

### NetApp for AWS / VMC

**NetApp Solutions** 

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## **NetApp Capabilities for AWS VMC**

Learn more about the capabilities that NetApp brings to the AWS VMware Cloud (VMC) - 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.

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

- Configuring VMC in AWS
- NetApp Storage Options for VMC
- NetApp / VMware Cloud Solutions

## **Configuring VMC in AWS**

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

### **NetApp Storage Options for VMC**

NetApp storage can be utilized in several ways - either as guess connected or as a supplemental NFS datastore - within AWS VMC.

Please visit Supported NetApp Storage Options for more information.

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.

### **Solution Use Cases**

With NetApp and VMware cloud solutions, many use cases are simple to deploy in your AWS VMC. Use cases are defined for each of the VMware defined cloud areas:

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

Browse the NetApp solutions for AWS VMC

### Protecting Workloads on AWS / VMC

# TR-4931: Disaster Recovery with VMware Cloud on Amazon Web Services and Guest Connect

A proven disaster recovery (DR) environment and plan is critical for organizations to ensure that business-critical applications can be rapidly restored in the event of a major outage. This solution focuses on demonstrating DR use cases with a focus on VMware and NetApp technologies, both on-premises and with VMware Cloud on AWS.

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#### Overview

NetApp has a long history of integration with VMware as evidenced by the tens of thousands of customers that have chosen NetApp as their storage partner for their virtualized environment. This integration continues with guest-connected options in the cloud and recent integrations with NFS datastores as well. This solution focuses on the use case commonly referred to as guest-connected storage.

In guest-connected storage, the guest VMDK is deployed on a VMware-provisioned datastore, and application data is housed on iSCSI or NFS and mapped directly to the VM. Oracle and MS SQL applications are used to demonstrate a DR scenario, as shown in the following figure.



#### Assumptions, pre-requisites and component overview

Before deploying this solution, review the overview of the components, the required pre-requisites to deploy the solution and assumptions made in documenting this solution.

#### DR Solution Requirements, Pre-requisities and Planning

#### Performing DR with SnapCenter

In this solution, SnapCenter provides application-consistent snapshots for SQL Server and Oracle application data. This configuration, together with SnapMirror technology, provides high-speed data replication between our on-premises AFF and FSx ONTAP cluster. Additionally, Veeam Backup & Replication provides backup and restore capabilities for our virtual machines.

In this section, we cover the configuration of SnapCenter, SnapMirror, and Veeam for both backup and restore.

The following sections cover configuration and the steps needed to complete a failover at the secondary site:

#### Configure SnapMirror relationships and retention schedules

SnapCenter can update SnapMirror relationships within the primary storage system (primary > mirror) and to secondary storage systems (primary > vault) for the purpose of long-term archiving and retention. To do so, you must establish and initialize a data replication relationship between a destination volume and a source volume using SnapMirror.

The source and destination ONTAP systems must be in networks that are peered using Amazon VPC peering, a transit gateway, AWS Direct Connect, or an AWS VPN.

The following steps are required for setting up SnapMirror relationships between an on-premises ONTAP system and FSx ONTAP:



Refer to the FSx for ONTAP – ONTAP User Guide for more information on creating SnapMirror relationships with FSx.

For the source ONTAP system residing on-premises, you can retrieve the inter-cluster LIF information from System Manager or from the CLI.

1. In ONTAP System Manager, navigate to the Network Overview page and retrieve the IP addresses of Type: Intercluster that are configured to communicate with the AWS VPC where FSx is installed.

Buckets												
Qtrees			-									
Quotas		Network Interfaces	Portsets									
Storage VMs		+ Add								Q Search 👲 De	awrload 🔍 Filter 🛛 Show/H	ede 🗸
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NETWORK	A	Name	Status	Storage VM	IPspace.	Address 🖓	Current Node	Current Port	Portset	Protocols	Туре	The
Overview		veeam_repo	0	Backup	Default	10.61.181.179	E13A300_1	a0a-181		SMB/CIPS, NFS, 53	Data	3
Ethernet Ports		CM01	0		Default	10.61.181.180	E13A300_1	181-161			Cluster/Node Mgmt	3
FC Ports		110.000			- water and the	100-00 Max 200		Constanting of the second				1
EVENTS & JOBS	1992	10C_N3	0		Deraut	10.01.181.153	£13A300_1	202-151			intercluster, cluster, Node Hight	1
PROTECTION	*	HC_N2	0		Default	10.61.181.184	E13A300_2	181-696			Intercluster,Cluster/Node Mgmt	ं
ALC: NO.	1225	lif_ora_svm_614	0	073_9791	Default	10.61.181.185	E13A300_1	a0a-181		SMB/CIFS, NFS, FL	Data	0

2. To retrieve the Intercluster IP addresses for FSx, log into the CLI and run the following command:

FSx-Dest::> network interface show -role intercluster

	Logical	Status	Network	Current	Current	Is
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port	Home
FsxId0ae40e	08acc0dea67					
	inter 1	up/up	172.30.15.42/25	FsxId0ae40e08	acc0dea6'	7-01
					e0e	true
	inter 2	up/up	172.30.14.28/26	FsxId0ae40e08	accOdea6'	7-02
					e0e	true

To establish cluster peering between ONTAP clusters, a unique passphrase entered at the initiating ONTAP cluster must be confirmed in the other peer cluster.

1. Set up peering on the destination FSx cluster using the cluster peer create command. When prompted, enter a unique passphrase that is used later on the source cluster to finalize the creation process.

```
FSx-Dest::> cluster peer create -address-family ipv4 -peer-addrs
source_intercluster_1, source_intercluster_2
Enter the passphrase:
Confirm the passphrase:
```

2. At the source cluster, you can establish the cluster peer relationship using either ONTAP System Manager or the CLI. From ONTAP System Manager, navigate to Protection > Overview and select Peer Cluster.



- 3. In the Peer Cluster dialog box, fill out the required information:
  - a. Enter the passphrase that was used to establish the peer cluster relationship on the destination FSx cluster.

- b. Select Yes to establish an encrypted relationship.
- c. Enter the intercluster LIF IP address(es) of the destination FSx cluster.
- d. Click Initiate Cluster Peering to finalize the process.

Local	Ren
STORAGE VM PERMISSIONS	PASSPHRASE 🛞
All storage VMs (incl X	
timeter of the function	It cannot be determined from the passphrase wheth
Storage VMs created in the future also will be given	this relationship was encrypted. Is the relationship
permissions.	encrypted?
	2 Yes No
	To generate passphrase, Launch Remote Cluste
	Intercluster Network Interfaces IP Addresses
	172.30.15.42
	172.30.14.28
	Cancel
	+ Add
4	

4. Verify the status of the cluster peer relationship from the FSx cluster with the following command:

FSx-Dest::> cluster p	eer show		
FsxId0ae40e08acc0dea67::> Peer Cluster Name	cluster peer show Cluster Serial Number	Availability	Authentication
E13A300	1-80-000011	Available	ok

#### Establish SVM peering relationship

The next step is to set up an SVM relationship between the destination and source storage virtual machines that contain the volumes that will be in SnapMirror relationships.

1. From the source FSx cluster, use the following command from the CLI to create the SVM peer relationship:

```
FSx-Dest::> vserver peer create -vserver DestSVM -peer-vserver
Backup -peer-cluster OnPremSourceSVM -applications snapmirror
```

- 2. From the source ONTAP cluster, accept the peering relationship with either ONTAP System Manager or the CLI.
- 3. From ONTAP System Manager, go to Protection > Overview and select Peer Storage VMs under Storage VM Peers.



- 4. In the Peer Storage VM's dialog box, fill out the required fields:
  - The source storage VM
  - The destination cluster
  - The destination storage VM



5. Click Peer Storage VMs to complete the SVM peering process.

SnapCenter manages retention schedules for backups that exist as snapshot copies on the primary storage system. This is established when creating a policy in SnapCenter. SnapCenter does not manage retention policies for backups that are retained on secondary storage systems. These policies are managed separately through a SnapMirror policy created on the secondary FSx cluster and associated with the destination volumes that are in a SnapMirror relationship with the source volume.

When creating a SnapCenter policy, you have the option to specify a secondary policy label that is added to the SnapMirror label of each snapshot generated when a SnapCenter backup is taken.



On the secondary storage, these labels are matched to policy rules associated with the destination volume for the purpose of enforcing retention of snapshots.

The following example shows a SnapMirror label that is present on all snapshots generated as part of a policy used for daily backups of our SQL Server database and log volumes.

Select secondary replication options	6
Select secondary replication options	

Update SnapMirror after creating a local Snapshot copy.

Update SnapVault after creating a local Snapshot copy.

Secondary policy label	Custom Label - 1
	sql-daily
Error retry count	3 🗘 🚺

For more information on creating SnapCenter policies for a SQL Server database, see the SnapCenter documentation.

You must first create a SnapMirror policy with rules that dictate the number of snapshot copies to retain.

1. Create the SnapMirror Policy on the FSx cluster.

FSx-Dest::> snapmirror policy create -vserver DestSVM -policy
PolicyName -type mirror-vault -restart always

2. Add rules to the policy with SnapMirror labels that match the secondary policy labels specified in the SnapCenter policies.

```
FSx-Dest::> snapmirror policy add-rule -vserver DestSVM -policy
PolicyName -snapmirror-label SnapMirrorLabelName -keep
#ofSnapshotsToRetain
```

The following script provides an example of a rule that could be added to a policy:

```
FSx-Dest::> snapmirror policy add-rule -vserver sql_svm_dest -policy
Async SnapCenter SQL -snapmirror-label sql-ondemand -keep 15
```



Create additional rules for each SnapMirror label and the number of snapshots to be retained (retention period).

#### **Create destination volumes**

To create a destination volume on FSx that will be the recipient of snapshot copies from our source volumes, run the following command on FSx ONTAP:

```
FSx-Dest::> volume create -vserver DestSVM -volume DestVolName
-aggregate DestAggrName -size VolSize -type DP
```

Create the SnapMirror relationships between source and destination volumes

To create a SnapMirror relationship between a source and destination volume, run the following command on FSx ONTAP:

```
FSx-Dest::> snapmirror create -source-path
OnPremSourceSVM:OnPremSourceVol -destination-path DestSVM:DestVol -type
XDP -policy PolicyName
```

#### Initialize the SnapMirror relationships

Initialize the SnapMirror relationship. This process initiates a new snapshot generated from the source volume and copies it to the destination volume.

FSx-Dest::> snapmirror initialize -destination-path DestSVM:DestVol

Deploy and configure Windows SnapCenter server on-premises.

#### Deploy Windows SnapCenter Server on premises

This solution uses NetApp SnapCenter to take application-consistent backups of SQL Server and Oracle databases. In conjunction with Veeam Backup & Replication for backing up virtual machine VMDKs, this provides a comprehensive disaster recovery solution for on-premises and cloud-based datacenters.

SnapCenter software is available from the NetApp support site and can be installed on Microsoft Windows systems that reside either in a domain or workgroup. A detailed planning guide and installation instructions can be found at the NetApp Documentation Center.

The SnapCenter software can be obtained at this link.

After it is installed, you can access the SnapCenter console from a web browser using *https://Virtual\_Cluster\_IP\_or\_FQDN:8146*.

After you log into the console, you must configure SnapCenter for backup SQL Server and Oracle databases.

To add storage controllers to SnapCenter, complete the following steps:

1. From the left menu, select Storage Systems and then click New to begin the process of adding your storage controllers to SnapCenter.

	letApp SnapC	enter®	0		•	≅ 9• .	scadmin SnapCe	nterAdmin 🛛 🖡 Sign Out
<		ONTA	P Storage					<u> </u>
	Dashboard	Туре	ONTAP SVMs	• Search	n by Name			New Delens
1	Resources	ONTA	AP Storage Connectio	ns				
	Monitor		Name 月	IP	Cluster Name	User Name	Platform	Controller License
<b>a</b>	Reports		Backup	172.16.13.17	172.16.13.17		AFF	~
			<u>FS02</u>	172.16.13.17	172.16.13.17		AFF	~
•	Hosts		ora_svm	172.16.13.17	172.16.13.17		AFF	
ł.	Storage Systems		ora svm dest		172.30.15.42		AFF	Not applicable
=	Settings		<u>sql_svm</u>	172.16.13.17	172.16.13.17		AFF	~
	No. of Concession		sql_svm_dest		172.30.15.42		AFF	Not applicable
<b>A</b>	Alerts		svm_HCApps		172.30.15.42		AFF	Not applicable

2. In the Add Storage System dialog box, add the management IP address for the local on-premises ONTAP cluster and the username and password. Then click Submit to begin discovery of the storage system.

Add Storage System	
Add Storage System	•
Storage System	10.61.181.180
Username	admin
Password	•••••
Event Management S Send AutoSuppor Log SnapCenter S More Options : Pla	System (EMS) & AutoSupport Settings It notification to storage system Server events to syslog atform, Protocol, Preferred IP etc
Submit         Cancel           3. Repeat this process to add the at the bottom of the Add Storag the FSx system as the secondar backup snapshots.	Reset FSx ONTAP system to SnapCenter. In this case, select More Options by System window and click the check box for Secondary to designate any storage system updated with SnapMirror copies or our primary

Platform	FAS	•	Secondary 🚯	
Protocol	HTTPS	•		
Port	443			
Timeout	60	seconds	0	
Preferred IP				0
Save Cance	<u>H</u>			

#### Add hosts to SnapCenter

The next step is adding host application servers to SnapCenter. The process is similar for both SQL Server and Oracle.

- 1. From the left menu, select Hosts and then click Add to begin the process of adding storage controllers to SnapCenter.
- 2. In the Add Hosts window, add the Host Type, Hostname, and the host system Credentials. Select the plug-in type. For SQL Server, select the Microsoft Windows and Microsoft SQL Server plug-in.

II Ne	etApp	SnapCenter®				
>	Man	aged Hosts				
	Se	arch by Name		Add Host		
<b>v</b>		Name	臣	Host Type	Windows -	
•		oraclesry_01.sddc.netapp.com		Host Name	sqlsrv-01.sddc.netapp.com	
		oraclesry 02.sddc.netapp.com		Credentials	sddc-jpowell	+
âĩ		oraclesry_03.sddc.netapp.com			1	
A.		oraclesry_04.sddc.netapp.com		Select Plug-ins to In	stall SnapCenter Plug-ins Package 4.6 for Windows	
ła.		oraclesry_05.sddc.netapp.com			Microsoft Windows	
		oraclesry 06.sddc.netapp.com			Microsoft SQL Server	
*		oraclesry_07.sddc.netapp.com			Microsoft Exchange Server     SAP HANA	
		oraclesry_08.sddc.netapp.com		More Options : P	Dort, gMSA, Install Path, Custom Plug-Ins	
		oraclesry_09.sddc.netapp.com			na pro z na zakona katerio (zako zako zako zako zako zako zako zako	
		oraclesry 10.sddc.netapp.com		Submit Cancel	]	

3. For Oracle, fill out the required fields in the Add Host dialog box and select the check box for the Oracle Database plug-in. Then click Submit to begin the discovery process and to add the host to SnapCenter.

Host Type	Linux	•		
Host Name	oraclesrv_11.sddc.netapp.com			
				-
Credentials Select Plug-ins to In:	voot tall SnapCenter Plug-ins Package 4.6 for Linux Oracle Database	•	+	e
Credentials Select Plug-ins to In	root         stall SnapCenter Plug-ins Package 4.6 for Linux         Oracle Database         SAP HANA	•	+	e
Credentials Select Plug-ins to In:	root         stall SnapCenter Plug-ins Package 4.6 for Linux         Oracle Database         SAP HANA         ort, Install Path, Custom Plug-Ins	•	*	

Policies establish the specific rules to be followed for a backup job. They include, but are not limited to, the backup schedule, replication type, and how SnapCenter handles backing up and truncating transaction logs.

You can access	policies	in the S	ettings s	ection of	f the S	SnapCenter	web clien	ıt.

	NetApp SnapC	enter®		_		• 🖻	<b>8</b> -	👤 scadmin
<		Global Settings	Policies	Users and Access	Roles C	redential	Software	
	Dashboard							<i>A</i>
<b>V</b>	Resources	Search by Name	2			New		lodity
	Monitor	Name	4E	Backup Type	Schedul	е Туре	Re	plication
~		SQL-Daily		Full and Log backup	Daily		Sn	apVault
<b>am</b>	Reports	SQL-Hourly		Full and Log backup	Hourly		Sn	apVault
A	Hosts	SQL-Hourly-Logs		Log backup	Hourly		Sn	apVault
÷.	Storage Systems	SQL-OnDemand		Full and Log backup	On dema	and	Sn	apVault
-	Settings	SQL-Weekly		Full and Log backup	Weekly		Sn	apVault
-	Sectings							
A	Alerts							

For complete information on creating policies for SQL Server backups, see the SnapCenter documentation.

For complete information on creating policies for Oracle backups, see the SnapCenter documentation.

#### Notes:

- As you progress through the policy creation wizard, take special note of the Replication section. In this section you stipulate the types of secondary SnapMirror copies that you want taken during the backups process.
- The "Update SnapMirror after creating a local Snapshot copy" setting refers to updating a SnapMirror relationship when that relationship exists between two storage virtual machines residing on the same cluster.
- The "Update SnapVault after creating a local SnapShot copy" setting is used to update a SnapMirror relationship that exists between two separate cluster and between an on-premises ONTAP system and Cloud Volumes ONTAP or FSxN.

The following image shows the preceding options and how they look in the backup policy wizard.

New SQL Serve	r Backup Policy				
1 Name	Select secondary rep	olication op	otions 🚯		
2 Backup Type	Update SnapMirror a	fter creating a	a local Snaps	shot copy.	
2					
3 Retention	Update SnapVault aft	er creating a l	local Snapsh	iot copy.	
3 Retention 4 Replication	Update SnapVault aft	er creating a l	local Snapsh	ot copy.	0
3 Retention 4 Replication	Update SnapVault aft Secondary policy label Error retry count	Choose	local Snapsh	÷	0

#### Create SnapCenter Resource Groups

Resource Groups allow you to select the database resources you want to include in your backups and the policies followed for those resources.

- 1. Go to the Resources section in the left-hand menu.
- 2. At the top of the window, select the resource type to work with (In this case Microsoft SQL Server) and then click New Resource Group.

	NetApp SnapC	enter@	Ø		٠	⊠ 0	L scadmin SnapCenter/	Admin 🛛 🗊 Sign Out
<		Micros	oft SQL Server					
	Dashboard	View	Resource Group	•	earch by name	9 V	) 🧧	New Resource Group
D	Resources	19	Name	Resource Count	Tags	Policie	s Last Backup	Overall Status
•	Monitor		SQLSRV-01	1		SQL-Da SQL-Ho	ily 05/11/2022 ourly	Completed
ай	Reports					SQL- OnDer	hand	
A	Hosts		60160100			SQL-We		Forder d
ł.	Storage Systems		SQLSRV-02			SQL-Da SQL-Ho SQL-	ourly 03/28/2022	Falled
÷	Settings					OnDer SQL-We	nand eekly	
▲	Alerts		SQLSRV-03	1		SQL-Da	ily05/11/2022	Completed

The SnapCenter documentation covers step-by-step details for creating Resource Groups for both SQL Server and Oracle databases.

For backing up SQL resources, follow this link.

For Backing up Oracle resources, follow this link.

#### Deploy and configure Veeam Backup Server

Veeam Backup & Replication software is used in the solution to back up our application virtual machines and archive a copy of the backups to an Amazon S3 bucket using a Veeam scale-out backup repository (SOBR). Veeam is deployed on a Windows server in this solution. For specific guidance on deploying Veeam, see the Veeam help Center Technical documentation.

After you deploy and license the software, you can create a scale-out backup repository (SOBR) as target storage for backup jobs. You should also include an S3 bucket as a backup of VM data offsite for disaster recovery.

See the following prerequisites before getting started.

- 1. Create an SMB file share on your on-premises ONTAP system as the target storage for backups.
- 2. Create an Amazon S3 bucket to include in the SOBR. This is a repository for the offsite backups.

First, add the ONTAP storage cluster and associated SMB/NFS filesystem as storage infrastructure in Veeam.

1. Open the Veeam console and log in. Navigate to Storage Infrastructure and then select Add Storage.



- 2. In the Add Storage wizard, select NetApp as the storage vendor and then select Data ONTAP.
- 3. Enter the management IP address and check the NAS Filer box. Click Next.

••	Management server DNS name or ID address:
Name	10.61.181.180
Credentials	Description:
NAS Filer	Created by SDDC\jpowell at 5/17/2022 10:34 AM.
Apply	
Summary	
	☐ Block or file storage for VMware vSphere ☐ Block storage for Microsoft Windows servers ☑ NAS filer
	< Previous Next > Finish Cance
dd your credenti	als to access the ONTAP cluster.
dd your credenti New NetApp Data ONTA Credentials Specify acco	ials to access the ONTAP cluster. <sup>NP Storage</sup> unt with storage administrator privileges.
dd your credenti New NetApp Data ONTA Credentials Specify acco Name	ials to access the ONTAP cluster. <sup>NP Storage</sup> unt with storage administrator privileges. <u>Credentials:</u>
dd your credenti New NetApp Data ONTA Credentials Specify acco Name	ials to access the ONTAP cluster. <sup>NP</sup> Storage unt with storage administrator privileges. Credentials: <u>Credentials:</u> <u>HCIEUC\Admin (HCIEUC\Admin, last edited: 98 days ago)</u> \ Add
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials	ials to access the ONTAP cluster.  AP Storage unt with storage administrator privileges.  Credentials:  Credentials:  Add  Manage accounts
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer	ials to access the ONTAP cluster. AP Storage unt with storage administrator privileges. Credentials: HCIEUC\Admin (HCIEUC\Admin, last edited: 98 days ago) \log Add Manage accounts Protocol: HTTPS \log Add
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply	ials to access the ONTAP cluster.  P Storage unt with storage administrator privileges.  Credentials:  Credentials:  HCIEUC\Admin (HCIEUC\Admin, last edited: 98 days ago) \low Add  Manage accounts  Protocol: HTTPS \ Port: 443 \=
dd your credenti New NetApp Data ONTA <b>Credentials</b> Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. P Storage unt with storage administrator privileges. Credentials: HCIEUCAdmin (HCIEUCAdmin, last edited: 98 days ago)    Add Manage accounts Protocol: HTTPS Port: 443
dd your credenti New NetApp Data ONTA <b>Credentials</b> Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. AP Storage unt with storage administrator privileges. Credentials: Manage accounts Protocol: HTTPS ~ Port: 443 •
dd your credenti New NetApp Data ONTA <b>Credentials</b> Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. P Storage unt with storage administrator privileges. Credentials: Manage accounts Protocol: HTTPS ~ Port: 443 •
dd your credenti New NetApp Data ONTA <b>Credentials</b> Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. P Storage unt with storage administrator privileges. Credentials: Manage accounts Protocol: HTTPS ~ Port: 443 ~
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. P Storage unt with storage administrator privileges. Credentials: Protocol: HTTPS ~ Port: 443 •
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. AP Storage unt with storage administrator privileges. Credentials: HCIEUCAdmin (HCIEUCVAdmin, last edited: 98 days ago)
dd your credenti New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply Summary	ials to access the ONTAP cluster. AP Storage unt with storage administrator privileges. Credentials: HCIEUC\Admin (HCIEUC\Admin, last edited: 98 days ago) \ Add Manage accounts Protocol: HTTPS \ Port: 443 \

New NetApp Data ONTAP Store	ge	×
NAS Filer Specify how this sto	orage can be accessed by file backup jobs.	
Name Credentials NAS Filer	Protocol to use: SMB NFS Create required export rules automatically	
Apply	All volumes	Choose
Summary	Automatic selection	Choose
	< Previous Apply Finish	Cancel

6. Complete the Apply and Summary pages of the wizard and click Finish to begin the storage discovery process. After the scan completes, the ONTAP cluster is added along with the NAS filers as available resources.



7. Create a backup repository using the newly discovered NAS shares. From Backup Infrastructure, select Backup Repositories and click the Add Repository menu item.

<ul> <li>Backup Repositories</li> <li>External Repositories</li> <li>Scale-out Repositories</li> <li>WAN Accelerators</li> <li>Service Providers</li> <li>SureBackup</li> <li>Application Groups</li> <li>Virtual Labs</li> <li>Managed Servers</li> <li>WANaged Servers</li> <li>Microsoft Windows</li> </ul>	Rep al Re out R cce Pro ckup licat ual L ed S ware	Rej Re it F ce Pro kuj ca al L d S	epo Rej elei ovi up atic Lai	osito oositi epos erato iden on G	ories orie itori ors s	s ies		2	2	
<ul> <li>External Repositories</li> <li>Scale-out Repositories</li> <li>WAN Accelerators</li> <li>Service Providers</li> <li>SureBackup</li> <li>Application Groups</li> <li>Virtual Labs</li> <li>Managed Servers</li> <li>WMware vSphere</li> <li>Microsoft Windows</li> </ul>	al Re out R Ccel Pro ckup licat Jal L ed S ware	Re ce Pro kul ca al L d S	Rep Rep eler ovi up atic Lal	epositi epos erato iden on G	orie itori ors s	ies				
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<ul> <li>Service Providers</li> <li>SureBackup</li> <li>Application Groups</li> <li>Virtual Labs</li> <li>Managed Servers</li> <li>Managed Servers</li> <li>Microsoft Windows</li> </ul>	Pro ckup licat ual L ed S ware	Pro kuj ca al L d S	ovi up atic Lal	ider: on G	S					
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Managed Servers Microsoft Windows	ed S ware	d S		ibs						
<ul> <li>VMware vSphere</li> <li>Microsoft Windows</li> </ul>	ware		Ser	erver	5					
E Microsoft Windows		are	re v	vSph	here					
	roso	osc	oft	t Wi	ndo	ZWS				

8. Follow all steps in the New Backup Repository Wizard to create the repository. For detailed information on creating Veeam Backup Repositories, see the Veeam documentation.

New Backup Repository

#### Share

Type in UNC path to share (mapped drives are not supported), specify share access credentials and how backup jobs should write data to this share.

 $\times$ 

Name Share	Shared folder: \\172.21.162.181\VBRRepo Browse Use \\server\folder format
Repository Mount Server Review Apply Summary	<ul> <li>This share requires access credentials:</li> <li>Sddc\administrator (sddc\administrator, last edited: 85 days ago)</li> <li>Add</li> <li>Manage accounts</li> </ul> Gateway server: <ul> <li>Automatic selection</li> <li>The following server:</li> <li>veeam.sddc.netapp.com (Backup server)</li> <li>Use this option to improve performance and reliability of backup to a NAS located in a remote site.</li> </ul>
	< Previous Next > Finish Cancel

The next step is to add the Amazon S3 storage as a backup repository.

1. Navigate to Backup Infrastructure > Backup Repositories. Click Add Repository.



2. In the Add Backup Repository wizard, select Object Storage and then Amazon S3. This starts the New Object Storage Repository wizard.

### Add Backup Repository

Select the type of backup repository you want to add.

		,
_		
-	_	٠
		,

Direct attached storage

Microsoft Windows or Linux server with internal or direct attached storage. This configuration enables data movers to run directly on the server, allowing for fastest performance.



Network attached storage

Network share on a file server or a NAS device. When backing up to a remote share, we recommend that you select a gateway server located in the same site with the share.



₿

Deduplicating storage appliance

Dell EMC Data Domain, ExaGrid, HPE StoreOnce or Quantum DXi. If you are unable to meet the requirements of advanced integration via native appliance API, use the network attached storage option instead.



On-prem object storage system or a cloud object storage provider. Object storage can only be used as a Capacity Tier of scale-out backup repositories, backing up directly to object storage is not currently supported.

- 3. Provide a name for your object storage repository and click Next.
- 4. In the next section, provide your credentials. You need an AWS Access Key and Secret Key.

	New Object Storage Repository	×	
	Account Specify AWS account	to use for connecting to Amazon S3 storage bucket.	
	Name	Credentials:	
	Account	🕅 AKIAX4H43ZT557HXQT2W (last edited: 107 days ago) 🗸 🖌 Add	
	Bucket	Manage cloud accounts AWS region:	
	Summary	Use the following gateway server:	
		veeam.sddc.netapp.com (Backup server)          Select a gateway server to proxy access to Amazon S3. If no gateway server is specified, all scale-out backup repository extents must have direct Internet access.         Cancel	
		Cancel	
5.	After the Amazon config Apply. Finally, click Finis	juration loads, choose your datacenter, bucket, and folder and click sh to close out the wizard.	

Now that we have added our storage repositories to Veeam, we can create the SOBR to automatically tier backup copies to our offsite Amazon S3 object storage for disaster recovery.

1. From Backup Infrastructure, select Scale-out Repositories and then click the Add Scale-out Repository menu item.



- 2. In the New Scale-out Backup Repository provide a name for the SOBR and click Next.
- 3. For the Performance Tier, choose the backup repository that contains the SMB share residing on your local ONTAP cluster.

New Scale-out Backup Repositor	у	×
Performance Tier Select backup reposi	tories to use as the landing zone and for the short-term retention.	
Name	Extents:	
Performance Tier	Name	Add
Placement Policy		Remove

- 4. For the Placement Policy, choose either Data Locality or Performance based your requirements. Select next.
- 5. For Capacity Tier we extend the SOBR with Amazon S3 object storage. For the purposes of disaster recovery, select Copy Backups to Object Storage as Soon as They are Created to ensure timely delivery of our secondary backups.

	Extend scale-out backup repository capacity with object storage:	
Performance Tier	Amazon S3 Repo 🗸 🗸	Add
Placement Policy	Define time windows when uploading to capacity tier is allowed	Window.
Capacity Tier	Copy backups to object storage as soon as they are created	
Archive Tier	the capacity tier as soon as they are created on the performance tier.	ps copied t
Summary	Move backups to object storage as they age out of the operational restore window Reduce your long-term retention costs by moving older backups to object storage	completel
	while preserving the ability to restore directly from offloaded backups.	
	while preserving the ability to restore directly from offloaded backups. Move backup files older than 14 🚖 days (your operational restore window)	Override.
	while preserving the ability to restore directly from offloaded backups. Move backup files older than 14  days (your operational restore window)	Override.
	while preserving the ability to restore directly from offloaded backups. Move backup files older than 14 representational restore window) Encrypt data uploaded to object storage Password: Manage passwords	Override. Add

#### Create the scale-out backup repository jobs

The final step to configuring Veeam is to create backup jobs using the newly created SOBR as the backup destination. Creating backup jobs is a normal part of any storage administrator's repertoire and we do not cover the detailed steps here. For more complete information on creating backup jobs in Veeam, see the Veeam Help Center Technical Documentation.

#### BlueXP backup and recovery tools and configuration

To conduct a failover of application VMs and database volumes to VMware Cloud Volume services running in AWS, you must install and configure a running instance of both SnapCenter Server and Veeam Backup and Replication Server. After the failover is complete, you must also configure these tools to resume normal backup operations until a failback to the on-premises datacenter is planned and executed.

#### Deploy secondary Windows SnapCenter Server

SnapCenter Server is deployed in the VMware Cloud SDDC or installed on an EC2 instance residing in a VPC with network connectivity to the VMware Cloud environment.

SnapCenter software is available from the NetApp support site and can be installed on Microsoft Windows systems that reside either in a domain or workgroup. A detailed planning guide and installation instructions can be found at the NetApp documentation center.

You can find the SnapCenter software at this link.

#### Configure secondary Windows SnapCenter Server

To perform a restore of application data mirrored to FSx ONTAP, you must first perform a full restore of the on-premises SnapCenter database. After this process is complete, communication with the VMs is reestablished and application backups can now resume using FSx ONTAP as the primary storage.

To achieve this, you must complete the following items on the SnapCenter Server:

- 1. Configure the computer name to be identical to the original on-premises SnapCenter Server.
- 2. Configure networking to communicate with VMware Cloud and the FSx ONTAP instance.
- 3. Complete the procedure to restore the SnapCenter database.
- 4. Confirm that SnapCenter is in Disaster Recovery mode to make sure that FSx is now the primary storage for backups.
- 5. Confirm that communication is reestablished with the restored virtual machines.

#### Deploy secondary Veeam Backup & Replication server

You can install the Veeam Backup & Replication server on a Windows server in the VMware Cloud on AWS or on an EC2 instance. For detailed implementation guidance, see the Veeam Help Center Technical Documentation.

To perform a restore of virtual machines that have been backed up to Amazon S3 storage, you must install the Veeam Server on a Windows server and configure it to communicate with VMware Cloud, FSx ONTAP, and the S3 bucket that contains the original backup repository. It must also have a new backup repository configured on FSx ONTAP to conduct new backups of the VMs after they are restored.

To perform this process, the following items must be completed:

- 1. Configure networking to communicate with VMware Cloud, FSx ONTAP, and the S3 bucket containing the original backup repository.
- 2. Configure an SMB share on FSx ONTAP to be a new backup repository.
- 3. Mount the original S3 bucket that was used as part of the scale-out backup repository on premises.
- 4. After restoring the VM, establish new backup jobs to protect SQL and Oracle VMs.

For more information on restoring VMs using Veeam, see the section "Restore Application VMs with Veeam Full Restore".

#### SnapCenter database backup for disaster recovery

SnapCenter allows for the backup and recovery of its underlying MySQL database and configuration data for the purpose of recovering the SnapCenter server in the case of a disaster. For our solution, we recovered the SnapCenter database and configuration on an AWS EC2 instance residing in our VPC. For more information on this step, see this link.

#### SnapCenter backup prerequisites

The following prerequisites are required for SnapCenter backup:

- A volume and SMB share created on the on-premises ONTAP system to locate the backed-up database and configuration files.
- A SnapMirror relationship between the on-premises ONTAP system and FSx or CVO in the AWS account. This relationship is used for transporting the snapshot containing the backed-up SnapCenter database and configuration files.
- Windows Server installed in the cloud account, either on an EC2 instance or on a VM in the VMware Cloud SDDC.
- SnapCenter installed on the Windows EC2 instance or VM in VMware Cloud.

- Create a volume on the on-premises ONTAP system for hosting the backup db and config files.
- Set up a SnapMirror relationship between on-premises and FSx/CVO.
- Mount the SMB share.
- Retrieve the Swagger authorization token for performing API tasks.
- Start the db restore process.
- Use the xcopy utility to copy the db and config file local directory to the SMB share.
- On FSx, create a clone of the ONTAP volume (copied via SnapMirror from on-premises).
- Mount the SMB share from FSx to EC2/VMware Cloud.
- Copy the restore directory from the SMB share to a local directory.
- Run the SQL Server restore process from Swagger.

SnapCenter provides a web client interface for executing REST API commands. For information on accessing the REST APIs through Swagger, see the SnapCenter documentation at this link.
After you have navigated to the Swagger page, you must retrieve an authorization token to initiate the database restore process.

1. Access the SnapCenter Swagger API web page at *https://<SnapCenter Server IP>:8146/swagger/*.

SnapCenter /	API <sup>O</sup>	
[ Base URL: /api ]		
https://snapcenter.sddc.netapp.com;81	146/Content/swagger/SnapCenter.yaml	
To access the swagger document https://{SCV_hostname}:{SCV_ho	iation of "SnapCenter Plug-in for VMware vSphere" API's, please use ost_port}/api/swagger-ui.html	
xpand the Auth section	and click Try it Out.	
xpand the Auth section Auth	and click Try it Out.	
Auth POST /4.6/auth/1	and click Try it Out.	

3. In the UserOperationContext area, fill in the SnapCenter credentials and role and click Execute.

TeleanNeuerEvairee		
boolean	Token never expires	
(query)	false ~	
UserOperationContext *	User credentials	
,	<pre>Edit Value Model {     "UserOperationContext": {         "User": {              "Name": "localhost\\scadmin",              "Passphrase": "NetApp321",              "Rolename": "SnapCenterAdmin"         }     } }</pre>	
	Cancel	11.
	Parameter content type application/json	

4. In the Response body below, you can see the token. Copy the token text for authentication when executing the backup process.

200	Response body
	"DiurinBane", null
	"BostId": 0.
	"RoleId": null.
	"JobIds": null
	b.
	"User": {
	"Token":
	"K1YxDg==tsV6EDdtdAmAYpe8q5SG6wcoGaSjwfE6jrNy5CsY63HKD5LkoZLIESRNAhpGJJ0UUDynENdgtVGDZnvx+I/ZJZIn5M1NZrj6
	CLfGTApg1GmcagT08bgb5bMTx07EcdrAidzAXUDb3GyLGKtW0GdwKzSeOwKj3uVupnk1E31skK6PRBv9RS8j0gHQvo4v4RL0hhThhwFhV
	9/23nFeJVP/p1Ev4vrV/zeZVTUHFHUM069XRe5cuW9nwjj4b0I5Y5FN3XDkjQ
	"Name": "SCAdmin",
	"TokenBashed": null,
	"Туре": "",
	"TokenTime": "2022-03-22T14:21:57.3665661-07:00",
	"Id": "1",
	"FullName": "SCAdmin",
	"Host": null,
	"Author": null,
	"UserName": "",
	"Domain": "", Downi
	"Passphrase": "",

Next go to the Disaster Recovery area on the Swagger page to begin the SnapCenter backup process.

1. Expand the Disaster Recovery area by clicking it.

# Disaster Recovery GET /4.6/disasterrecovery/server/backup POST /4.6/disasterrecovery/server/backup DELETE /4.6/disasterrecovery/server/backup Deletes the existing SnapCenter DR backup. POST /4.6/disasterrecovery/server/backup Deletes the existing Snapcenter DR backup. POST /4.6/disasterrecovery/server/restore Stats SnapCenter Server Restore. POST /4.6/disasterrecovery/storage Enable or disable the storage disaster recovery.

2. Expand the /4.6/disasterrecovery/server/backup section and click Try it Out.



3. In the SmDRBackupRequest section, add the correct local target path and select Execute to start the backup of the SnapCenter database and configuration.



The backup process does not allow backing up directly to an NFS or CIFS file share.

Token * required string	User authorization token
(header)	TUHFHUM069XRe5cuW9nwyj4b0I5Y5FN3XDkjQ==
SmDRBackupRequest * <sup>required</sup>	Parameters to take Backup
(body)	Edit Value Model
	<pre>{     "TargetPath": "C:\\SnapCenter_Backups\\" }</pre>
	Cancel
	Parameter content type application/json
	Execute

Log into SnapCenter to review log files when starting the database restore process. Under the Monitor section, you can view the details of the SnapCenter server disaster recovery backup.

Snap	oCenter Server disaster recovery backup	
~	SnapCenter Server disaster recovery backup	î
~	Precheck validation	
~	Disaster recovery backup of 'oraclesrv_04.sddc.netapp.com'	
~	Disaster recovery backup of SnapCenter Server 'SnapCenter.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_02.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_03.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_05.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_07.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-02.sddc.netapp.com'	
4	Disaster recovery backup of 'sqlsrv-03.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_10.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-04.sddc.netapp.com'	Π.
~	Disaster recovery backup of 'sqlsrv-01.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-05.sddc.netapp.com'	
~	Disaster recovery backup of 'oraclesrv_09.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-06.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-07.sddc.netapp.com'	~
Tas	sk Name: SnapCenter Server disaster recovery backup Start Time: 03/23/2022 10:27:11 AM End Time: 03/23/	2022
:27:4	17 AM	

Next you must move the backup from the local drive on the SnapCenter server to the CIFS share that is used to SnapMirror copy the data to the secondary location located on the FSx instance in AWS. Use xcopy with specific options that retain the permissions of the files.

Open a command prompt as Administrator. From the command prompt, enter the following commands:

```
xcopy <Source_Path> \\<Destination_Server_IP>\<Folder_Path> /0 /X
/E /H /K
xcopy c:\SC_Backups\SnapCenter_DR \\10.61.181.185\snapcenter_dr /0
/X /E /H /K
```

### Failover

### Disaster occurs at primary site

For a disaster that occurs at the primary on-premises datacenter, our scenario includes failover to a secondary site residing on Amazon Web Services infrastructure using VMware Cloud on AWS. We assume that the virtual machines and our on-premises ONTAP cluster are no longer accessible. In addition, both the SnapCenter and Veeam virtual machines are no longer accessible and must be rebuilt at our secondary site.

This section address failover of our infrastructure to the cloud, and we cover the following topics:

- SnapCenter database restore. After a new SnapCenter server has been established, restore the MySQL database and configuration files and toggle the database into disaster recovery mode in order to allow the secondary FSx storage to become the primary storage device.
- Restore the application virtual machines using Veeam Backup & Replication. Connect the S3 storage that contains the VM backups, import the backups, and restore them to VMware Cloud on AWS.
- Restore the SQL Server application data using SnapCenter.
- Restore the Oracle application data using SnapCenter.

SnapCenter supports disaster recovery scenarios by allowing the backup and restore of its MySQL database and configuration files. This allows an administrator to maintain regular backups of the SnapCenter database at the on-premises datacenter and later restore that database to a secondary SnapCenter database.

To access the SnapCenter backup files on the remote SnapCenter server, complete the following steps:

- 1. Break the SnapMirror relationship from the FSx cluster, which makes the volume read/write.
- 2. Create a CIFS server (if necessary) and create a CIFS share pointing to the junction path of the cloned volume.
- 3. Use xcopy to copy the backup files to a local directory on the secondary SnapCenter system.
- 4. Install SnapCenter v4.6.
- 5. Ensure that SnapCenter server has the same FQDN as the original server. This is required for the db restore to be successful.

To start the restore process, complete the following steps:

- 1. Navigate to the Swagger API web page for the secondary SnapCenter server and follow the previous instructions to obtain an authorization token.
- 2. Navigate to the Disaster Recovery section of the Swagger page, select /4.6/disasterrecovery/server/restore, and click Try it Out.

POST	/4.6/disasterrecovery/server/restore Starts SnapCenter Server Restore.	
Starts SnapC	Center Server Restore.	
Parameters	Try it out	ļ

3. Paste in your authorization token and, in the SmDRResterRequest section, paste in the name of the backup and the local directory on the secondary SnapCenter server.

Name	Description
Token * <sup>required</sup>	User authorization token
(header)	KIYxOg==rMXzS7EPIGRzTXjfton6Q+JoNGpueQt
SmDRRestoreRequest * required object (body)	Parameters to take for Restore
	<pre>{     BackupName": "SnapCenter.sddc.netapp.com_03-23-2022_12.38.00.6713",     "BackupPath": "C:\\SnapCenter\\" }</pre>

4. Select the Execute button to start the restore process.

5. From SnapCenter, navigate to the Monitor section to view the progress of the restore job.

	letApp Snap(	Center®	)	
<		Jobs	Schedules	Events Logs
	Dashboard	search	n by name	
<b>v</b>	Resources	Jobs - I	Filter	
•	Monitor	ID	Status	Name
<b>a</b> i	Reports	20482	4	SnapCenter Server Disaster Recovery
		20481	~	SnapCenter Server disaster recovery backup
<b>A</b>	Hosts	20480	×	SnapCenter Server disaster recovery backup
80	Storage Systems	20475	~	Backup of Resource Group 'SQLSRV-09' with policy 'SQL-Hourly'
	Settings	20474	~	Backup of Resource Group 'SQLSRV-05' with policy 'SQL-Hourly'
		20473	3	Backup of Resource Group 'OracleSrv_06' with policy 'Oracle-Hourly'
A	Alerts	20472	×	SnapCenter Server disaster recovery backup

# Job Details

SnapCenter Server Disaster Recovery

- SnapCenter Server Disaster Recovery
- Prepare for restore job
- Precheck validation
- Saving original server state
- Schedule restore
- Repository restore
- Config restore
  - Reset MySQL password
- 6. To enable SQL Server restores from secondary storage, you must toggle the SnapCenter database into Disaster Recovery mode. This is performed as a separate operation and initiated on the Swagger API web page.
  - a. Navigate to the Disaster Recovery section and click /4.6/disasterrecovery/storage.
  - b. Paste in the user authorization token.
  - c. In the SmSetDisasterRecoverySettingsRequest section, change EnableDisasterRecover to true.
  - d. Click Execute to enable disaster recovery mode for SQL Server.

(header) KIYxOg==rMXzS7EPIGRzTXjfton6Q+JoNGpueQt SmSetDisasterRecoverySettingsRequest * required object (body) Edit Value Model {	Token * <sup>required</sup>	User authorization token
SmSetDisasterRecoverySettingsRequest * required       Parameters to enable or disable the DR mode         object       Edit Value   Model         (body)       {	(header)	KIYxOg==rMXzS7EPIGRzTXjfton6Q+JoNGpueQt
(body) Edit Value Model	SmSetDisasterRecoverySettingsRequest * required	Parameters to enable or disable the DR mode
(	(body)	Edit Value Model
"EnableDisasterRecovery": true }		<pre>{     "EnableDisasterRecovery": true }</pre>

Restore application VMs with Veeam full restore

From the secondary Veeam server, import the backups from S3 storage and restore the SQL Server and Oracle VMs to your VMware Cloud cluster.

To import the backups from the S3 object that was part of the on-premises scale-out backup repository, complete the following steps:

1. Go to Backup Repositories and click Add Repository in the top menu to launch the Add Backup Repository wizard. On the first page of the wizard, select Object Storage as the backup repository type.

Add B Select the t	ackup Repository type of backup repository you want to add.
0000	Direct attached storage Microsoft Windows or Linux server with internal or direct attached storage. This configuration enables data movers to run directly on the server, allowing for fastest performance.
-	Network attached storage Network share on a file server or a NAS device. When backing up to a remote share, we recommend that you select a gateway server located in the same site with the share.
¥	Deduplicating storage appliance Dell EMC Data Domain, ExaGrid, HPE StoreOnce or Quantum DXi. If you are unable to meet the requirements of advanced integration via native appliance API, use the network attached storage option instead.
	Object storage On-prem object storage system or a cloud object storage provider. Object storage can only be used as a Capacity Tier of scale-out backup repositories, backing up directly to object storage is not currently supported.

2. Select Amazon S3 as the Object Storage type.

Ð	Object Storage Select the type of object storage you want to use as a backup repository.
R	S3 Compatible Adds an on-premises object storage system or a cloud object storage provider.
aws	Amazon S3 Adds Amazon cloud object storage. Amazon S3, Amazon S3 Glacier (including Deep Archive) and Amazon Snowball Edge are supported
٥	Google Cloud Storage Adds Google Cloud storage. Both Standard and Nearline storage classes are supported.
٢	IBM Cloud Object Storage Adds IBM Cloud object storage. S3 compatible versions of both on-premises and IBM Cloud storage offerings are supported.
Δ	Microsoft Azure Storage Adds Microsoft Azure cloud object storage. Microsoft Azure Blob Storage, Microsoft Azure Archive Storage and Microsoft Azure Data Box are supported.



4. Select your pre-entered credentials from the drop-down list or add a new credential for accessing the cloud storage resource. Click Next to continue.

Name Credentials:   Account Manage cloud accounts   Bucket AWS region:   Global	
Account Manage cloud accounts Bucket Summary Global	
Account Manage cloud accounts AWS region: Global	Add
ucket AWS region: Global	
Global	
ummary	
Use the following gateway server:	
EC2AMAZ-3POTKQV (Backup server)	
Select a gateway server to proxy access to Amazon S3. If no gateway server is specified, a backup repository extents must have direct Internet access.	

5. On the Bucket page, enter the data center, bucket, folder, and any desired options. Click Apply.

Name	Data center:	
	US East (N. Virginia)	3
Account	Bucket:	
Bucket	ehcveeamrepo	Browse
Summany	Folder:	
Saminary	RTP	Browse
	already running backup offload tasks will be allowed to complete, but no new task Make recent backups immutable for: 30 4	s will be started
	<ul> <li>already running backup offload tasks will be allowed to complete, but no new task</li> <li>Make recent backups immutable for: 30 ÷ days</li> <li>Protects backups from modification or deletion by ransomware, hackers or malicion native object storage capabilities.</li> <li>Use infrequent access storage class (may result in higher costs)</li> <li>With lower price per GB but higher retrieval and early deletion fees, this storage class for long-term storage of GES full backups. Avoid using it for short-term storage of GES full backups.</li> </ul>	s will be started ous insiders usin ss is best suited

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To import the backups from the S3 repository that was added in the previous section, complete the following steps.

1. From the S3 backup repository, select Import Backups to launch the Import Backups wizard.



2. After the database records for the import have been created, select Next and then Finish at the summary screen to start the import process.

Please wait v	vhile we're preparing object storage repository.	
nport	Message	Duration
ummany	Starting infrastructure item update process	0:00:16
unning	Creating database records for repository	0:00:04

3. After the import is complete, you can restore VMs into the VMware Cloud cluster.

Name: Action type: nitiated by:	Configuration Database Resynchr Configuration Resynchronize EC2AMAZ-3POTKQV\vadmin	Status: Start time: End time:	Success 4/6/2022 3:01:30 PM 4/6/2022 3:04:57 PM	
Log				
Message				Duration
Starting I	ting repositories			
Enumera	repositon			
Processir	no capacity tier extent of S3 Backup Ren	ository 2		0:03:23
S3 Backu	in Repository: added 2 unencrynted	shory 2		0:03:20
Importin	a backup 2 out of 2			0:03:15
Backup r	epositories synchronization completed s	successfully		VI MES AS
				-

To restore SQL and Oracle virtual machines to the VMware Cloud on AWS workload domain/cluster, complete the following steps.

1. From the Veeam Home page, select the object storage containing the imported backups, select the VMs to restore, and then right click and select Restore Entire VM.

Instant     Instant Disk     Entire     Virtual     VM     Guest     Application       Recovery     Recovery     VM     Disks     Files     Items *     Edition	azon Microsoft Google C2 Azure laas CE Restore to Cloud Actions		
Home	Q. Type in an object name to search for	×	
▲ 物 Jobs 細目 Backup ▲ 聞 Backups	Job Name 1 Begin Oracle Servers Control Serve	Creation Time 3/27/2022 1:00 AM 3/27/2022 1:00 AM	R
Object Storage (Imported)     Last 24 Hours	SQLSRV-01	Instant recovery Instant disk recovery	
La success	日 SQLSRV-04 日 SQLSRV-05 日 SQLSRV-05 日 SQLSRV-06 日 SQLSRV-07	Restore entire VM Restore virtual disks Restore VM files Restore guest files	*
	日 SQLSRV-09 日 SQLSRV-09 日 SQLSRV-10 〇〇	Restore to Amazon EC2 Restore to Microsoft Azure Restore to Google CE	
		Export backup Delete from disk	

2. On the first page of the Full VM Restore wizard, modify the VMs to backup if desired and select Next.

Virtual machines to restor	e:		_
Name	for instant lookup	Restore point	Add
SQLSRV-04	62.7 GB	less than a day ago (1:03 AM	Point
			Remove
	Virtual machines to restor	Virtual machines to restore: Type in a VM name for instant lookup Name Size SQLSRV-04 62.7 GB	Virtual machines to restore:          Image: Type in a VM name for instant lookup         Name       Size         Restore point         Image: SQLSRV-04         62.7 GB         Iess than a day ago (1:03 AM

3. On the Restore Mode page, select Restore to a New Location, or with Different Settings.

Full VM Restore	×
Restore Mode Specify wheth	e er selected VMs should be restored back to the original location, or to a new location or with different settings.
Virtual Machines Restore Mode	<ul> <li>Restore to the original location</li> <li>Quickly initiate the restore of selected VM to its original location, with the original name and settings. This option minimizes the chance of user input error.</li> </ul>
Host Resource Pool	Restore to a new location, or with different settings Customize the restored VM location, and change its settings. The wizard will automatically populate all controls with the original VM settings as the defaults.
Datastore Folder	Staged restore Run the selected VM directly from backup files in the isolated DataLab to make changes to the guest OS or applications prior to placing the VM into production environment.
Network	Pick proxy to use
Secure Restore Summary	
	Quick rollback (restore changed blocks only) Allows for quick VM recovery in case of guest OS software problem, or user error. Do not use this option when recovering from disaster caused by hardware or storage issue, or power loss.
	< Previous Next > Finish Cancel

4. On the host page, select the Target ESXi host or cluster to restore the VM to.

Host		100	
By default, origin Host. Use multi-s Virtual Machines Restore Mode	Select host:		ting desired VM and clickin
Host	V LES Cluster 1		
Resource Pool			
Datastore			
Folder			
Network			
Secure Restore			
Summary			
	Pn		Hort
	EB3• Type in an object name to search for	Q	riost
	ок	Cancel	Finich Cancel

5. On the Datastores page, select the target datastore location for both the configuration files and hard disk.

Virtual Machines	Files location:			
Restore Mode	File	Size	Datastore	Disk type
Host	Configuration files		WorkloadDatastore (VM	
	Hard disk 1 (SQLSR	100 GB	WorkloadDatastore (VM	Same as source
Resource Pool				
Datastore				
Folder				
Vetwork				
ecure Restore				
iummary				

6. On the Network page, map the original networks on the VM to the networks in the new target location.

Virtual Machines	Network connections:		
Restore Mode	Source	Target	
	SQLSRV-04     Management 181 (DSwitch)	Not connected	
Host	Data - A - 3374 (DSwitch)	Not connected	
Resource Pool	Data - B - 3375 (DSwitch)	Not connected	
Datastore			
Folder			
Network			
Secure Restore			
Summary			
			10



7. Select whether to scan the restored VM for malware, review the summary page, and click Finish to start the restore.

### **Restore SQL Server application data**

The following process provides instructions on how to recover a SQL Server in VMware Cloud Services in AWS in the event of a disaster that renders the on-premises site inoperable.

The following prerequisites are assumed to be complete in order to continue with the recovery steps:

- 1. The Windows Server VM has been restored to the VMware Cloud SDDC using Veeam Full Restore.
- A secondary SnapCenter server has been established and SnapCenter database restore and configuration has been completed using the steps outlined in the section "SnapCenter backup and restore process summary."

After the restore of the VM is complete, you must configure networking and other items in preparation for rediscovering the host VM within SnapCenter.

- 1. Assign new IP addresses for Management and iSCSI or NFS.
- 2. Join the host to the Windows domain.
- 3. Add the hostnames to DNS or to the hosts file on the SnapCenter server.



If the SnapCenter plug-in was deployed using domain credentials different than the current domain, you must change the Log On account for the Plug-in for Windows Service on the SQL Server VM. After changing the Log On account, restart the SnapCenter SMCore, Plug-in for Windows, and Plug-in for SQL Server services.



To automatically rediscover the restored VMs in SnapCenter, the FQDN must be identical to the VM that was originally added to the SnapCenter on premises.

### Configure FSx storage for SQL Server restore

To accomplish the disaster recovery restore process for a SQL Server VM, you must break the existing SnapMirror relationship from the FSx cluster and grant access to the volume. To do so, complete the following steps.

1. To break the existing SnapMirror relationship for the SQL Server database and log volumes, run the following command from the FSx CLI:

FSx-Dest::> snapmirror break -destination-path DestSVM:DestVolName

2. Grant access to the LUN by creating an initiator group containing the iSCSI IQN of the SQL Server Windows VM:

FSx-Dest::> igroup create -vserver DestSVM -igroup igroupName
-protocol iSCSI -ostype windows -initiator IQN

3. Finally, map the LUNs to the initiator group that you just created:

```
FSx-Dest::> lun mapping create -vserver DestSVM -path LUNPath igroup
igroupName
```

4. To find the path name, run the lun show command.

### Set up the Windows VM for iSCSI access and discover the file systems

- 1. From the SQL Server VM, set up your iSCSI network adapter to communicate on the VMware Port Group that has been established with connectivity to the iSCSI target interfaces on your FSx instance.
- 2. Open the iSCSI Initiator Properties utility and clear out the old connectivity settings on the Discovery, Favorite Targets, and Targets tabs.
- 3. Locate the IP address(es) for accessing the iSCSI logical interface on the FSx instance/cluster. This can be found in the AWS console under Amazon FSx > ONTAP > Storage Virtual Machines.

Endpoints	
Management DNS name	Management IP address
svm-045c077375d3d9799.fs-0ae40e08acc0dea67.fsx.us-east-1.amazonaws.com	198.19.254.53
NFS DNS name svm-045c077375d3d9799.fs-0ae40e08acc0dea67.fsx.us-east-1.amazonaws.com	NFS IP address
iSCSI DNS name	iSCSI IP addresses
iscsi.svm-045c077375d3d9799.fs-0ae40e08acc0dea67.fsx.us-east-1.amazonaws.com	172.30.15.101, 172.30.14.49

4. From the Discovery tab, click Discover Portal and enter the IP addresses for your FSx iSCSI targets.

SCSI Init	iator Prope	ties				>
Targets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration	
Targe The s	t portals system will lo	ok for Targets on fo	blowing portals:		Refresh	
Addr	ess	Port	Adapter	I	P address	
To ac	id <mark>a</mark> target p	ortal, <mark>click</mark> Discover	Portal.	Disco	over Portal	
To re then	move a targ click Remove	et portal, select the	address above and		Remove	

Enter the IP address or DNS name want to add.	e and port number of the portal you
	and the second
To change the default settings of the Advanced button.	the discovery of the target portal, dick
To change the default settings of the Advanced button. IP address or DNS name:	Port: (Default is 3260.)

5. On the Target tab, click Connect, select Enable Multi-Path if appropriate for your configuration and then click OK to connect to the target.

argets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration	
Ouick C	Connect					
To disc DNS na	cover and log ame of the ta	g on to a target usir arget and then click	ng a basic connection, t Quick Connect.	ype the IP	address or	
Target	:			Q	ick Connect	1
Discove	ered targets					
					Refresh	
Name	e.			Status		1
ion. 10	992-08.com	netapo:sp. 5918h03	sf9ef411ecb007495	Inactive		
					0	
					1	
To con	nect using a	dvanced ontions is	elect a target and then		1	
To con click Co	nect using a	dvanced options, se	elect a target and then		1 Connect	
To con dick Co To	inect using a onnect.	dvanced options, si	elect a target and then		Connect	
To con dick Co To th Co	nect using a onnect. onnect To Ta	dvanced options, se arget	elect a target and then		1 Connect	
To con dick Co To th Fo Ta	nect using a onnect. onnect To Ta arget name:	dvanced options, se arget	elect a target and then		1 Connect	
To con click Co To th Fo Se 19	onnect using a connect. connect To Ta arget name: 2-08.com.ne	dvanced options, se arget tapp:sn.5918b03f9	elect a target and then Def411ecb0074956fb75	F45c:vs.6	1 Connect	
To con dick Co th Fo Ta Se Po Fo	onnect using a connect. connect To Ta arget name: 2-08.com.ne	dvanced options, se arget etapp:sn.5918b03f9	elect a target and then Pef411ecb0074956fb75	f45c:vs.6	1 Connect	
To con dick Co th Fc Ta se 19 Fc Ta	onnect using a connect. connect To Ta arget name: 2-08.com.ne Add this con This will mak	dvanced options, so arget etapp:sn.5918b03fs nection to the list o	elect a target and then Pef411ecb0074956fb75 f Favorite Targets. natically attempt to rest	f45c:vs.6	Connect	
To con dick Co th Co Fo Ta se 19 Fo Ta	inect using a onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e	dvanced options, se arget tapp:sn.5918b03f9 nection to the list o se the system auton every time this comp	elect a target and then Def411ecb0074956fb75 f Favorite Targets. natically attempt to rest puter restarts.	f45c:vs.6 ore the	Connect	
To con dick Co th Fc Ta Se 19 Fc Ta Se 19 Fc	inect using a onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e	dvanced options, se arget etapp:sn.5918b03fs nection to the list o se the system auton every time this comp	elect a target and then Pef411ecb0074956fb75 f Favorite Targets. natically attempt to rest puter restarts.	f45c:vs.6 ore the	Connect	
To con dick Co th Co Fo Ta se 19 Fo th S	inect using a onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e Enable multi-	dvanced options, se arget etapp:sn. 5918b03fs inection to the list o se the system auton every time this comp -path	elect a target and then Def411ecb0074956fb75 f Favorite Targets. natically attempt to rest puter restarts.	f45c:vs.6 ore the	Connect	
To con dick Co To Co Fo Ta Se 19 Fo th	inect using a onnect. onnect To Ta arget name: 2-08.com.ne 2-08.com.ne Add this con This will mak connection e Enable multi-	dvanced options, se arget etapp:sn. 5918b03f9 mection to the list o se the system auton every time this comp -path 2	elect a target and then Def411ecb0074956fb75 f Favorite Targets. natically attempt to rest puter restarts.	f45c:vs.6 ore the	Cancel	
To con dick Co th Co Fo Ta se 19 Fo Ta Fo Ta Fo Ta	nect using a onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e Enable multi- dvanced	dvanced options, se arget etapp:sn.5918b03fs inection to the list o se the system auton every time this comp -path 2	elect a target and then Pef411ecb0074956fb75 f Favorite Targets. natically attempt to rest puter restarts.	f45c:vs.6 ore the	Connect	

6. Open the Computer Management utility and bring the disks online. Verify that they retain the same drive letters that they previously held.

Basic 579.98 GB Online	MSSQL_DATA (E:) 579.98 GB NTFS Healthy (Primary Partition)	
*O Disk 2 Basic		
99.98 GB Offline	Online	
	Properties	
0	Help	1.650

1. From the SQL Server VM, open Microsoft SQL Server Management Studio and select Attach to start the process of connecting to the database.



2. Click Add and navigate to the folder containing the SQL Server primary database file, select it, and click OK.

-	QLSRV-01				×
Database Data File location:	E:\MSSQL 2019\MSSQ	L15.MSSQLSERVEF	C		P
C: SRECYCLE.BIN SRECYCLE.BIN MSSQL 2019 MSSQL 15.MSS MSSQL DATA System Volume Info	QLSERVER mation	.HC01_01.mdf			
File name: SQI	.HC01_01.mdf		Database Data F	iles(*.mdf)	 ~

- 3. If the transaction logs are on a separate drive, choose the folder that contains the transaction log.
- 4. When finished, click OK to attach the database.



With the SnapCenter database restored to its previous state, it automatically rediscovers the SQL Server hosts. For this to work correctly, keep in mind the following prerequisites:

- SnapCenter must be placed in Disaster Recover mode. This can be accomplished through the Swagger API or in Global Settings under Disaster Recovery.
- The FQDN of the SQL Server must be identical to the instance that was running in the on-premises datacenter.
- The original SnapMirror relationship must be broken.
- The LUNs containing the database must be mounted to the SQL Server instance and the database attached.

To confirm that SnapCenter is in Disaster Recovery mode, navigate to Settings from within the SnapCenter web client. Go to the Global Settings tab and then click Disaster Recovery. Make sure that the Enable Disaster Recovery checkbox is enabled.

	letApp Snap(	Center®
<		Global Settings Policies Users and Access
	Dashboard	
0	Resources	Global Settings
٠	Monitor	
<b>m</b>	Reports	Hypervisor Settings 🚯
Å	Hosts	Notification Server Settings 🚯
ł	Storage Systems	Configuration Settings ()
÷=	Settings	Purge Jobs Settings 🚯
	Alerts	Domain Settings 🜖
		CA Certificate Settings 🕕
		Disaster Recovery
		Enable Disaster Recovery Apply

### **Restore Oracle application data**

The following process provides instructions on how to recover Oracle application data in VMware Cloud Services in AWS in the event of a disaster that renders the on-premises site inoperable.

Complete the following prerequisites to continue with the recovery steps:

- 1. The Oracle Linux server VM has been restored to the VMware Cloud SDDC using Veeam Full Restore.
- 2. A secondary SnapCenter server has been established and the SnapCenter database and configuration files have been restored using the steps outlined in this section "SnapCenter backup and restore process summary."

To make the secondary storage volumes hosted on the FSxN instance accessible to the Oracle servers, you must first break the existing SnapMirror relationship.

1. After logging into the FSx CLI, run the following command to view the volumes filtered by the correct name.

```
FSx-Dest::> volume show -volume VolumeName*
FsxId0ae40e08acc0dea67::> volume show -volume oraclesrv 03*
Vserver
        Volume Aggregate
                                State
                                          Type
                                                     Size Available Used%
                                           ----
ora svm dest
        oraclesrv_03_u01_dest
                                                            93.12GB
                    aggrl
                                online
                                           DP
                                                    100GB
                                                                       6%
ora svm dest
        oraclesrv 03 u02 dest
                                           DP
                                                    200GB
                                                            34.98GB
                                                                      82%
                     aggrl
                                online
ora svm dest
        oraclesrv 03 u03 dest
                                           DP
                                                    150GB
                     aggrl
                               online
                                                            33.37GB
                                                                      778
3 entries were displayed.
FsxId0ae40e08acc0dea67::>
```

2. Run the following command to break the existing SnapMirror relationships.

FSx-Dest::> snapmirror break -destination-path DestSVM:DestVolName

```
FsxId0ae40e08acc0dea67::> snapmirror break -destination-path ora_svm_dest:oraclesrv_03_u02_dest
Operation succeeded: snapmirror break for destination "ora_svm_dest:oraclesrv_03_u02_dest".
```

```
FsxId0ae40e08acc0dea67::> snapmirror break -destination-path ora_svm_dest:oraclesrv_03_u03_dest
Operation succeeded: snapmirror break for destination "ora_svm_dest:oraclesrv_03_u03_dest".
```

3. Update the junction-path in the Amazon FSx web client:

FSx > Volumes > fsvol-01167370e9b7aefa0 oraclesrv\_03\_u01\_dest (fsvol-01167370e9b7aefa0) Attach Actions 🔺 Update volume Summary Create backup Delete volume Volume ID Creation time SVM ID 2022-03-08T14:52:09-05:00 svm-02b2ad25c6b2e5bc2 fsvol-01167370e9b7aefa0 🗇 Lifecycle state Junction path Volume name ⊘ Created - 🗇 oraclesrv\_03\_u01\_dest Volume type Tiering policy name UUID ONTAP SNAPSHOT\_ONLY 3d7338ce-9f19-11ecb007-4956fb75f45c Size Tiering policy cooling period (days) 100.00 GB 🗇 2 File system ID fs-0ae40e08acc0dea67 Storage efficiency enabled Disabled Resource ARN arn:aws:fsx:useast-1:541696183547:volume/fs-0ae40e08acc0dea67/fsvol-01167370e9b7aefa0 🗇

4. Add the junction path name and click Update. Specify this junction path when mounting the NFS volume from the Oracle server.

# Update volume

## Junction path

# /oraclesrv\_03\_u01\_dest

The location within your file system where your volume will be mounted.

### Volume size

102400

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.

×

\$

Capacity pool tiering policy You can optionally enable automatic tiering of y	our data to lower-cost capacity pool storage.
Snapshot Only	

In Cloud Manager, you can obtain the mount command with the correct NFS LIF IP address for mounting the NFS volumes that contain the Oracle database files and logs.

1. In Cloud Manager, access the list of volumes for your FSx cluster.

HCApps	Overview	Volumes			
	50 volume	:5			
	Volum	ne Name 🗧	State	Storage VM 🔶	Disk Type
	oracle u02_d	srv_02_ est	<ul> <li>Online</li> </ul>	ora_svm_dest	SSD
	oracle u03_d	srv_02_ est	• Online	ora_svm_dest	SSD
	oracle u01_d	srv_03_ est	• Online	ora_svm_dest	SSD

2. From the action menu, select Mount Command to view and copy the mount command to be used on our Oracle Linux server.

etApp	or Information nconn.	~ 
	Edit	
	Clone	_
	Restore from Snapshot copy	
	Create a Snapshot copy	
Capacity Pool U	Mount Command	
0 B	Change Tiering Policy	
0 B	Delete	
	Snapshot	
Go to your linux n	Mount Volume NFS oraclesrv_03_u01_dest	
Mount Command		
		E com

4. From the Oracle Linux server, use the mount command to mount the NFS volumes.
FSx-Dest::> mount -t oracle server ip:/junction-path

Repeat this step for each volume associated with the Oracle databases.



To make the NFS mount persistent upon rebooting, edit the /etc/fstab file to include the mount commands.

5. Reboot the Oracle server. The Oracle databases should start up normally and be available for use.

#### Failback

Upon successful completion of the failover process outlined in this solution, SnapCenter and Veeam resume their backup functions running in AWS, and FSx for ONTAP is now designated as primary storage with no existing SnapMirror relationships with the original on-premises datacenter. After normal function has resumed on premises, you can use a process identical to the one outlined in this documentation to mirror data back to the on-premises ONTAP storage system.

As is also outlined in this documentation, you can configure SnapCenter to mirror the application data volumes from FSx for ONTAP to an ONTAP storage system residing on premises. Similarly, you can configure Veeam to replicate backup copies to Amazon S3 using a scale-out backup repository so that those backups are accessible to a Veeam backup server residing at the on-premises datacenter.

Failback is outside the scope of this documentation, but failback differs little from the detailed process outlined here.

### Conclusion

The use case presented in this documentation focuses on proven disaster recovery technologies that highlight the integration between NetApp and VMware. NetApp ONTAP storage systems provide proven data-mirroring technologies that allow organizations to design disaster recovery solutions that span on-premises and ONTAP technologies residing with the leading cloud providers.

FSx for ONTAP on AWS is one such solution that allows for seamless integration with SnapCenter and SyncMirror for replicating application data to the cloud. Veeam Backup & Replication is another well-known technology that integrates well with NetApp ONTAP storage systems and can provide failover to vSphere-native storage.

This solution presented a disaster recovery solution using guest connect storage from an ONTAP system hosting SQL Server and Oracle application data. SnapCenter with SnapMirror provides an easy-to-manage solution for protecting application volumes on ONTAP systems and replicating them to FSx or CVO residing in the cloud. SnapCenter is a DR-enabled solution for failing over all application data to VMware Cloud on AWS.

#### Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

• Links to solution documentation

NetApp Hybrid Multicloud with VMware Solutions

**NetApp Solutions** 

# Veeam Backup & Restore in VMware Cloud, with Amazon FSx for ONTAP

Veeam Backup & Replication is an effective and reliable solution for protecting data in VMware Cloud. This solution demonstrates the proper setup and configuration for using Veeam Backup and Replication to backup and restore application VMs residing on FSx for ONTAP NFS datastores in VMware Cloud.

Author: Josh Powell - NetApp Solutions Engineering

# Overview

VMware Cloud (in AWS) supports the use of NFS datastores as supplemental storage, and FSx for NetApp ONTAP is a secure solution for customers who need to store large amounts of data for their cloud applications that can scale independent of the number of ESXi hosts in the SDDC cluster. This integrated AWS storage service offers highly efficient storage with all of the traditional NetApp ONTAP capabilities.

# Use Cases

This solution addresses the following use cases:

- Backup and restore of Windows and Linux virtual machines hosted in VMC using FSx for NetApp ONTAP as a backup repository.
- Backup and restore of Microsoft SQL Server application data using FSx for NetApp ONTAP as a backup repository.
- Backup and restore of Oracle application data using FSx for Netapp ONTAP as a backup repository.

# NFS Datastores Using Amazon FSx for ONTAP

All virtual machines in this solution reside on FSx for ONTAP supplemental NFS datastores. Using FSx for ONTAP as a supplemental NFS datastore has several benefits. For example, it allows you to:

- Create a scalable and highly available file system in the cloud without the need for complex setup and management.
- Integrate with your existing VMware environment, allowing you to use familiar tools and processes to manage your cloud resources.
- Benefit from the advanced data management features provided by ONTAP, such as snapshots and replication, to protect your data and ensure its availability.

This list provides the high level steps necessary to configure Veeam Backup & Replication, execute backup and restore jobs using FSx for ONTAP as a backup repository, and perform restores of SQL Server and Oracle VMs and databases:

- 1. Create the FSx for ONTAP file system to be used as iSCSI backup repository for Veeam Backup & Replication.
- 2. Deploy Veeam Proxy to distribute backup workloads and mount iSCSI backup repositories hosted on FSx for ONTAP.
- 3. Configure Veeam Backup Jobs to backup SQL Server, Oracle, Linux and Windows virtual machines.
- 4. Restore SQL Server virtual machines and individual databases.
- 5. Restore Oracle virtual machines and individual databases.

# Prerequisites

The purpose of this solution is to demonstrate data protection of virtual machines running in VMware Cloud and located on NFS Datastores hosted by FSx for NetApp ONTAP. This solution assumes the following components are configured and ready for use:

- 1. FSx for ONTAP filesystem with one or more NFS datastores connected to VMware Cloud.
- 2. Microsoft Windows Server VM with Veeam Backup & Replication software installed.
  - vCenter server has been discovered by the Veeam Backup & Replication server using their IP address or fully qualified domain name.
- 3. Microsoft Windows Server VM to be installed with Veeam Backup Proxy components during the solution deployment.
- 4. Microsoft SQL Server VMs with VMDKs and application data residing on FSx for ONTAP NFS datastores. For this solution we had two SQL databases on two separate VMDKs.
  - Note: As a best practice database and transaction log files are placed on separate drives as this will improve performance and reliability. This is in part due to the fact that transaction logs are written sequentially, whereas database files are written randomly.
- 5. Oracle Database VMs with VMDKs and application data residing on FSx for ONTAP NFS datastores.
- 6. Linux and Windows file server VMs with VMDKs residing on FSx for ONTAP NFS datastores.
- 7. Veeam requires specific TCP ports for communication between servers and components in the backup environment. On Veeam backup infrastructure components, the required firewall rules are automatically created.

For a full listing of the network port requirements refer to the Ports section of the Veeam Backup and Replication User Guide for VMware vSphere.

# **High Level Architecture**

The testing / validation of this solution was performed in a lab that may or may not match the final deployment environment. For more information, please refer to the following sections.



# Hardware / Software Components

The purpose of this solution is to demonstrate data protection of virtual machines running in VMware Cloud and located on NFS Datastores hosted by FSx for NetApp ONTAP. This solution assumes the following components are already configured and ready for use:

- · Microsoft Windows VM's located on an FSx for ONTAP NFS Datastore
- · Linux (CentOS) VM's located on an FSx for ONTAP NFS Datastore
- Microsoft SQL Server VM's located on an FSx for ONTAP NFS Datastore
  - Two databases hosted on separate VMDK's
- Oracle VM's located on an FSx for ONTAP NFS Datastore

# **Solution Deployment**

In this solution we provide detailed instructions for deploying and validating a solution utilizing Veeam Backup and Replication software to perform backup and recovery of SQL Server, Oracle, and Windows and Linux file server virtual machines in a VMware Cloud SDDC on AWS. The Virtual Machines in this solution reside on a supplemental NFS datastore hosted by FSx for ONTAP. In addition, a separate FSx for ONTAP file system is used to host iSCSI volumes that will be used for Veeam backup repositories.

We will go over FSx for ONTAP file system creation, mounting iSCSI volumes to be used as backup repositories, creating and running backup jobs, and performing VM and database restores.

For detailed information on FSx for NetApp ONTAP refer to the FSx for ONTAP User Guide.

For detailed information on Veeam Backup and Replication refer to the Veeam Help Center Technical Documentation site.

For considerations and limitations when using Veeam Backup and Replication with VMware Cloud on AWS, refer to VMware Cloud on AWS and VMware Cloud on Dell EMC Support. Considerations and Limitations.

# **Deploy Veeam Proxy server**

A Veeam proxy server is a component of the Veeam Backup & Replication software that acts as an intermediary between the source and the backup or replication target. The proxy server helps to optimize and accelerate data transfer during backup jobs by processing data locally and can use different Transport Modes to access data using VMware vStorage APIs for Data Protection or through direct storage access.

When choosing a Veeam proxy server design it is important to consider the number of concurrent tasks and the transport mode or type of storage access desired.

For sizing the number of proxy servers, and for their system requirements, refer to the Veeam VMware vSphere Best Practice Guide.

The Veeam Data Mover is a component of the Veeam Proxy Server and utilizes a Transport Mode as a method for obtaining VM data from the source and transferring it to the target. The transport mode is specified during the configuration of the backup job. It is possible to increase the efficiency backups from NFS datastores by using direct storage access.

For more information on Transport Modes refer to the Veeam Backup and Replication User Guide for VMware vSphere.

In the following step we cover deployment of the Veeam Proxy Server on a Windows VM in the VMware Cloud SDDC.

In this step the Veeam Proxy is deployed to an existing Windows VM. This allows backup jobs to be distributed between the primary Veeam Backup Server and the Veeam Proxy.

- 1. On the Veeam Backup and Replication server, open the administration console and select **Backup Infrastructure** in the lower left menu.
- 2. Right click on Backup Proxies and click on Add VMware backup proxy... to open the wizard.



3. In the Add VMware Proxy wizard click the Add New... button to add a new proxy server.

VeeamSrv Proxy descr Apply ummary Transport n Automatic Connected Automatic	r (Backup server) ~ Add New. cription: by VEEAMSRV\Administrator at 12/22/2022 9:11 PM. mode: c selection Choose
affic Rules Proxy descr pply Created by Transport n Automatic Connected Automatic	rription: by VEEAMSRV\Administrator at 12/22/2022 9:11 PM. mode: c selection Choose
pply mmary Transport n Automatic Connected Automatic	mode: c selection Choose
mmary Transport n Automatic Connected Automatic	mode: c selection Choose
Transport n Automatic Connected Automatic	mode: c selection Choose
Transport n Automatic Connected Automatic	mode: c selection Choose
Automatic Connected Automatic	d datactores:
Connected Automatic	d datastores:
Automatic	datastores.
	c detection (recommended) Choose
Max concur 2	orrent tasks:

• Fill out the DNS name or IP address

4.

- $\circ$  Select an account to use for Credentials on the new system or add new credentials
- Review the components to be installed and then click on Apply to begin the deployment

Vame	Message	Duration
Cradantials	Starting infrastructure item update process	0:00:03
reachuais	Collecting hardware info	
eview	Detecting operating system	
	🖉 Detecting OS version	
pply	🖉 Creating temporary folder	
	Package VeeamTransport.msi has been uploaded	0:00:05
ummary	Package VeeamGuestAgent_x86.msi has been uploaded	
	💙 Package VeeamGuestAgent_x64.msi has been uploaded	
	📀 Package VeeamLogBackupService_x86.msi has been uploaded	0:00:01
	Package VeeamLogBackupService_x64.msi has been uploaded	
	Installing package Transport	0:00:19

5. Back in the **New VMware Proxy** wizard, choose a Transport Mode. In our case we chose **Automatic Selection**.

Se	erver	Transport Mode	×	luni soniare ad	ded to the
M	lanaged Se	Backup proxy transport mode:		iux servers au	aed to the
Server Traffic Rules		Automatic selection Data retrieval mode is selected automatically by analyzing backup proxy configuration and reachable VMFS and NFS datastores. Transport modes allowing for direct storage access will be used whenever possible.		2/2022 9 ~	Add New.
Apply Summary		<ul> <li>Direct storage access         Data is retrieved directly from shared storage, without impacting production hosts. For block storage, backup proxy server must be connected into SAN fabric via hardware or software HBA, and have VMFS volumes mounted.     </li> <li>Virtual appliance         Data is retrieved directly from storage through hypervisor I/O stack by hot adding backed up virtual disks to a backup proxy VM. Datastores containing protected VMs must be connected to a host running backup proxy VM.     </li> <li>Network         Data is retrieved from storage through hypervisor network stack using NBD protocol over host management interface. This mode has no special setup requirements. Recommended for 10 Gb Ethernet or faster.     </li> <li>Options              Failover to network mode if primary mode fails, or is unavailable             Enable host to proxy traffic encryption in Network mode (NBDSSL)     </li> </ul>	n J		Choose
		Cancel		Finish	Cancel

6. Select the Connected datastores that you want the VMware Proxy to have direct access to.

#### New VMware Proxy

#### Server

Choose a server for VMware backup proxy. You can choose between any Microsoft Windows or Linux servers added to the Managed Servers which are not assigned a VMware backup proxy role already.

Server	Choose server:	
	veeamproxy.demozone.com (Created by VEEAMSRV\Administrator at 12/22/2022 9 🗸	Add New
Traffic Rules	Proxy description:	
Apply	Created by VEEAMSRV\Administrator at 12/22/2022 9:11 PM.	
Summary		
	Transport mode:	
	Transport mode: Direct storage access	Choose
	Transport mode: Direct storage access Connected datastores:	Choose

X

X

		25.2	6
	Select objects:	62	er
0	<ul> <li>Hosts and Disks</li> <li>Vcenter.sddc-52-34-17-99.vmwarevmc.com</li> <li>DS01</li> <li>DS02</li> </ul>		)2:
	Type in an object name to search for	Q	

7. Configure and apply any specific network traffic rules such as encryption or throttling that are desired. When complete click on the **Apply** button to complete the deployment.

The following netwo	ork traffic rules apply to	this prove		
Name		r crins proxy.		
Internet	Encryption Enabled	Throttling Disabled	Time period	View
	60 1			
in a lage manual h sta				
	Manage network tra	Manage network traffic rules	Manage network traffic rules	Internet     Enabled     Disabled       Manage network traffic rules

# Configure storage and Backup Repositories

The primary Veeam Backup server and Veeam Proxy server have access to a backup repository in the form of direct connected storage. In this section we cover creating an FSx for ONTAP file system, mounting iSCSI LUNs to the Veeam servers and creating Backup Repositories.

Create an FSx for ONTAP file system that will be used to host the iSCSI volumes for the Veeam Backup Repositories.

1. In the AWS console, Go to FSx and then **Create file system** 



2. Select Amazon FSx for NetApp ONTAP and then Next to continue.

Amazon F5x for NetApp ONTAP	Amazon FSx for OpenZFS	Amazon FSx for Windows File Server	Amazon FSx for Lustre
FSXa	FSX <sub>7</sub> =	FS⊁⊐	FSX
Amazon FSx for NetApp ONTAP	Amazon FSx for OpenZFS	Amazon FSx for Windows File Server	Amazon FSx for Lustre
nazon FSx for NetApp ONTAP			
mazon FSx for NetApp ONTAP nazon FSx for NetApp ONTAP provides featu Broadly accessible from Linux, Windows, ar	are-rich, high-performance, and highly-reliable	storage built on NetApp's popular ONTAP file system an nning on AWS or on-premises) via industry-standard NF	d fully managed by AWS. S. SMB, and iSCSI protocols.
mazon FSx for NetApp ONTAP nazon FSx for NetApp ONTAP provides featu Broadly accessible from Linux, Windows, ar Provides ONTAP's popular data manageme	rre-rich, high-performance, and highly-reliable Id macOS compute instances and containers (ru nt capabilities like Snapshots, SnapMirror (for d	storage built on NetApp's popular ONTAP file system an nning on AWS or on-premises) via industry-standard NF ata replication), FlexClone (for data cloning), and data co	d fully managed by AWS. S. SMB, and ISCSI protocols. Impression / deduplication.
mazon FSx for NetApp ONTAP nazon FSx for NetApp ONTAP provides feats Broadly accessible from Linux, Windows, ar Provides ONTAP's popular data manageme Delivers hundreds of thousands of IOPS wit	are-rich, high-performance, and highly-reliable ad macOS compute instances and containers (ru nt capabilities like Snapshots, SnapMirror (for d th consistent sub-millisecond latencies, and up :	storage built on NetApp's popular ONTAP file system an nning on AWS or on-premises) via industry-standard NF ata replication), FlexClone (for data cloning), and data co to 3 GB/s of throughput.	d fully managed by AWS. S, SMB, and ISCSI protocols. ampression / deduplication.
mazon FSx for NetApp ONTAP nazon FSx for NetApp ONTAP provides feats Broadly accessible from Linux, Windows, ar Provides ONTAP's popular data manageme Delivers hundreds of thousands of IOPS wi Offers highly-available and highly-durable	ine-rich, high-performance, and highly-reliable id macOS compute instances and containers (ru nt capabilities like Snapshots, SnapMirror (for d th consistent sub-millisecond latencies, and up i multi-AZ SSD storage with support for cross-re	storage built on NetApp's popular ONTAP file system an nning on AWS or on-premises) via industry-standard NF ata replication), FlexClone (for data cloning), and data c to 3 GB/s of throughput. gion replication and built-in, fully managed backups.	d fully managed by AWS. S, SMB, and ISCSI protocols. ampression / deduplication.

3. Fill in the file system name, deployment type, SSD storage capacity and the VPC in which the FSx for ONTAP cluster will reside. This must be a VPC configured to communicate with the virtual machine network in VMware Cloud. Click on **Next**.

# Create file system **Creation method** Quick create Standard create You set all of the configuration options, including Use recommended best-practice configurations. Most configuration options can be changed after the file specifying performance, networking, security, backups, system is created. and maintenance. **Quick configuration** File system name - optional Info 1 BackupFSxN Maximum of 256 Unicode letters, whitespace, and numbers, plus + - = . \_ : / Deployment type Info O Multi-AZ O Single-AZ SSD storage capacity Info GiB 4096 Minimum 1024 GiB; Maximum 192 TiB Virtual Private Cloud (VPC) Info Specify the VPC from which your file system is accessible. Demo-FsxforONTAP-VPC | vpc-05596abe79cb653b7 V Storage efficiency Select whether you would like to enable ONTAP's storage efficiency features: deduplication, compression, and compaction Enabled (recommended) O Disabled Cancel Back 4. Review the deployment steps and click on Create File System to begin the file system creation

process.

Create and configure the iSCSI LUNs on FSx for ONTAP and mount to the Veeam backup and proxy servers. These LUNs will later be used to create Veeam backup repositories.



Creating an iSCSI LUN on FSx for ONTAP is a multi-step process. The first step of creating the volumes can be accomplished in the Amazon FSx Console or with the NetApp ONTAP CLI.



For more information on using FSx for ONTAP, see the FSx for ONTAP User Guide.

1. From the NetApp ONTAP CLI create the initial volumes using the following command:

```
FSx-Backup::> volume create -vserver svm_name -volume vol_name
-aggregate aggregate name -size vol_size -type RW
```

2. Create LUNs using the volumes created in the previous step:

```
FSx-Backup::> lun create -vserver svm_name -path
/vol/vol_name/lun_name -size size -ostype windows -space-allocation
enabled
```

3. Grant access to the LUNs by creating an initiator group containing the iSCSI IQN of the Veeam backup and proxy servers:

FSx-Backup::> igroup create -vserver svm\_name -igroup igroup\_name
-protocol iSCSI -ostype windows -initiator IQN



To complete the preceding step you will need to first retrieve the IQN from the iSCSI initiator properties on the Windows servers.

4. Finally, map the LUNs to the initiator group that you just created:

```
FSx-Backup::> lun mapping create -vserver svm_name -path
/vol/vol_name/lun_name igroup igroup_name
```

5. To mount the iSCSI LUNs, log into the Veeam Backup & Replication Server and open iSCSI Initiator Properties. Go to the **Discover** tab and enter the iSCSI target IP address.

iscover larger Portai	×	nfiguration
inter the IP address or DNS name and port number of the port vant to add.	al you ortal, click	resh
e Advanced button.		ldress
P address or DNS name: Port: (Default is 32	50.)	
10.49.0.154 3260		
Advanced QK	Cancel	Portal
then dick Remove.	Ran	nove
iSNS servers		
iSNS servers The system is registered on the following iSNS servers:	Ref	fresh
iSNS servers The system is registered on the following iSNS servers: Name	Ret	fresh
iSNS servers The system is registered on the following iSNS servers: Name To add an iSNS server, dick Add Server.	Ref Add Si	fresh erver

6. On the **Targets** tab, highlight the inactive LUN and click on **Connect**. Check the **Enable multi-path** box and click on **OK** to connect to the LUN.

argets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration	
Quick C	onnect					
To disco DNS na	over and log me of the ta	on to a target usin arget and then dick	ng a basic connection, t Quick Connect.	ype the IP	address or	
Target:				Qu	iid: Connect	
Discove	red targets					
					Refresh	
No. of C				Chata		
iqn. 19	92-08.com.	netapp:sn.d9aad3c	d818011edbfcd87a	Inactive		
iqn. 19	92-08.com.ı	netapp:sn.d9aad3c	d818011edbfcd87a	Inactive		
iqn. 19 To conr click Co	92-08.com. nect using a nnect.	netapp:sn.d9aad3c dvanced options, so	d8 180 1 1edbfcd8 7a	Inactive	Connect	
To conr click Co To com then cli	92-08.com. nect using a nnect. pletely disco ck Disconne	netapp:sn.d9aad3c dvanced options, su onnect a target, sel	elect a target and then	Inactive	Connect Disconnect	
To conr dick Co To com then di For targ	92-08.com. nect using a nnect. pletely disco ck Disconner get properti he target ar	netapp:sn.d9aad3c dvanced options, so onnect a target, sel ct. es, including configu nd click Properties.	elect a target and then ect the target and uration of sessions,	Inactive	Connect Disconnect Properties	

7. In the Disk Management utility initialize the new LUN and create a volume with the desired name and drive letter. Check the **Enable multi-path** box and click on **OK** to connect to the LUN.

Computer Management (Local	oluma	Laugut Tune	Eile Surtem	Statur			
Computer Management (Local System Tools Task Scheduler Storage	olume New Simple Volum Format Partitio To store data Choose whet Do not File Allo Volu 20 3a 39 On Disk 1	Layout Type ne Wizard n o on this partition, y her you want to for format this volume this volume with the system: cation unit size: ime label: Perform a quick for Enable file and fold	File System ou must format mat this volume he following set NTFS Default Backup_ mat er compression	Status it first. e, and if so, what setti tings: Target <back nex<="" td=""><td>ngs you want to use.</td><td>nary Partitio</td></back>	ngs you want to use.	nary Partitio	

8. Repeat these steps to mount the iSCSI volumes on the Veeam Proxy server.

In the Veeam Backup and Replication console, create backup repositories for the Veeam Backup and Veeam Proxy servers. These repositories will be used as backup targets for the virtual machines backups.

1. In the Veeam Backup and Replication console click on **Backup Infrastructure** in the lower left and then select **Add Repository** 

	Repository Tools	
<b>∃</b> • Home	Backup Repository	
Add Edir Repository Reposit Manage Repositor	t Rescan tory ory Tools	
Backup Infrastruc	ture	
<ul> <li>Backup Pro</li> <li>Backup Rep</li> <li>External Re</li> <li>Scale-out F</li> <li>WAN Acce</li> <li>Service Pro</li> <li>SureBackup</li> <li>Managed S</li> </ul>	oxies positories Repositories Ierators widers p Servers	
Home		
Backup Infra	structure	
Storage Infra	structure	
Tape Infrastru	ucture	
Files		<u>ه</u> پ

2. In the New Backup Repository wizard, enter a name for the repository and then select the server from the drop-down list and click on the **Populate** button to choose the NTFS volume that will be used.

Name	Repository server:			
Conver	veeamproxy.demozone.com (Cre	ated by VEEAMSRV\Administrator at 12	/22/2022 9 🗸	Add New.
D	Path	Capacity	Free	Populate
Repository	C:\	89.4 GB	74 GB	
Mount Server	⊂ E\	1.9 TB	1.9 TB	
Review				
Apply				
Summary				

- 3. On the next page choose a Mount server that will be used to mount backups to when performing advanced restores. By default this is the same server that has the repository storage connected.
- 4. Review your selections and click on **Apply** to start the backup repository creation.

North Contraction of the Contrac	me following components will be processed of	n server veeamproxy.demozone.com:
	Component name	Status
berver	Transport	already exists
Repository	vPower NFS	will be installed
	Mount Server	will be installed
Mount Server		
ummary		
Summary	Search the repository for existing backups and	nd import them automatically
Summary	Search the repository for existing backups and set of the system index data to the system index	nd import them automatically re catalog

### Configure Veeam backup jobs

Backup jobs should be created utilizing the the Backup Repositories in the previous section. Creating backup jobs is a normal part of any storage administrator's repertoire and we do not cover all of the steps here. For more complete information on creating backup jobs in Veeam, see the Veeam Help Center Technical Documentation.

In this solution separate backup jobs were created for:

- Microsoft Windows SQL Servers
- Oracle database servers
- · Windows file servers
- Linux file servers

- 1. Enable application-aware processing to create consistent backups and perform transaction log processing.
- 2. After enabling application-aware processing add the correct credentials with admin privileges to the application as this may be different than the guest OS credentials.

Specify	Oracle a	ccount w	ith SYS	DBA	privileges: 🗊		
🔧 Us	e guest O	S credent	ials			~	Add
1.0					Manage acco	ounts	
Archive	ed logs:						
O Do	not delet	e archive	d logs				
Del	ete logs o	lder than	: 24	1	hours		
() Del	ete logs o	ver:	10	-	GB		
	kun loas	ever."	15	(1) (*)	minutes		
Dot Doc	nin lan h	ereij.	1.2				
(®)	Until the	correspo	ndina	mac	re-level backup is o	deleted	
0	Keep onl	y last	5	day	s of log backups		
Loc	shipping	servers:					
Au	tomatic s	election				1	Choose
1							

3. To manage the retention policy for the backup check the **Keep certain full backups longer for archival purposes** and click the **Configure...** button to configure the policy.

Con	figure GFS		×	
$\square$	Keep weekly full backups for: 15 🚔 weeks		10:3 ~	
	If multiple full backups exist, use the one from:	Sunday	- packup	
	Keep monthly full backups for: 12 🜩 months			
	Use weekly full backup from the following week of a month:	First	-	Configure
	Keep yearly full backups for: 1 📮 years		Ľ	<b>,</b>
	Use monthly full backup from the following month:	January		
			Ve recom d off-site.	mend to ma
0	IVE As Default OK	Cancel		

#### **Restore Application VMs with Veeam full restore**

Performing a full restore with Veeam is the first step in performing an application restore. We validated that full restores of our VMs powered on and all services were running normally.

Restoring servers is a normal part of any storage administrator's repertoire and we do not cover all of the steps here. For more complete information on performing full restores in Veeam, see the Veeam Help Center Technical Documentation.

#### **Restore SQL Server databases**

Veeam Backup & Replication provides several options for restoring SQL Server databases. For this validation we used the Veeam Explorer for SQL Server with Instant Recovery to execute restores of our SQL Server databases. SQL Server Instant Recovery is a feature that allows you to quickly restore SQL Server databases without having to wait for a full database restore. This rapid recovery process minimizes downtime and ensures business continuity. Here's how it works:

- Veeam Explorer mounts the backup containing the SQL Server database to be restored.
- The software **publishes the database** directly from the mounted files, making it accessible as a temporary database on the target SQL Server instance.
- While the temporary database is in use, Veeam Explorer **redirects user queries** to this database, ensuring that users can continue to access and work with the data.
- In the background, Veeam **performs a full database restore**, transferring data from the temporary database to the original database location.
- Once the full database restore is complete, Veeam Explorer **switches user queries back to the original** database and removes the temporary database.

1. In the Veeam Backup and Replication console, navigate to the list of SQL Server backups, right click on a server and select **Restore application items** and then **Microsoft SQL Server databases...**.



2. In the Microsoft SQL Server Database Restore Wizard select a restore point from the list and click on **Next**.

Restore Point Reason	VM name: sql_srv_wkld_1 VM size: 43.9 GB O Restore from the latest available backup	Original ho	st: vcenter.sddc-44-235-223-88.vm.
	Created Iess than a day ago (9:44 PM Tuesday Iess than a day ago (9:07 PM Tuesday	Type Increment Full	Backup SQL Server Backups SQL Server Backups

3. Enter a **Restore reason** if desired and then, on the Summary page, click on the **Browse** button to launch Veeam Explorer for Microsoft SQL Server.

Microsoft SQL Se	erver Database Restore
------------------	------------------------

store Point ason	Summary: VM name: sql_srv_wkld_1
mmary	Current: sql_srv_wkld_1 less than a day ago (9:07 PM Tuesday 1/10/2023)

4. In Veeam Explorer expand the list of database instances, right click and select **Instant recovery** and then the specific restore point to recover to.

ā ∎ * Home	Database	sql_srv_wkld_1 as of less than a day ago (9:07 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SQL Sen
Instant Recovery •	Publish Database * Publish Database * Publish Restore Restore Restore Restore	Export Export Files V Schema V Export
Databases		Database Info
▲ 🔚 SQLSRV-0 ▲ 🔚 Defaul	1 % Instance	Name:         DATA_01           Backup created:         1/10/2023 9:07 PM
0 D/	<ul> <li>Instant recovery</li> <li>Publish database</li> <li>Restore database</li> <li>Restore schema</li> <li>Export backup</li> </ul>	of the state of Tuesday 1/10/2023, 9:07 PM to SQLSRV-01 to an server Available Restore Period Not available
	Export files       Export schema	Database Files Primary database file E:\MSSQL 2019\MSSQL15.MSSQLSERVER\MSSQL\DATA\DATA_01.mdf
		Secondary database and log files E:\MSSQL 2019\MSSQL15.MSSQLSERVER\MSSQL\LOGS\DATA_log.ldf E:\MSSQL 2019\MSSQL15.MSSQLSERVER\MSSQL\DATA\DATA_02.ndf E:\MSSQL 2019\MSSQL15.MSSQLSERVER\MSSQL\DATA\DATA_03.ndf E:\MSSQL 2019\MSSQL15.MSSQLSERVER\MSSQL\DATA\DATA_04.ndf

5. In the Instant Recovery Wizard specify the switchover type. This can either be automatically with minimal downtime, manually, or at a specified time. Then click the **Recover** button to begin the restore process.

×

		1999
Specify database	switchover scheduling options	
Specify switchover typ	e:	
Auto		
Switchover will be ready.	performed automatically with minimal possible downtime once the databas	se is
() Manual		
Switchover can be	performed manually at any point in time after the database is ready.	
Switchover can be	performed mandally at any point in time after the database is ready.	
- 227		
Scheduled at:	1/10/2023 10:16 PM	
Scheduled at:	1/10/2023 10:16 PM	
Scheduled at:	1/10/2023 10:16 PM	1
Scheduled at:	1/10/2023 10:16 PM	1
Scheduled at:	1/10/2023 10:16 PM	1
Scheduled at:	1/10/2023 10:16 PM Back Recover Cance can be monitored from Veeam Explorer.	1
Scheduled at:	1/10/2023 10:16 PM Back Recover Cance Cance can be monitored from Veeam Explorer.	4
Scheduled at:	1/10/2023 10:16 PM Back Recover Cance can be monitored from Veeam Explorer.	1
Scheduled at:	1/10/2023 10:16 PM Back Recover Cance Cance can be monitored from Veeam Explorer.	4
Scheduled at:	1/10/2023 10:16 PM         Back       Recover         Cance         can be monitored from Veeam Explorer.         ref_srv_widd_1 as of fees there a day ago (007 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SQL Server	ł
Scheduled at:	1/10/2023 10:16 PM         Back       Recover         Cance         can be monitored from Veeam Explorer.         reg(stry_stidd_1 as of less them a day ago (007 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SQL Server         Instant Recovery Info         States       Senting (restored)	1

For more detailed information on performing SQL Server restore operations with Veeam Explorer refer to the Microsoft SQL Server section in the Veeam Explorers User Guide.

Duration

00:35

VeeaM

Database Files

Status

Action

Persistent

Primary database file. EVMSSQL 2019/MSSQL15/MSSQLSERVER/MSSQL\DATA\DATA\_01 and

Secondary database and log face EVMSSCI. 2019 MSSCI 15 MSSCI SERVER/MSSCI LLOGS/DATA\_log Aff EVMSSCI. 2019 MSSCI 15 MSSCI SERVER/MSSCI LOGT/DATA\_log Aff EVMSSCI. 2019 MSSCI 15 MSSCI SERVER/MSSCI LOGT/DATA/DATA EVMSSCI 2019 MSSCI 15 MSSCI SERVER/MSSCI LOGT/DATA/DATA, 04 with

Action
Instant Recovery started at U10/2023 10.12:06 PM
Publishing database
Copying target files
Database published at U10/2023 10.12:43 PM
Synchronizing files
Ready for switchover
Databasing database
Count of the files of the second second

#### Restore Oracle databases with Veeam Explorer

Veeam Explorer for Oracle database provides the ability to perform a standard Oracle database restore or an uninterrupted restore using Instant Recovery. It also supports publishing databases for fast access, recovery of Data Guard databases and restores from RMAN backups.

For more detailed information on performing Oracle database restore operations with Veeam Explorer refer to the Oracle section in the Veeam Explorers User Guide.

In this section an Oracle database restore to a different server is covered using Veeam Explorer.

1. In the Veeam Backup and Replication console, navigate to the list of Oracle backups, right click on a server and select **Restore application items** and then **Oracle databases...**.

観 Backup Tools 王・ Home Backup			Vee	am Backup and Replication
Instant Instant Disk Entire Virtual VM Guest Application Recovery VM Disks Files Files - Items - Restore	Amazon Microsoft Google EC2 Azrure laas CE Restore to Cloud	te Disk		
Home	Q. Type in an object name to search for	×		
「 No Jobs	Job Name 1 Cracle Backups Gora srv_01 Filora srv_02	Creation Time 1/20/2023 2:24 PM 1/20/2023 6:00 PM 1/20/2023 6:02 PM	Restore Points	Repository Repository - Veeam Serve
Loss     Success     Warning     Failed	SQL Serve     Instant recovery.     SQL Serve     Instant disk recov     Restore entire VM     Restore virtual dis     Restore VM files.     Restore vurt file.	* 20/2023 6:01 PM * 20/2023 9:05 PM 10/2023 9:05 PM * *	5	Repository - Veeam Serve
	1 Restore application	on items + Ea NOracle databases	Sue	
	Restore to Amazo Restore to Micro Restore to Googl Export backup	on EC2 Noft Azure e CE		

2. In the Oracle Database Restore Wizard select a restore point from the list and click on **Next**.

Restore Point Reason Summary	VM name: ora_srv_03 VM size: 38.5 GB Restore from the latest available backup Restore from this restore point:	Original ho	ost: vcenter.sddc-44-235-223-88.vm
	Created	Туре	Backup
	Iess than a day ago (6:01 PM Friday 1/ Iess than a day ago (5:01 PM Friday 1/	Increment Increment	Oracle Backups Oracle Backups
	<ul> <li>less than a day ago (4:02 PM Friday 1/</li> <li>less than a day ago (3:47 PM Friday 1/</li> <li>less than a day ago (2:47 PM Friday 1/</li> </ul>	Increment Increment Full	Oracle Backups Oracle Backups Oracle Backups

3. Enter a **Restore reason** if desired and then, on the Summary page, click on the **Browse** button to launch Veeam Explorer for Oracle.

Oracle Database Restore	>
DRACLE' Summary	
Review the re to select data	estore point settings, and click Browse to exit the wizard and open Veeam Explorer for Oracle, where you will be able abases to restore.
Restore Point	Summary:
Reason	VM name: ora_srv_03 Restore point:
Summary	Current: ora_srv_03 less than a day ago (6:01 PM Friday 1/20/2023)
	< Previous Rest Provise Cancel
	~

4. In Veeam Explorer expand the list of database instances, click on the database to be restored and then from the **Restore Database** drop-down menu at the top select **Restore to another server...** 



5. In the Restore Wizard specify the restore point to restore from and click Next.

Specify restore point		
Specify point in time you want	to restore the database to:	
Restore to the point in tim	e of the selected image-level backup	č.
Restore to a specific point	in time (requires redo log backups)	
5:01 PM 1/20/2023	e a la a s	6:01 PN 1/20/202
	Friday, January 20, 2023 6:01	PM
Perform restore to the	specific transaction	
Enables you to review database to the mome	major database transactions around f ent in time right before the unwanted	the selected time, and restore the I change.
🤼 To enable this fun	ctionality, specify the staging Oracle :	server under Menu > Options.

6. Specify the target server the database will be restored to and the account credentials and click **Next**.

Advanced
Browse

Control files			~
/oracle/app/oradata/oradk	01/control01.ctl		
/oracle/app/recovery_area	/oradb01/control02.ctl		
Data files			
/oracle/app/oradata/orada	01/system01.dbf		
/oracle/app/oradata/orada	01/sysaux01.dbf		
/oracle/app/oradata/oradb	01/undotbs01.dbf		
/oracle/app/oradata/oradk	01/pdbseed/system01.dbf		
/oracle/app/oradata/oradk	01/pdbseed/sysaux01.dbf		
/oracle/app/oradata/oradk	01/users01.dbf		

In this section a database is published to an alternate server for fast access without launching a full restore.

1. In the Veeam Backup and Replication console, navigate to the list of Oracle backups, right click on a server and select **Restore application items** and then **Oracle databases...**.



2. In the Oracle Database Restore Wizard select a restore point from the list and click on Next.

Restore Point Reason Summary	VM name: ora_srv_02 Original host: vcenter.sddc-44-235-223-8 VM size: 38.1 GB Restore from the latest available backup Restore from this restore point:				
	Created	Type	Backup		
	() less than a day ago (7:03 PM Friday 1/	Increment	Oracle Backups		
	🕑 less than a day ago (6:02 PM Friday 1/	Increment	Oracle Backups		
	🔮 less than a day ago (5:02 PM Friday 1/	Increment	Oracle Backups		
	I less than a day ago (4:03 PM Friday 1/	Increment	Oracle Backups		
	() less tran a day ago (3.49 PM Phday 1/	Full			

- 3. Enter a **Restore reason** if desired and then, on the Summary page, click on the **Browse** button to launch Veeam Explorer for Oracle.
- 4. In Veeam Explorer expand the list of database instances, click on the database to be restored and then from the **Publish Database** drop-down menu at the top select **Publish to another server...**

<b>∃</b> • Databa	se					
Instant Recovery •	Publish Database •	Restore Database •	Export as RMAN back	; up ▼ D	Export atabase Files •	
Instant Recovery	Publis	erver	Expor	t		
Databases			Database Info			
<ul> <li>ora_srv_02</li> <li>OraDB19Home1</li> <li>oradb01</li> </ul>		Name: Oracle Sl	D:	c	oradb01 oradb01	
		Log mod	le:	4	ARCHIVELOG	
			Backup t	ime:	1	/20/2023 7:03 PM
			Local list	ener:	L	ISTENER_ORADB01

- 5. In the Publish wizard, specify the restore point at which to publish the database from and click **Next**.
- 6. Finally, specify the target linux file system location and click on **Publish** to begin the restore process.

Restore to a different loca	tion	
Oracle Home	/oracle/app/product/19c	Browse
Global Database Name:	oradb01.demozone.com	
Oracle SID:	oradb01	

7. Once the publish has completed log into the target server and run the following commands to ensure the database is running:

oracle@ora\_srv\_01> sqlplus / as sysdba

SQL> select name, open\_mode from v\$database;



# Conclusion

VMware Cloud is a powerful platform for running business-critical applications and storing sensitive data. A secure data protection solution is essential for businesses that rely on VMware Cloud to ensure business continuity and help protect against cyber threats and data loss. By choosing a reliable and robust data protection solution, businesses can be confident that their critical data is safe and secure, no matter what.

The use case presented in this documentation focuses on proven data protection technologies that highlight the integration between NetApp, VMware, and Veeam. FSx for ONTAP is supported as supplemental NFS datastores for VMware Cloud in AWS and is used for all virtual machine and application data. Veeam Backup & Replication is a comprehensive data protection solution designed to help businesses improve, automate, and streamline their backup and recovery processes. Veeam is used in conjunction with iSCSI backup target volumes, hosted on FSx for ONTAP, to provide a secure and easy to manage data protection solution for application data residing in VMware Cloud.

# **Additional Information**

To learn more about the technologies presented in this solution refer to the following additional information.

- FSx for ONTAP User Guide
- Veeam Help Center Technical Documentation
- VMware Cloud on AWS Support. Considerations and Limitations

# TR-4955: Disaster Recovery with FSx for ONTAP and VMC (AWS VMware Cloud)

Disaster Recovery Orchestrator (DRO; a scripted solution with UI) can be used to seamlessly recover workloads replicated from on-premises to FSx for ONTAP. DRO automates the recovery from the SnapMirror level, through VM registration to VMC, to network mappings directly on NSX-T. This feature is included with all VMC environments.

# Overview

Disaster recovery to cloud is a resilient and cost-effective way of protecting the workloads against site outages and data corruption events (for example, ransomware). With NetApp SnapMirror technology, on-premises VMware workloads can be replicated to FSx for ONTAP running in AWS.

Disaster Recovery Orchestrator (DRO; a scripted solution with UI) can be used to seamlessly recover workloads replicated from on-premises to FSx for ONTAP. DRO automates the recovery from the SnapMirror level, through VM registration to VMC, to network mappings directly on NSX-T. This feature is included with all VMC environments.



# Getting started

# Deploy and configure VMware Cloud on AWS

VMware Cloud on AWS provides 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 the workloads. To configure a VMC environment on AWS, follow the steps at this link. A pilot-light cluster can also be used for DR purposes.



In the initial release, DRO supports an existing pilot-light cluster. On-demand SDDC creation will be available in an upcoming release.

# Provision and configure FSx for ONTAP

Amazon FSx for NetApp ONTAP is a fully managed service that provides highly reliable, scalable, high-

performing, and feature-rich file storage built on the popular NetApp ONTAP file system. Follow the steps at this link to provision and configure FSx for ONTAP.

### Deploy and configure SnapMirror to FSx for ONTAP

The next step is to use NetApp BlueXP and discover the provisioned FSx for ONTAP on AWS instance and replicate the desired datastore volumes from an on-premises environment to FSx for ONTAP with the appropriate frequency and NetApp Snapshot copy retention:

		Account Y Workspace nimblab nimhybridiab	* Connector * 🔒 🏠 🌩 🥝 😝
Canvas     My Working Environm	ents My Opportunities New		🖽 Go to Tabular View
+ Add Working Environment	$\sim$	C Enable Services ()	(i)
nimfax F5x for ONTAP 7 13.01 Tie Volumes Capacity	ntaphci-a300e9u28 On-Premises ONTAP 131,27 Till Copecity		DETAILS
h.		-	SERVICES
DemofSxN Exs.for Domain		ANF Anura Natikon Files	Backup and recovery . 1
5 4.74 TIB Volumes Capacity aws		© Failed	Copy & sync 1,57 TiB # On Data Synced
			Loading
Azure Blob Storage	Amazon 53	5	Classification Enable ()
0 Storage Accounts	6 Buckets	aws -+	Enter Working Environment

Follow the steps in this link to configure BlueXP. You can also use the NetApp ONTAP CLI to schedule replication following this link.



A SnapMirror relationship is a prerequisite and must be created beforehand.

# **DRO** installation

To get started with DRO, use the Ubuntu operating system on a designated EC2 instance or virtual machine to make sure you meet the prerequisites. Then install the package.

# Prerequisites

- Make sure that connectivity to the source and destination vCenter and storage systems exists.
- DNS resolution should be in place if you are using DNS names. Otherwise, you should use IP addresses for the vCenter and storage systems.
- Create a user with root permissions. You can also use sudo with an EC2 instance.

#### **OS requirements**

- Ubuntu 20.04 (LTS) with minimum of 2GB and 4 vCPUs
- The following packages must be installed on the designated agent VM:
  - Docker
- Docker-compose
- ∘ Jq

Change permissions on docker.sock: sudo chmod 666 /var/run/docker.sock.



The deploy.sh script executes all the required prerequisites.

#### Install the package

1. Download the installation package on the designated virtual machine:

git clone https://github.com/NetApp/DRO-AWS.git



The agent can be installed on-premises or within an AWS VPC.

2. Unzip the package, run the deployment script, and enter the host IP (for example, 10.10.10.10).

```
tar xvf DRO-prereq.tar
```

3. Navigate to the directory and run the deploy script as follows:

```
sudo sh deploy.sh
```

4. Access the UI using:

```
https://<host-ip-address>
```

with the following default credentials:

Username: admin Password: admin



The password can be changed using the "Change Password" option.

Disaster Recovery Orchestrator	FSX <sub>m</sub>
Usename Password	
Login .	

#### **DRO** configuration

After FSx for ONTAP and VMC have been configured properly, you can begin configuring DRO to automate the recovery of on-premises workloads to VMC by using the read-only SnapMirror copies on FSx for ONTAP.

NetApp recommends deploying the DRO agent in AWS and also to the same VPC where FSx for ONTAP is deployed (it can be peer connected too), so that the DRO agent can communicate through the network with your on-premises components as well as with the FSx for ONTAP and VMC resources.

The first step is to discover and add the on-premises and cloud resources (both vCenter and storage) to DRO. Open DRO in a supported browser and use the default username and password (admin/admin) and Add Sites. Sites can also be added using the Discover option. Add the following platforms:

- On-premises
  - On-premises vCenter
  - ONTAP storage system
- Cloud
  - VMC vCenter
  - FSx for ONTAP



G) 1

View VM List

1

Source

1

1

1

1

Cloud

On Prem

2 Sites

Cloud

On Prem

Destination

Source

**G**1

0 0

Success

Success

...

•••

1

On Prem

• 44.235.223.88

• 172.21.253.160

Once added, DRO performs automatic discovery and displays the VMs that have corresponding SnapMirror replicas from the source storage to FSx for ONTAP. DRO automatically detects the networks and portgroups used by the VMs and populates them.

<b>NetApp</b>	Disaster Recovery Orchest	rator 💊 Dashboard Dis	cover Resource Groups Replic	ation Plans Job Monitoring		4 O-	<b>?</b> ⁺ ⊕
	Back		VM List				
			Site: On Prem   vCenter: 172.	VM Protection			
	10 Data	stores	219 Vinual Machines	S Protected	Unprof	216 ected	
	38 vus				م 📘	Create Resource Group	
	VM Name	C VM Status	₩ VM State (1)	T DetaStore	C CRU	<ul> <li>Memory (MB)</li> </ul>	
	a300-vcsa02	0 Not Protected	() Powered On	A300_NF5_D504	16	65538	
	PFSense	Not Protected	() Powered On	A300_NF5_D504	4	8192	
	PFSense260	0 Not Protected	() Pownred On	A300_NFS_DS04	4	16384	
	NimDC02	0 Not Protected	(1) Powered On	A300_NFS_DS04	4	8192	
	jhRBhoja-187	0 Not Protected	() Powered On	A300_NFS_DS04	4	16384	
	jhNmo-187	0 Not Protected	() Powered On	A300_NFS_D504	4	16384	
	NimMSdesktop	0 Not Protected	(1) Powered On	A300_NFS_DS04	8	12288	

The next step is to group the required VMs into functional groups to serve as resource groups.

#### **Resource groupings**

After the platforms have been added, you can group the VMs you want to recover into resource groups. DRO resource groups allow you to group a set of dependent VMs into logical groups that contain their boot orders, boot delays, and optional application validations that can be executed upon recovery.

To start creating resource groups, complete the following steps:

- 1. Access Resource Groups, and click Create New Resource Group.
- 2. Under **New resource group**, select the source site from the dropdown and click **Create**.
- 3. Provide Resource Group Details and click Continue.
- 4. Select the appropriate VMs using the search option.
- 5. Select the boot order and boot delay (secs) for the selected VMs. Set the order of the power-on sequence by selecting each VM and setting up the priority for it. Three is the default value for all VMs.

Options are as follows:

- 1 The first virtual machine to power on
- 3 Default
- 5 The last virtual machine to power on
- 6. Click Create Resource Group.

NetApp	Disaster Recovery Orchestrator 💊	Dashboard Discover R	Replication Plans	Job Monitoring	🌲 🔅 🔞 🕲 🔹
	Resource Group	C 1 Site	🛃 1	Center 3 Virtual Machines	
	1				
	Resource Group			Q O Create New Resource Gr	bup
	Resource Group Name	C Site Name	〒 Source vCenter	i≑   VM List	
	DemoRG1	On Prem	172.21.253.160	View VM List ····	

#### **Replication plans**

You need a plan to recover applications in the event of a disaster. Select the source and destination vCenter platforms from the drop down and pick the resource groups to be included in this plan, along with the grouping of how applications should be restored and powered on (for example, domain controllers, then tier-1, then tier-2, and so on). Such plans are sometimes also called blueprints. To define the recovery plan, navigate to the **Replication Plan** tab and click **New Replication Plan**.

To start creating a replication plan, complete the following steps:

1. Access Replication Plans, and click Create New Replication Plan.

netApp	Disaster Recovery Orchestrator 🍾 Dashboard Discover	Resource Groups Replication Plans Job M	fonitoring	¢* ?* ®*
		Source Details	Destination Details	
	Replication Plans	1 Contents	1 I VCenters	
				1
	1 Replication Plan		Q O Create New Replication Plan	
	Plan Name 🗘   Active Site   Status	Compliance Source Site 🔤	Destination Site 💲	
	<ul> <li>Source</li> <li>Active</li> </ul>	Healthy On Prem	Cloud Resource Groups ····	

2. Under **New Replication Plan**, provide a name for the plan and add recovery mappings by selecting the source site, associated vCenter, destination site, and associated vCenter.

Replication Plan Details     Plan Name     Plan Name     Recovery Mapping     Source Site     Select Source Site     Select Source Site     Select Source Venter     Select Source vCenter     Select Destination vCenter	Create New Replication Plan	Replication Plan and Site Details     Select Resource	Groups (3) Set Execution Order (4) Set VM Detail	Is
Plan Name       Image: Control of Con		Replication	Plan Details	
Recovery Mapping         Source Site       Destination Site         Select Source Site       Select Destination Site         Source vCenter       Destination vCenter         Select Source vCenter       Select Destination vCenter		Plan Name	0	
Recovery Mapping         Source Site       Destination Site         Select Source Site       Select Destination Site         Source vCenter       Destination vCenter         Select Source vCenter       Select Destination vCenter				
Source Site     Destination Site       Select Source Site     Select Destination Site       Source vCenter     Destination vCenter       Select Source vCenter     Select Destination vCenter		Recover	y Mapping	
Source vCenter     •     Select Destination Site     •       Select Source vCenter     •     Select Destination vCenter     •		Source Site	Destination Site	
Source vCenter     Destination vCenter       Select Source vCenter     Select Destination vCenter		Select Source Site +	Select Destination Site +	
		Source vCenter 0	Destination vCenter	
		Pre-requisite - You must configure SnapMirror relat create successful replication plan	ionships between the source site and target site to $$\times$$	

3. After Recovery mapping is completed, select the cluster mapping.

Create New Replication Plan	1 Replication Plan and Site Details	2 Select Resource	Groups (3) Set Execution Orde	r (4) Set VM Details	
		Replication	Plan Details		
	Plan Name			0	
	DemoRP				
		Recovery	Mapping		
	Source Site	0	Destination Site	0	
	On Prem	÷	Cloud	÷	
	Source vCenter	0	Destination vCenter	0	
	172.21.253.160	•	44.235.223.88		
		Cluster	Mapping		
	Source Site Resource	O Destination	on Site Resource	0	
	TempCluster	*	Cluster-1 ~	Add	
	Source Resource	Destination	Resource		
	A300-Cluster01	Cluster-1		Delete	

- 4. Select **Resource Group Details** and click **Continue**.
- 5. Set the execution order for the resource group. This option enables you to select the sequence of operations when multiple resource groups exist.
- 6. After you are done, select the network mapping to the appropriate segment. The segments should already be provisioned within VMC, so select the appropriate segment to map the VM.
- 7. Based on the selection of VMs, datastore mappings are automatically selected.



SnapMirror is at the volume level. Therefore, all VMs are replicated to the replication destination. Make sure to select all VMs that are part of the datastore. If they are not selected, only the VMs that are part of the replication plan are processed.

Replication Plan Details         Select Execution Order ()         Resource Oroup Name       Execution Order ()         DemoRG1       3         DemoRG1         Delete         Delete         DetaStore         Destination Nolume         DRO_Mini_copy	Details	
Select Execution Order ()         Resource Group Name       Execution Order ()         DemoRG1       3         Network Mapping         No more Source/Destination network resources available for mapping         Source Resource       Destination Resource         VLAN 3375       sddc-cgw-network-1         DataStore Mapping       Destination Volume         Source DetaStore       Destination Volume         DRO_Mini       DRO_Mini_copy		
Resource Oroup Name       Execution Order ()         DemoRG1       3         Network Mapping       No more Source/Destination network resources available for mapping         Source Resource       Destination Resource         VLAN 3375       sddc-cgw-network-1         DataStore Mapping         Source DetaStore       Destination Volume         DRO_Mini       DRO_Mini_copy	Order	
DemaRG1     3       Network Mapping       No more Source/Destination network resources available for mapping       Source Resource       Source Resource     Destination Resource       VLAN 3375     sddc-cgw-network-1       Delete       DataStore Mapping       Source DetaStore       Destination Volume       DRO_Mini     DRO_Mini_copy	Execution Order 👔	
Network Mapping         No more Source/Destination network resources available for mapping         Source Resource         Source Resource       Destination Resource         VLAN 3375       sddc-cgw-network-1       Delete         DataStore Mapping         Source Destination Volume         DRO_Mini       DRO_Mini_copy	3	
VLAN 3375     sddc-cgw-network-1     Delete       DataStore Mapping       Source DataStore     Destination Volume       DRO_Mini     DRO_Mini_copy	ources available for mapping	
DataStore Mapping       Source DataStore     Destination Volume       DRO_Mini     DRO_Mini_copy	-1 Delete	
Source DataStore         Destination Volume           DR0_Mini         DR0_Mini_copy	ping	
DRO_Mini_copy	ation Volume	
	fini_copy	
		Execution Order () 3 ping ources available for mapping rec -1 Delete pping ation Volume fini_copy

8. Under the VM details, you can optionally resize the VM's CPU and RAM parameters; this can be very helpful when recovering large environments to smaller target clusters or for conducting DR tests without having to provision a one-to-one physical VMware infrastructure. Also, you can modify the boot order and boot delay (seconds) for all the selected VMs across the resource groups. There is an additional option to modify the boot order if there are any changes required from those selected during the resource-group boot-order selection. By default, the boot order selected during resource-group selection is used; however, any modifications can be performed at this stage.

NetApp Disaster Recovery Orchestrator 💊	Dashboard Discove	er Resource Groups Replic	ation Plans   Job M	onitoring	<b>≜</b> ☆* @* ©*
Create New Replication Plan Replication	on Plan and Site Details	Select Resource Groups	Set Execution Ord	er 🕜 Set VM Deta	ls ×
		VM Details			
З ум.	5			٩	
VMN	lame No. of	CPUs Memory (MB)	NIC/IP	Boot Order ④ ■ Override	
Reso	ource Group : DemoRG1				
Mini_	Test01 1	2048	<ul><li>Static</li><li>Dynamic</li></ul>	3	
Mini_	Test02 1	2048	<ul><li>Static</li><li>Dynamic</li></ul>	2	
Mini_	Test03 1	2048	O Static Dynamic	1	
					-
		Previous Create Re	plication Plan		

9. Click Create Replication Plan.

Source Details     Destination Details       Peplication Plans     Image: Application Plans     Image: Application Plans									
2   Image: Constraint of the second constraint o	_			Source Details		Destination Details	Destination Details		
Sites vCenters Sites vCenters	B 2	plication Plans	2 1 Resource Groups	<u>△</u> 1	🛃 1	<u> </u>	🔁 1		
2 Replication Plans O O Create New Replication Plan	2 Replication	Plans				0.0	Create New Replication Plan		
2 Replication Plans Q O Create New Replication Plan	2 Replication	Plans				۵ ۵	Create New Replication Plan		
2 Replication Plans     Q O     Create New Replication Plan       Plan Name     ○   Active Site       Status       Compliance	2 Replication Plan Name	Plans \$   Active Site	Status	Compliance	Source Site =	Q O Destination Site 😂	Create New Replication Plan		
2 Replication Plans     Q O     Create New Replication Plan       Plan Name     Create New Replication Plan	2 Replication	Plans	Status	Compliance	Source Site	Q O	Create New Replication Plan		
Plan Name     Create New Replication Plan       Plan Name     Create New Replication Plan       Plan Name     Compliance       Source Site     Compliance       DemoRP     Source       O Source     Active       O Not Available     On Prem       Cloud     Resource Groups	2 Replication Plan Name DemoRP	Plans           Image: Active Site           Image: Source	Status O Active	Compliance () Not Available	Source Site 👳	Q O Destination Site 0	Create New Replication Pla		
Plan Name     C Mattive Site     Status     Compliance     Source Site     Image: Compliance     Compli	2 Replication Plan Name DemoRP	Plans           C         Active Site           O Source	Status ⓒ Active	Compliance ① Not Available	Source Site 🛛 👻 On Prem	Q O Destination Site 0 Cloud	Create New Replication Plan		

After the replication plan is created, the failover option, the test-failover option, or the migrate option can be exercised depending on the requirements. During the failover and test-failover options, the most recent SnapMirror Snapshot copy is used, or a specific Snapshot copy can be selected from a point-in-time Snapshot copy (per the retention policy of SnapMirror). The point-in-time option can be very helpful if you are facing a corruption event like ransomware, where the most recent replicas are already compromised or encrypted. DRO shows all available points in time. To trigger failover or test failover with the configuration specified in the replication plan, you can click **Failover** or **Test failover**.

			Source Details		Destination Det	ails
B 2 Rep	lication Plans	1 Resource Groups	C 1 Sites	1 vCenters	Sites 1	P 1 vCenters
2 Replication Pla	ans				Q 0	Create New Replication Plan
Plan Name	C Active Site	Status	Compliance	Source Site 👳	Destination Site 🗘	Υ
DemoRP	Source	<ul> <li>Active</li> </ul>	Healthy	On Prem	Cloud	Resource Groups
DemoRP	⊘ Source	<ul> <li>Active</li> </ul>	Healthy	On Prem	Cloud	Plan Details Resource
						Edit Plan
						Failover
						Test Failover
						Migrate
						Run Compliance
						Delete Plan

Failover Details	×
Volume Snapshot Details <ul> <li>Use latest snapshot (i)</li> <li>Select specific snapshot (i)</li> </ul>	
Start Failover	

The replication plan can be monitored in the task menu:

🗖 NetApp	Disaster Rec	overy Orchestrator 🔌 Dashboard Discover R	esource Groups Replication Plans	Job Monitoring		۵	\$* <b>?</b> * <b>®</b> *
	Back		Failover Steps Replication Plan: DemoRP				
	~	Breaking SnapMirror relationships (in parallel)		0	) Success 11.3 Sec	onds 🕡	
	~	Mounting volumes and creating datastores (in parallel)		Ø	) Success 34.7 Se	conds 🕕	
	~	Registering VMs (in parallel)		Ø	) Success 13.2 Sec	conds 🛈	
	~	Powering on VMs in protection group - DemoRG1 - in target		0	) Success 95.8 Se	conds 🕕	
	~	Updating replication status		0	) Success 0.5 Sec	onds 🕕	

After failover is triggered, the recovered items can be seen in the VMC vCenter (VMs, networks, datastores). By default, the VMs are recovered to the Workload folder.

2	2 Participant Concept	1 Augustion Page	219	Promotion UNAs	0 219 Upplaced
Tadarradi Q2 citad Insurante.	D Z. Taxage freedomonts	Stepslage Cannon			installing line ()
icanie Anterus	D 22	Di free	2005 Cont	5	
Ovines	Epidere	472.21.264.249 872.21.264.249	44,235,223,8 49,45,6 199		
23 Entertown	<ul> <li>45</li> <li>Manual A</li> </ul>	112 27 283 989 112 28 286 299	44,256,220,8 46,46,6 199		
23 Entertores	2 45 Marriela	112 27.353 980 112 27.366 219	44,206,201 #		

Failback can be triggered at the replication-plan level. For a test failover, the tear-down option can be used to roll back the changes and remove the FlexClone relationship. Failback related to failover is a two-step process. Select the replication plan and select **Reverse data sync**.

netApp	Disaster Recovery Or	chestrator 💊 🛛 Da	shboard Discover	Resource Groups	Replication Plans	Job Monitoring	f(		¢* ?* ®*
	Replication	n Plans	1 Resource Groups	Source Details	2 1 vCenters		Destination Details	Centers 1	
	2 Replication Plans						Q O Cre	ate New Replication Plan	
	Plan Name 🗢 DemoRP	O Destination	Status     Running In Failover 1	Compliance	On Prem	E Destinatio	n Site 🗢 🗍 🗌 Resou	rce Groups	
	DemoRP	<ul> <li>Source</li> </ul>	<ul> <li>Active</li> </ul>	Healthy	On Prem	Cloud	Resou	Plan Details	
								Fallback	
■ NetApp	Disaster Recovery Or	chestrator 🗞 Da	ashboard Discover	Resource Groups	Replication Plans	Job Monitoring	I.	<b>A</b>	¢* @* @*
	Deale								
	васк			Reverse Data Replication F	a Sync Steps Plan: DemoRP				
	✓ Powering	ng off VMs in protection g	roup - DemoRG1 - in source				J In progress	- 0	
	✓ Reversion	ing SnapMirror relationshi	ps (in parallel)				✓ Initialized	- ①	

Once completed, you can trigger failback to move back to original production site.

netApp	Disaster Recovery Orchestrator 💊 Dashboard Discover Resource Groups Replication Plans Job 1	Monitoring 🗍 🌲 🌣 + 😨 +
	2     Image: Constraint of the second constraints       Replication Plans     Image: Constraint of the second constraints	Destination Details
	2 Replication Plans Plan Name ≎ Active Site Status Compliance Source Site <del>=</del>	Q O Create New Replication Plan
	DemoRP	Cloud Resource Groups
	DemoRP     Source    Active     Healthy    On  Prem	Cloud Resource Failback
■ NetApp	p Disaster Recovery Orchestrator 🍾 Dashboard Discover Resource Groups Replication Plans Job	Monitoring 💄 🌣 🕑 - 🕑 -
	Back Failback Steps	

Nowering off VMs in protection group - DemoRG1 - in target       ( In progress - 0)         Image: Image		Failba Replication	ck Steps Plan: DemoRP		
Inregistering VMs in target (in parallel)       Initialized       Initialized <td>~</td> <td>Powering off VMs in protection group - DemoRG1 - in target</td> <td></td> <td>C In progress</td> <td>- ①</td>	~	Powering off VMs in protection group - DemoRG1 - in target		C In progress	- ①
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From NetApp BlueXP, we can see that replication health has broken off for the appropriate volumes (those that were mapped to VMC as read-write volumes). During test failover, DRO does not map the destination or replica volume. Instead, it makes a FlexClone copy of the required SnapMirror (or Snapshot) instance and exposes the FlexClone instance, which does not consume additional physical capacity for FSx for ONTAP. This process makes sure that the volume is not modified and replica jobs can continue even during DR tests or triage workflows. Additionally, this process makes sure that, if errors occur or corrupted data is recovered, the recovery can be cleaned up without the risk of the replica being destroyed.



#### Ransomware recovery

Recovering from ransomware can be a daunting task. Specifically, it can be hard for IT organizations to pinpoint where the safe point of return is and, once that is determined, to protect recovered workloads from reoccurring attacks from, for example, sleeping malware or vulnerable applications.

DRO addresses these concerns by enabling you to recover your system from any available point in time. You can also recover workloads to functional and yet isolated networks so that applications can function and communicate with each other in a location where they are not exposed to north-south traffic. This gives your security team a safe place to conduct forensics and make sure there is no hidden or sleeping malware.

#### **Benefits**

- Use of the efficient and resilient SnapMirror replication.
- Recovery to any available point in time with Snapshot copy retention.
- Full automation of all required steps to recover hundreds to thousands of VMs from the storage, compute, network, and application validation steps.
- Workload recovery with ONTAP FlexClone technology using a method that doesn't change the replicated volume.
  - Avoids risk of data corruption for volumes or Snapshot copies.
  - Avoids replication interruptions during DR test workflows.
  - Potential use of DR data with cloud computing resources for workflows beyond DR such as DevTest, security testing, patch or upgrade testing, and remediation testing.
- CPU and RAM optimization to help lower cloud costs by allowing recovery to smaller compute clusters.

# Using Veeam Replication and FSx for ONTAP for Disaster recovery to VMware Cloud on AWS

Amazon FSx for NetApp ONTAP integration with VMware Cloud on AWS is an AWSmanaged external NFS datastore built on NetApp's ONTAP file system that can be attached to a cluster in the SDDC. It provides customers with flexible, high-performance virtualized storage infrastructure that scales independently of compute resources.

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#### Overview

For those customers looking to use VMware Cloud on AWS SDDC as the disaster recovery target, FSx for ONTAP datastores can be used to replicate data from on-premises using any validated third-party solution that provides VM replication capability. By adding FSx for ONTAP datastore, it will enable cost optimised deployment than building VMware cloud on AWS SDDC with enormous amount of ESXi hosts just to accommodate the storage.

This approach also helps customers to use pilot light cluster in VMC along with FSx for ONTAP datastores to host the VM replicas. The same process can also be extended as a migration option to VMware Cloud on AWS by gracefully failing over the replication plan.

#### **Problem Statement**

This document describes how to use FSx for ONTAP datastore and Veeam Backup and replication to set up disaster recovery for on-premises VMware VMs to VMware Cloud on AWS using the VM replication functionality.

Veeam Backup & Replication allows onsite and remote replication for disaster recovery (DR). When virtual machines are replicated, Veeam Backup & Replication creates an exact copy of the VMs in the native VMware vSphere format on the target VMware Cloud on AWS SDDC cluster and keeps the copy synchronized with the original VM.

Replication provides the best recovery time objective (RTO) values as there is a copy of a VM in the ready-tostart state. This replication mechanism ensures that the workloads can quickly start in VMware Cloud on AWS SDDC in case of a disaster event. The Veeam Backup & Replication software also optimizes traffic transmission for replication over WAN and slow connections. In addition, it also filters out duplicate data blocks, zero data blocks, swap files and excluded VM guest OS files, and compresses the replica traffic.

To prevent replication jobs from consuming the entire network bandwidth, WAN accelerators and network throttling rules can be put in place. The replication process in Veeam Backup & Replication is job driven which means replication is performed by configuring replication jobs. In case of a disaster event, failover can be triggered to recover the VMs by failing over to its replica copy.

When failover is performed, a replicated VM takes over the role of the original VM. Fail over can be performed to the latest state of a replica or to any of its good known restore points. This enables ransomware recovery or isolated testing as needed. In Veeam Backup & Replication, failover and failback are temporary intermediate step that should be further finalized. Veeam Backup & Replication offers multiple options to handle different disaster recovery scenarios.



#### **Solution Deployment**

#### High level steps

- 1. Veeam Backup and Replication software is running in on-premises environment with appropriate network connectivity.
- Configure VMware Cloud on AWS, see the VMware Cloud Tech Zone article VMware Cloud on AWS integration with Amazon FSx for NetApp ONTAP Deployment Guide to deploy, configure VMware Cloud on AWS SDDC and FSx for ONTAP as NFS datastore. (A pilot-light environment set up with a minimal configuration can be used for DR purposes. VMs will fail over to this cluster in the event of an incident, and additional nodes can be added).
- 3. Set up replication jobs to create VM replicas using Veeam Backup and Replication.
- 4. Create failover plan and perform failover.
- 5. Switch back to production VMs once the disaster event is complete and primary site is Up.

#### Pre-requisites for Veeam VM Replication to VMC and FSx for ONTAP datastores

- 1. Ensure Veeam Backup & Replication backup VM is connected to the source vCenter as well as the target VMware cloud on AWS SDDC clusters.
- 2. The backup server must be able to resolve short names and connect to source and target vCenters.
- 3. The target FSx for ONTAP datastore must have enough free space to store VMDKs of replicated VMs

For additional information, refer to "Considerations and Limitations" covered here.

#### **Deployment Details**

Veeam Backup & Replication leverages VMware vSphere snapshot capabilities and during replication, Veeam Backup & Replication requests VMware vSphere to create a VM snapshot. The VM snapshot is the point-in-time copy of a VM that includes virtual disks, system state, configuration and so on. Veeam Backup & Replication uses the snapshot as a source of data for replication.

To replicate VMs, follow the below steps:

- 1. Open the Veeam Backup & Replication Console.
- 2. On the Home view, select Replication Job > Virtual machine > VMware vSphere.
- 3. Specify a job name and select the appropriate advanced control checkbox. Click Next.
  - Select the Replica seeding check box if connectivity between on-premises and AWS has restricted bandwidth.
  - Select the Network remapping (for AWS VMC sites with different networks) check box if segments on VMware Cloud on AWS SDDC do not match that of on-premises site networks.
  - If the IP addressing scheme in on-premises production site differs from the scheme in the AWS VMC site, select the Replica re-IP (for DR sites with different IP addressing scheme) check box.



4. Select the VMs that needs to be replicated to FSx for ONTAP datastore attached to VMware Cloud on AWS SDDC in the Virtual Machines step. The Virtual machines can be placed on vSAN to fill the available vSAN datastore capacity. In a pilot light cluster, the usable capacity of a 3-node cluster will be limited. The rest of the data can be replicated to FSx for ONTAP datastores. Click Add, then in the Add Object window select the necessary VMs or VM containers and click Add. Click Next.

#### Virtual Machines

Select one or more VMs to replicate. Use exclusion settings to exclude specific VMs and virtual disks from replication.

	Name	Туре	Size	^	Add
Virtual Machines	TestVeeam21	Virtual Machine	873 MB		Remove
Destination	TestVeeam22	Virtual Machine	890 MB		TIMETINE P.
	TestVeeam23	Virtual Machine	883 MB		- 1923 D. C. C.
Network	TestVeeam24	Virtual Machine	879 MB		Exclusions
	TestVeeam25	Virtual Machine	885 MB		Source
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	TestVeeam32	Virtual Machine	881 MB		
Summary	TestVeeam33	Virtual Machine	877 MB		
	TestVeeam34	Virtual Machine	875 MB		
	TestVeeam35	Virtual Machine	882 MB		Recalculate
	WinSQL401	Virtual Machine	20.3 GB		
	WinSQL405	Virtual Machine	24.2 GB		Total size:
	Phone con tor			•	120 GB

5. After that, select the destination as VMware Cloud on AWS SDDC cluster / host and the appropriate resource pool, VM folder and FSx for ONTAP datastore for VM replicas. Then Click **Next**.

Name	Host or cluster:	
Virtual Machines		Choose
Destination	Resource pool:	
Network	Resources	Choose
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ummary		
	C Previour Next > Finish	Cancel

6. In the next step, create the mapping between source and destination virtual network as needed.

Name	Network mapping:		
Virtual Machines	Source network	Target network	Add
Destination	SWL_3510 (vDS-Switch0)	SegmentTemp	Later
Job Settings Data Transfer Guest Processing Schedule			
Summary			

- 7. In the **Job Settings** step, specify the backup repository that will store metadata for VM replicas, retention policy and so on.
- 8. Update the **Source** and **Target** proxy servers in the **Data Transfer** step and leave **Automatic** selection (default) and keep **Direct** option selected and click **Next**.
- 9. At the **Guest Processing** step, select **Enable application-aware processing** option as needed. Click **Next**.

Name Virtual Machines	Enable application-aware processing Detects and prepares applications for consistent backup, performs transaction logs configures the OS to perform required application restore steps upon first boot.	processing, and
Destination	Customize application handling options for individual machines and applications Guest interaction proxy:	Applications
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Data Transfer	×	Add
	Manage accounts	
iuest Processing	Customize guest OS credentials for individual machines and operating systems	Credentials
chedule	Verify network connectivity and credentials for each machine included in the job	Test Now
ummary		

- 10. Choose the replication schedule to run the replication job to run on a regular basis.
- 11. At the **Summary** step of the wizard, review details of the replication job. To start the job right after the wizard is closed, select the **Run the job when I click Finish** check box, otherwise leave the check box unselected. Then click **Finish** to close the wizard.

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Once the replication job starts, the VMs with the suffix specified will be populated on the destination VMC SDDC cluster / host.

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For additional information for Veeam replication, refer to How Replication Works.

#### Step 2: Create a failover plan

When the initial replication or seeding is complete, create the failover plan. Failover plan helps in performing failover for dependent VMs one by one or as a group automatically. Failover plan is the blueprint for the order in which the VMs are processed including the boot delays. The failover plan also helps to ensure that critical dependant VMs are already running.

To create the plan, navigate to the new sub section called Replicas and select Failover Plan. Choose the appropriate VMs. Veeam Backup & Replication will look for the closest restore points to this point in time and use them to start VM replicas.



The failover plan can only be added once the initial replication is complete and the VM replicas are in Ready state.



The maximum number of VMs that can be started simultaneously when running a failover plan is 10.



During the failover process, the source VMs will not be powered off.

To create the Failover Plan, do the following:

- 1. On the Home view, select Failover Plan > VMware vSphere.
- 2. Next, provide a name and a description to the plan. Pre and Post-failover script can be added as required. For instance, run a script to shutdown VMs before starting the replicated VMs.

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Backup Replication CDP Job * Jobs Policy Primary Jobs Auxiliary Jobs Restor Home	r New Falover Plan General Type in name ar	M description for this failover plan, and optionally specify scripts to trigger before and after the failover.
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3. Add the VMs to the plan and modify the VM boot order and boot delays to meet the application dependencies.

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For additional information for creating replication jobs, refer Creating Replication Jobs.

During failover, the source VM in the production site is switched over to its replica at the disaster recovery site. As part of the failover process, Veeam Backup & Replication restores the VM replica to the required restore point and moves all I/O activities from the source VM to its replica. Replicas can be used not only in case of a disaster, but also to simulate DR drills. During failover simulation, the source VM remains running. Once all the necessary tests have been conducted, you can undo the failover and return to normal operations.



Make sure network segmentation is in place to avoid IP conflicts during DR drills.

To start the failover plan, simply click in **Failover Plans** tab and right click on the failover plan. Select **Start**. This will failover using the latest restore points of VM replicas. To fail over to specific restore points of VM replicas, select **Start to**.

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The state of the VM replica changes from Ready to Failover and VMs will start on the destination VMware Cloud on AWS SDDC cluster / host.

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Once the failover is complete, the status of the VMs will change to "Failover".

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Veeam Backup & Replication stops all replication activities for the source VM until its replica is returned to the Ready state.

For detailed information about failover plans, refer to Failover Plans.

When the failover plan is running, it is considered as an intermediate step and needs to be finalized based on the requirement. The options include the following:

• Failback to production - switch back to the original VM and transfer all changes that took place while the VM replica was running to the original VM.



When you perform failback, changes are only transferred but not published. Choose **Commit failback** (once the original VM is confirmed to work as expected) or **Undo failback** to get back to the VM replica If the original VM is not working as expected.

- **Undo failover** switch back to the original VM and discard all changes made to the VM replica while it was running.
- **Permanent Failover** permanently switch from the original VM to a VM replica and use this replica as the original VM.

In this demo, Failback to production was chosen. Failback to the original VM was selected during the Destination step of the wizard and "Power on VM after restoring" check box was enabled.



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Failback commit is one of the ways to finalize failback operation. When failback is committed, it confirms that the changes sent to the VM which is failed back (the production VM) are working as expected. After the commit operation, Veeam Backup & Replication resumes replication activities for the production VM.

For detailed information about the failback process, refer Veeam documentation for Failover and Failback for replication.

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After failback to production is successful, the VMs are all restored back to the original production site.

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#### Conclusion

FSx for ONTAP datastore capability enables Veeam or any validated third-party tool to provide low-cost DR solution using Pilot light cluster and without standing up large number of hosts in the cluster just to accommodate the VM replica copy. This provides a powerful solution to handle a tailored, customized disaster recovery plan and also allows to reuse existing backup products in house to meet the DR needs, thus enabling cloud-based disaster recovery by exiting DR datacentres on-premises. Failover can be done as planned failover or failover with a click of a button when disaster occurs, and decision is made to activate the DR site.

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

https://netapp.hosted.panopto.com/Panopto/Pages/Embed.aspx?id=15fed205-8614-4ef7-b2d0-b061015e925a

### **Migrating Workloads on AWS / VMC**

#### TR 4942: Migrate Workloads to FSx ONTAP datastore using VMware HCX

A common use case for VMware Cloud (VMC) on Amazon Web Services (AWS), with its supplemental NFS datastore on Amazon FSx for NetApp ONTAP, is the migration of VMware workloads. VMware HCX is a preferred option and provides various migration methods to move on-premises virtual machines (VMs) and their data, running on any VMware supported datastores, to VMC datastores, which includes supplemental NFS datastores on FSx for ONTAP.

Author(s): NetApp Solutions Engineering

## Overview: Migrating virtual machines with VMware HCX, FSx ONTAP supplemental datastores, and VMware Cloud

VMware HCX is primarily a mobility platform that is designed to simplify workload migration, workload rebalancing, and business continuity across clouds. It is included as part of VMware Cloud on AWS and offers many ways to migrate workloads and can be used for disaster recovery (DR) operations.

This document provides step-by-step guidance for deploying and configuring VMware HCX, including all its main components, on-premises and on the cloud data center side, which enables various VM migration mechanisms.

For more information, see Introduction to HCX Deployments and Install Checklist B - HCX with a VMware Cloud on AWS SDDC Destination Environment.

#### **High-level steps**

This list provides the high-level steps to install and configure VMware HCX:

- 1. Activate HCX for the VMC software-defined data center (SDDC) through VMware Cloud Services Console.
- 2. Download and deploy the HCX Connector OVA installer in the on-premises vCenter Server.
- 3. Activate HCX with a license key.
- 4. Pair on-premises VMware HCX Connector with VMC HCX Cloud Manager.
- 5. Configure the network profile, compute profile, and service mesh.
- 6. (Optional) Perform Network Extension to extend the network and avoid re-IP.
- 7. Validate the appliance status and ensure that migration is possible.
- 8. Migrate the VM workloads.

#### Prerequisites

Before you begin, make sure the following prerequisites are met. For more information, see Preparing for HCX Installation. After the prerequisites are in place, including connectivity, configure and activate HCX by generating a license key from the VMware HCX Console at VMC. After HCX is activated, the vCenter Plug- in is deployed and can be accessed by using the vCenter Console for management.

The following installation steps must be completed before proceeding with HCX activation and deployment:

- 1. Use an existing VMC SDDC or create a new SDDC following this NetApp link or this VMware link.
- 2. The network path from the on-premises vCenter environment to the VMC SDDC must support migration of VMs by using vMotion.
- 3. Make sure the required firewall rules and ports are allowed for vMotion traffic between the onpremises vCenter Server and the SDDC vCenter.
- 4. The FSx for ONTAP NFS volume should be mounted as a supplemental datastore in the VMC SDDC. To attach the NFS datastores to the appropriate cluster, follow the steps outlined in this NetApp link or this VMware link.

#### **High Level Architecture**

For testing purposes, the on-premises lab environment used for this validation was connected through a site-to-site VPN to AWS VPC, which allowed on-premises connectivity to AWS and to VMware cloud SDDC through External transit gateway. HCX migration and network extension traffic flows over the internet between on-premises and VMware cloud destination SDDC. This architecture can be modified to use Direct Connect private virtual interfaces.

The following image depicts the high-level architecture.



#### **Solution Deployment**

Follow the series of steps to complete the deployment of this solution:

To perform the installation, complete the following steps:

- 1. Log in to the VMC Console at vmc.vmware.com and access Inventory.
- 2. To select the appropriate SDDC and access Add- ons, click View Details on SDDC and select the Add Ons tab.
- 3. Click Activate for VMware HCX.



This step takes up to 25 minutes to complete.



- 4. After the deployment is complete, validate the deployment by confirming that HCX Manager and its associated plug-ins are available in vCenter Console.
- 5. Create the appropriate Management Gateway firewalls to open the ports necessary to access HCX Cloud Manager.HCX Cloud Manager is now ready for HCX operations.

For the on-premises Connector to communicate with the HCX Manager in VMC, make sure that the appropriate firewall ports are open in the on-premises environment.

- 1. From the VMC Console, navigate to the HCX Dashboard, go to Administration, and select the Systems Update tab. Click Request a Download Link for the HCX Connector OVA image.
- 2. With the HCX Connector downloaded, deploy the OVA in the on-premises vCenter Server. Right- click vSphere Cluster and select the Deploy OVF Template option.

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- 3. Enter the required information in the Deploy OVF Template wizard, click Next and then Finish to deploy the VMware HCX Connector OVA.
- 4. Power on the virtual appliance manually.For step- by- step instructions, go to VMware HCX User Guide.

After you deploy the VMware HCX Connector OVA on-premises and start the appliance, complete the following steps to activate HCX Connector. Generate the license key from the VMware HCX Console at VMC and input the license during the VMware HCX Connector setup.

- 1. From the VMware Cloud Console, go to Inventory, select the SDDC, and click View Details. From the Add Ons tab, in the VMware HCX tile, click Open HCX.
- 2. From the Activation Keys tab, click Create Activation Key. Select the System Type as HCX Connector and click Confirm to generate the key. Copy the activation key.

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A separate key is required for each HCX Connector deployed on-premises.

3. Log in to the on-premises VMware HCX Connector at "https://hcxconnectorIP:9443" using administrator credentials.



Use the password defined during the OVA deployment.

4. In the Licensing section, enter the activation key copied from step 2 and click Activate.



The on-premises HCX Connector must have internet access for the activation to complete successfully.

- 5. Under Datacenter Location, provide the desired location for installing the VMware HCX Manager onpremises. Click Continue.
- 6. Under System Name, update the name and click Continue.
- 7. Select Yes and then Continue.
- 8. Under Connect Your vCenter, provide the IP address or fully qualified domain name (FQDN) and the credentials for the vCenter Server and click Continue.



Use the FQDN to avoid communication issues later.

9. Under Configure SSO/PSC, provide the Platform Services Controller's FQDN or IP address and click Continue.



Enter the vCenter Server's IP address or FQDN.

- 10. Verify that the information is entered correctly and click Restart.
- 11. After complete, the vCenter Server is displayed as green. Both the vCenter Server and SSO must

have the correct configuration parameters, which should be the same as the previous page.



This process should take approximately 10–20 minutes and for the plug-in to be added to the vCenter Server.

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#### Step 4: Pair on-premises VMware HCX Connector with VMC HCX Cloud Manager

1. To create a site pair between the on-premises vCenter Server and the VMC SDDC, log in to the onpremises vCenter Server and access the HCX vSphere Web Client Plug- in.

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2. Under Infrastructure, click Add a Site Pairing. To authenticate the remote site, enter the VMC HCX Cloud Manager URL or IP address and the credentials for the CloudAdmin role.

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HCX information can be retrieved from the SDDC Settings page.

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3. To initiate the site pairing, click Connect.



VMware HCX Connector must be able to communicate with the HCX Cloud Manager IP over port 443.

4. After the pairing is created, the newly configured site pairing is available on the HCX Dashboard.

The VMware HCX Interconnect (HCX-IX) appliance provides secure tunnel capabilities over the internet and private connections to the target site that enable replication and vMotion-based capabilities. The interconnect provides encryption, traffic engineering, and an SD-WAN. To create the HCI-IX Interconnect Appliance, complete the following steps:

1. Under Infrastructure, select Interconnect > Multi-Site Service Mesh > Compute Profiles > Create Compute Profile.



Compute profiles contain the compute, storage, and network deployment parameters required to deploy an interconnect virtual appliance. They also specify which portion of the VMware data center will be accessible to the HCX service.

For detailed instructions, see Creating a Compute Profile.

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- After the compute profile is created, create the network profile by selecting Multi-Site Service Mesh > Network Profiles > Create Network Profile.
- 3. The network profile defines a range of IP address and networks that will be used by HCX for its virtual appliances.



This will require two or more IP address. These IP addresses will be assigned from the management network to virtual appliances.

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For detailed instructions, see Creating a Network Profile.



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If you are connecting with an SD-WAN over the internet, you have to reserve public IPs under the Networking and Security section.

4. To create a service mesh, select the Service Mesh tab within the Interconnect option and select onpremises and VMC SDDC sites.

The service mesh establishes a local and remote compute and network profile pair.

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Part of this process involves deploying HCX appliances that will be automatically configured on both the source and target sites, creating a secure transport fabric.

5. Select the source and remote compute profiles and click Continue.
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|---|--|------------|
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6. Select the service to be activated and click Continue.

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An HCX Enterprise license is required for Replication Assisted vMotion Migration, SRM Integration, and OS Assisted Migration.

7. Create a name for the service mesh and click Finish to begin the creation process. The deployment should take approximately 30 minutes to complete. After the service mesh is configured, the virtual infrastructure and networking required to migrate the workload VMs has been created.

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### Step 6: Migrating Workloads

HCX provides bidirectional migration services between two or more distinct environments such as onpremises and VMC SDDCs. Application workloads can be migrated to and from HCX activated sites using a variety of migration technologies such as HCX bulk migration, HCX vMotion, HCX Cold migration, HCX Replication Assisted vMotion (available with HCX Enterprise edition), and HCX OS Assisted Migration (available with HCX Enterprise edition).

To learn more about available HCX migration technologies, see VMware HCX Migration Types

The HCX-IX appliance uses the Mobility Agent service to perform vMotion, Cold, and Replication Assisted vMotion (RAV) migrations.



The HCX-IX appliance adds the Mobility Agent service as a host object in the vCenter Server. The processor, memory, storage and networking resources displayed on this object do not represent actual consumption on the physical hypervisor hosting the IX appliance.

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### VMware HCX vMotion

This section describes the HCX vMotion mechanism. This migration technology uses the VMware vMotion protocol to migrate a VM to VMC SDDC. The vMotion migration option is used for migrating the VM state of a single VM at a time. There is no service interruption during this migration method.



Network Extension should be in place (for the port group in which the VM is attached) in order to migrate the VM without the need to make an IP address change.

1. From the on-premises vSphere client, go to Inventory, right- click on the VM to be migrated, and select HCX Actions > Migrate to HCX Target Site.

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2. In the Migrate Virtual Machine wizard, select the Remote Site Connection (target VMC SDDC).

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3. Add a group name and under Transfer and Placement, update the mandatory fields (Cluster, Storage, and Destination Network), Click Validate.

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4. After the validation checks are complete, click Go to initiate the migration.



The vMotion transfer captures the VM active memory, its execution state, its IP address, and its MAC address. For more information about the requirements and limitations of HCX vMotion, see Understanding VMware HCX vMotion and Cold Migration.

5. You can monitor the progress and completion of the vMotion from the HCX > Migration dashboard.

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#### VMware Replication Assisted vMotion

As you might have noticed from VMware documentation, VMware HCX Replication Assisted vMotion (RAV) combines the benefits of bulk migration and vMotion. Bulk migration uses vSphere Replication to migrate multiple VMs in parallel—the VM gets rebooted during switchover. HCX vMotion migrates with no downtime, but it is performed serially one VM at a time in a replication group. RAV replicates the VM in parallel and keeps it in sync until the switchover window. During the switchover process, it migrates one VM at a time with no downtime for the VM.

The following screenshot show the migration profile as Replication Assisted vMotion.



The duration of the replication might be longer compared to the vMotion of a small number of VMs. With RAV, only sync the deltas and include the memory contents. The following is a screenshot of the migration status—it shows how the start time of the migration is the same and the end time is different for each VM.

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For additional information about the HCX migration options and on how to migrate workloads from onpremises to VMware Cloud on AWS using HCX, see the VMware HCX User Guide.

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VMware HCX vMotion requires 100Mbps or higher throughput capability.



The target VMC FSx for ONTAP datastore must have sufficient space to accommodate the migration.

# Conclusion

Whether you are targeting all-cloud or hybrid cloud and data residing on any type/vendor storage in onpremises, Amazon FSx for NetApp ONTAP along with HCX provide excellent options to deploy and migrate the workloads while reducing the TCO by making the data requirements seamless to the application layer. Whatever the use case, choose VMC along with FSx for ONTAP datastore 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 used to connect the storage and migrate VMs using VMware vSphere replication, VMware vMotion or even NFC copy.

# **Takeaways**

The key points of this document include:

- You can now use Amazon FSx ONTAP as a datastore with VMC SDDC.
- You can easily migrate data from any on-premises datacenter to VMC running with FSx for ONTAP datastore
- You can easily grow and shrink the FSx ONTAP datastore to meet the capacity and performance requirements during migration activity.

## Where to find additional information

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

VMware Cloud documentation

https://docs.vmware.com/en/VMware-Cloud-on-AWS/

Amazon FSx for NetApp ONTAP documentation

https://docs.aws.amazon.com/fsx/latest/ONTAPGuide

VMware HCX User Guide

 https://docs.vmware.com/en/VMware-HCX/4.4/hcx-user-guide/GUID-BFD7E194-CFE5-4259-B74B-991B26A51758.html

# Region Availability – Supplemental NFS datastore for VMC

Learn more about the the Global Region support for AWS, VMC and FSx ONTAP.



NFS datastore will be available in regions where both services (VMC and FSx ONTAP) are available.

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.
- 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

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