSMBvol01

A human readable name used for display purposes.

Billing Label

Label your volumes for billing reports, queries. Supported with CVS-Performance service type; can be set with CVS service type but not available for billing at this time.



3. Select the appropriate service. For GCVE, choose CVS-Performance and desired service level for improved latency and higher performance based on the workload requirements.

Create File System

Service Type

←

Cloud Volumes Service is offered as two service types: CVS and CVS-Performance. Select the service type that matches your workload needs. <u>Region availability</u> is varies by service type. Learn more is



Offers volumes created with zonal high availability.



Offers 3 performance levels and improved latency to address higher performance application requirements.

Volume Replication

Secondary

Select to create volume as a destination target for volume replication. Applicable only to CVS-performance volumes.

4. Specify the Google Cloud region for the volume and volume path (The volume path must be unique across all of cloud volumes in the project)



Region

Region availability varies by service type.

europe-west3	Ŧ	0
Volume will be provisioned in the region you select.		
Volume Path *		

C

nimCVSMBvoI01

Must be unique to the project.

5. Select the level of performance for the volume.

Se	rvice Level	
Se	lect the performance level required for your workload.	
0	Standard Up to 16 MiB/s per TiB	
0	Premium Up to 64 MIB/s per TIB	
0	Extreme Up to 128 MiB/s per TiB	
s	inapshot 👻	
T	he snapshot to create the volume from.	
Spe	cify the size of the volume and the protocol type. In this testing, SMB is used.	
÷	Create File System	
Vo	lume Details	
Vo	lume Details Ilocated Capacity *	
Vo 1 A	Iume Details Ilocated Capacity * O24 GiB Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB)	
	Iume Details Ilocated Capacity * 024 GiB Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) rotocol Type *	
Vo A 10 A	Iume Details Ilocated Capacity * 024 GiB Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) rotocol Type * MB	
Vo	Iume Details Ilocated Capacity * 024 GiB Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) rotocol Type * MB Make snapshot directory (.snapshot) visible Makes .snapshot directory visible to clients. For NFSv4.1 volumes (CVS-Performance only), the directory visible to clients. For NFSv4.1 volumes (CVS-Performance only), the directory visible to clients.	
	Ilucated Capacity *	
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	Ilume Details Ilocated Capacity * O24 GiB Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) Interctorol Type * MB Make snapshot directory (.snapshot) visible Makes snapshot directory visible to clients. For NFSv4.1 volumes (CVS-Performance only), the directory itself will not be listed but can be accessed to list contents, etc. Enable SMB Encryption Enable this option only if you require encryption of your SMB data traffic. Enable CA share support for S01. Server, FSI onix	
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	Ilume Details Illocated Capacity * O24 GiB Ilocated Size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) Ilocated size must be between 1 TiB (1024 GiB) and 100 TiB (102400 GiB) Inotocol Type * MB Make snapshot directory (.snapshot) visible Makes .snapshot directory visible to clients. For NFSv4.1 volumes (CVS-Performance only), the directory itself will not be listed but can be accessed to list contents, etc. Enable SMB Encryption Enable this option only if you require encryption of your SMB data traffic. Enable CA share support for SQL Server, FSLogix Enable this option only for SQL Server and FSLogix workloads that require continuous availability. Hide SMB Share Enable this option to make SMB shares non-browsable	

□ \$ F	Shared V Provide th	PC configur e host projec	ation at name w	hen deployi	ng in a shar	ed VPC ser	vice project.	
clos	C Network	Name * Nes-vpc						•
Sele	ect the VF r.	°C Network f	rom which	n the volum	e will be acc	essible. Th	is cannot be	changed
	Jse Cust	om Address	Range					
Res net	erved Ad app-addi	dress range esses						
V SI	NOW SN		LICY					
SA	VE	CANCEL						
	Save to	create the	volume.					
Click								

To mount the SMB volume, do the following:

- 1. In the Cloud Console, go to Cloud Volumes > Volumes.
- 2. Go to the Volumes page
- 3. Click the SMB volume for which you want to map an SMB share.
- 4. Scroll to the right, under Show More, click Mount Instructions.

To perform the mounting process from within the Windows guest OS of the VMware VM, follow the below steps:

- 1. Click the Start button and then click on Computer.
- 2. Click Map Network Drive.
- 3. In the Drive list, click any available drive letter.
- 4. In the folder box, type:

\\nimsmb-3830.nimgcveval.com\nimCVSMBvol01

What net	work folder would ye	ou like to map?								
Specify the	frive letter for the connecti	on and the folder that you wan	t to connect to:							
	7.									
Unive:	2									
Folder:	\\10.53.0.4\nimcvsmbvp	N01 ~	Browse							
	Example: \\server\share									
	Reconnect at sign-in									
	Connect using different credentials									
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Region Availability for Supplemental NFS datastores on AWS, Azure, and GCP

Learn more about the the Global Region support for supplemental NFS datastores on AWS, Azure and Google Cloud Platform (GCP).

AWS Region Availability

The availability of supplemental NFS datastores on AWS / VMC is defined by Amazon. First, you need to determine if both VMC and FSxN are available in a specified region. Next, you need to determine if the FSxN supplemental NFS datastore is supported in that region.

• Check the availability of VMC here.

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- Amazon's pricing guide offers information on where FSxN (FSx ONTAP) is available. You can find that information here.
- Availability of the FSxN supplemental NFS datastore for VMC is coming soon.

While information is still being released, the following chart identifies the current support for VMC, FSxN and FSxN as a supplemental NFS datastore.

Americas

AWS Region	VMC Availability	FSx ONTAP Availability	NFS Datastore Availability
US East (Northern Virginia)	Yes	Yes	Yes
US East (Ohio)	Yes	Yes	Yes
US West (Northern California)	Yes	No	No
US West (Oregon)	Yes	Yes	Yes
GovCloud (US West)	Yes	Yes	Yes
Canada (Central)	Yes	Yes	Yes
South America (Sao Paulo)	Yes	Yes	Yes

Last updated on: June 2, 2022.

EMEA

AWS Region	VMC Availability	FSx ONTAP Availability	NFS Datastore Availability
Europe (Ireland)	Yes	Yes	Yes
Europe (London)	Yes	Yes	Yes
Europe (Frankfurt)	Yes	Yes	Yes
Europe (Paris)	Yes	Yes	Yes
Europe (Milan)	Yes	Yes	Yes
Europe (Stockholm)	Yes	Yes	Yes

Last updated on: June 2, 2022.

Asia Pacific

AWS Region	VMC Availability	FSx ONTAP Availability	NFS Datastore Availability
Asia Pacific (Sydney)	Yes	Yes	Yes
Asia Pacific (Tokyo)	Yes	Yes	Yes
Asia Pacific (Osaka)	Yes	No	No
Asia Pacific (Singapore)	Yes	Yes	Yes
Asia Pacific (Seoul)	Yes	Yes	Yes
Asia Pacific (Mumbai)	Yes	Yes	Yes
Asia Pacific (Jakarta)	No	No	No
Asia Pacific (Hong Kong)	Yes	Yes	Yes

Azure Region Availability

The availability of supplemental NFS datastores on Azure / AVS is defined by Microsoft. First, you need to determine if both AVS and ANF are available in a specific region. Next, you need to determine if the ANF supplemental NFS datastore is supported in that region.

- Check the availability of AVS and ANF here.
- Check the availability of the ANF supplemental NFS datastore here.

GCP Region Availability

GCP region availability will be released when GCP enters public availability.

Summary and Conclusion: Why NetApp Hybrid Multicloud with VMware

NetApp Cloud Volumes along with VMware solutions for the major hyperscalers provides great potential for organizations looking to leverage hybrid cloud. The rest of this section provides the use cases that show integrating NetApp Cloud Volumes enables true hybrid Multicloud capabilities.

Use case #1: Optimizing storage

When performing a sizing exercise using RVtools output, it is always evident that the horsepower (vCPU/vMem) scale is parallel with storage. Many times, organizations find themselves in a situation where the storage space requires drives the size of the cluster well beyond what is needed for horsepower.

By integrating NetApp Cloud Volumes, organizations can realize a vSphere-based cloud solution with a simple migration approach, with no re-platforming, no IP changes, and no architectural changes. Additionally, this optimization enables you to scale the storage footprint while keeping the host count to least amount required in vSphere, but no change to the storage hierarchy, security, or files made available. This allows you to optimize the deployment and reduce the overall TCO by 35–45%. This integration also enables you to scale storage from warm storage to production-level performance in seconds.

Use case #2: Cloud migration

Organizations are under pressure to migrate applications from on-premises data centers to the Public Cloud for multiple reasons: an upcoming lease expiration; a finance directive to move from capital expenditure (capex) spending to operational expenditures (opex) spending; or simply a top-down mandate to move everything to the cloud.

When speed is critical, only a streamlined migration approach is feasible because re-platforming and refactoring applications to adapt to the cloud's particular laaS platform is slow and expensive, often taking months. By combining NetApp Cloud Volumes with the bandwidth-efficient SnapMirror replication for guest-connected storage (including RDMs in conjunction with application-consistent Snapshot copies and HCX, cloud specific migration (e.g. Azure Migrate), or third-party products for replicating VMs), this transition is even easier than relying on time-consuming I/O filters mechanisms.

Use case #3: Data center expansion

When a data center reaches capacity limits due to seasonal demand spikes or just steady organic growth, moving to the cloud-hosted VMware along with NetApp Cloud Volumes is an easy solution. Leveraging NetApp Cloud Volumes allows storage creation, replication, and expansion very easily by providing high availability across availability zones and dynamic scaling capabilities. Leveraging NetApp Cloud Volumes helps in minimizing host cluster capacity by overcoming the need for stretch clusters.

Use case #4: Disaster recovery to the cloud

In a traditional approach, if a disaster occurs, the VMs replicated to the cloud would require conversion to the cloud's own hypervisor platform before they could be restored – not a task to be handled during a crisis.

By using NetApp Cloud Volumes for guest-connected storage using SnapCenter and SnapMirror replication from on-premises along with public cloud virtualization solutions, a better approach for disaster recovery can be devised allowing VM replicas to be recovered on fully consistent VMware SDDC infrastructure along with cloud specific recovery tools (e.g. Azure Site Recovery) or equivalent third-party tools such as Veeam. This approach also enables you to perform disaster recovery drills and recovery from ransomware quickly. This also enables you to scale to full production for testing or during a disaster by adding hosts on-demand.

Use case #5: Application modernization

After applications are in the public cloud, organizations will want to take advantage of the hundreds of powerful cloud services to modernize and extend them. With the use of NetApp Cloud Volumes, modernization is an easy process because the application data is not locked into vSAN and allows data mobility for a wide range of use cases, including Kubernetes.

Conclusion

Whether you are targeting an all-cloud or hybrid cloud, NetApp Cloud Volumes provides excellent options to deploy and manage the application workloads along with file services and block protocols while reducing the TCO by making the data requirements seamless to the application layer.

Whatever the use case, choose your favorite cloud/hyperscaler together with NetApp Cloud Volumes for rapid realization of cloud benefits, consistent infrastructure, and operations across on-premises and multiple clouds, bidirectional portability of workloads, and enterprise-grade capacity and performance.

It is the same familiar process and procedures that are used to connect the storage. Remember, it is just the position of the data that changed with new names; the tools and processes all remain the same and NetApp Cloud Volumes helps in optimizing the overall deployment.

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