

# **Protecting Workloads on AWS / VMC**

**NetApp Solutions** 

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# **Protecting Workloads on AWS / VMC**

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

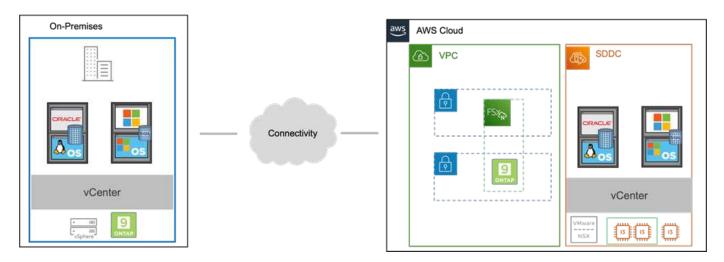
A proven disaster recovery (DR) environment and plan is critical for organizations to ensure that business-critical applications can be rapidly restored in the event of a major outage. This solution focuses on demonstrating DR use cases with a focus on VMware and NetApp technologies, both on-premises 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 ONTAP – ONTAP User Guide for more information on creating SnapMirror relationships with FSx.

#### Record the source and destination Intercluster logical interfaces

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	45-2002 (0.45 (0.4										
Quotas	Network Interfaces	Portsets									
Storage VMs	+ Add								Q Search 🔮 D	ownload ♥ Filter	ulida na
Tiers	and the second s									densional in the sound th	
NETWORK A	Name	Status	Storage VM	IPspace	Address 0	Current Node	Current Port	Portset	Protocols	Туре	Th
Overview	veeam_/repo	0	Backup	Default	10.61.181.179	E13A300_1	a0a-181		SMB/CIFS, NFS, S3	Data	
Ethernet Ports	CM01	0		Default	10.61.181.180	E13A300_1	202-181			Cluster/Node Mgmt	
FC Ports											-
EVENTS & JOBS	HC_NS	0		Default	10.61.181.183	E13A300_1	a0a-181			Intercluster,Cluster/Node Mgmt	
PROTECTION	HC_N2	0		Default	10.61.181.184	E13A300_2	181-600			Intercluster, Cluster/Node Mgmt	
HOSTS Y	lif_ora_sym_614	0	ora_tvm	Default	10.61.181.185	E13A300_1	a0a-181		SMB/CIFS, NFS, FL	Data	

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

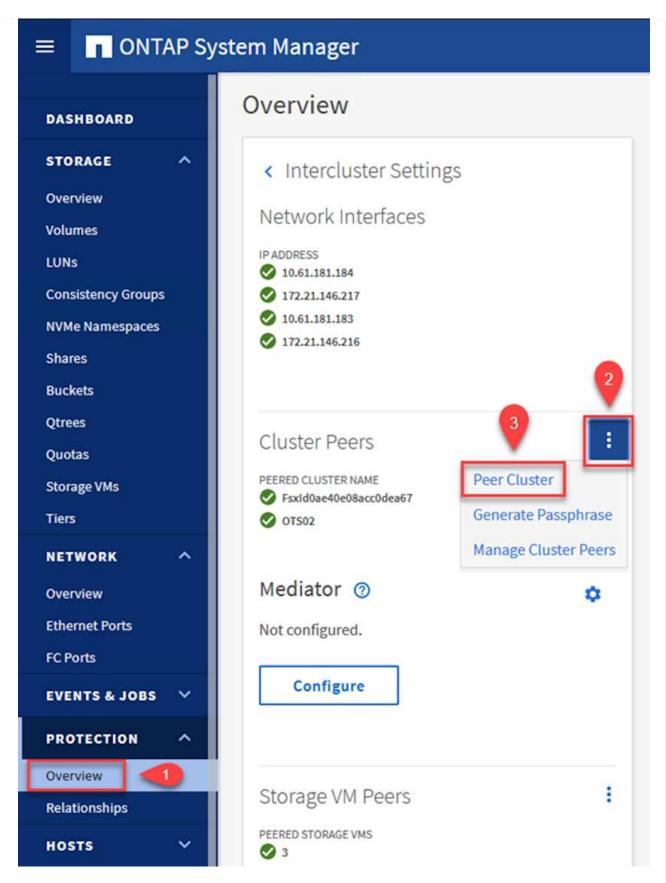
	Logical	Status	Network	Current	Current	Is
Vserver	Interface	Admin/Oper	Address/Mask	Node	Port	Home
sxId0ae4	e08acc0dea67					
	inter_1	up/up	172.30.15.42/25	FsxId0ae40e08	acc0dea6	7-01
					e0e	true
	inter_2	up/up	172.30.14.28/26	FsxId0ae40e08	acc0dea67	7-02
					e0e	true

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.

Peer Cluster

Local	• Remo
STORAGE VM PERMISSIONS	PASSPHRASE ⑦
All storage VMs (incl ×	
torage VMs created in the future also will be given ermissions.	2 Yes No
	To generate passphrase, Launch Remote Cluster
	Intercluster Network Interfaces IP Addresses
	3 172.30.15.42
	172.30.14.28
	Cancel
	+ Add

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

FSx-Dest::> cluster p	eer show		
FsxIdOae40e08accOdea67::> 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.

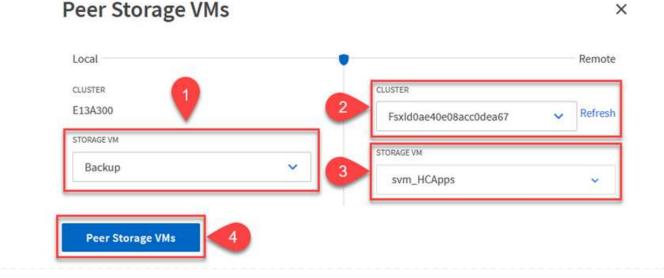
1. From the source FSx cluster, use the following command from the CLI to create the SVM peer relationship:

```
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 ()

Update SnapMirror after creating a local Snapshot copy.

✓ Update SnapVault after creating a local Snapshot copy.

Secondary policy label	Custom Label 🔹	0
	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 SnapCo	enter®	D			<b>≅ 0</b> -	👤 scadmin 🛛 SnapC	CenterAdmin 🛛 🖡 Sign C
<		ONTAI	P Storage					
	Dashboard	Туре	ONTAP SVMs	• Search	n by Name			+ II New Date
2	Resources	ONTA	AP Storage Connectio	ns				
•	Monitor		Name 41	IP	Cluster Name	User Nan	ne Platform	Controller Licens
<b>a</b> 1	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	
1	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	~
	and the second s		sal sym_dest		172.30.15.42		AFF	Not applicable
▲	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	•••••
<ul> <li>Send AutoSuppor</li> <li>Log SnapCenter S</li> </ul>	System (EMS) & AutoSupport Settings t notification to storage system erver events to syslog atform, Protocol, Preferred IP etc
Submit Cancel	Reset
at the bottom of the Add Storag	FSx ONTAP system to SnapCenter. In this case, select More Options the System window and click the check box for Secondary to designate ary storage system updated with SnapMirror copies or our primary

Platform	FAS	•	Secondary 🚯	
Protocol	HTTPS	•		
Port	443			
Timeout	60	seconds	0	
Preferred IP				0
Course Conce				
Save Cance	9			

#### 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.

	etApp	• SnapCenter®				
>	Man	aged Hosts				
	Se	arch by Name		Add Host		
<b>I</b>		Name	11	Host Type	Windows	•
•		oraclesry_01.sddc.netapp.com		Host Name	sqlsrv-01.sddc.netapp.com	
1.00		oraclesry_02.sddc.netapp.com		Credentials	sddc-jpowell	+
âÎ		oraclesry_03.sddc.netapp.com			1	
Α.		oraclesry_04.sddc.netapp.com		Select Plug-ins to In	stall SnapCenter Plug-ins Package 4.6 for Windows	
24		oraclesry_05.sddc.netapp.com			Microsoft Windows	
Advanced.		oraclesry_06.sddc.netapp.com			Microsoft SQL Server	
華		oraclesry_07.sddc.netapp.com			Microsoft Exchange Server     SAP HANA	
▲		oraclesry_08.sddc.netapp.com		More Options : P	ort, gMSA, Install Path, Custom Plug-Ins	
		oraclesry_09.sddc.netapp.com				
		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			
			1	
Credentials Select Plug-ins to In:	root       stall SnapCenter Plug-ins Package 4.6 for Linux       Oracle Database	•	+	(
	• Tall SnapCenter Plug-ins Package 4.6 for Linux	•	+	•
Select Plug-ins to In:	stall SnapCenter Plug-ins Package 4.6 for Linux	•	+	

#### **Create SnapCenter policies**

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 Settings section of the SnapCenter web client.

	Dashboard	Microsoft SQL Server			
2	Resources	Search by Name		New	
	Monitor	Name 4	Backup Type	Schedule Type	Replication
		SQL-Daily	Full and Log backup	Daily	SnapVault
Ϋ́]	Reports	SQL-Hourly	Full and Log backup	Hourly	SnapVault
	Hosts	SQL-Hourly-Logs	Log backup	Hourly	SnapVault
-	Storage Systems	SQL-OnDemand	Full and Log backup	On demand	SnapVault
	Settings	SQL-Weekly	Full and Log backup	Weekly	SnapVault

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 FSx ONTAP.

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	ptions 🐧		
2 Backup Type	Update SnapMirror at	fter creating a	a local Snap	shot copy.	
3 Retention	Update SnapVault aft	er creating a	local Snaps	hot copy.	
4 Replication	Secondary policy label	Choose		÷.	0
	Error retry count	з С	0		
5 Script		1.4			

#### 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.

	letApp SnapC	enter®	<b>)</b>		•	<b>⊴ ? 1</b> scad	lmin SnapCenterA	dmin 🛛 🗊 Sign Out
<		Micros	oft SQL Server					-
	Dashboard	View	Resource Group	•	earch by name	V	2	New Resource Gr
0	Resources	19	Name	Resource Count	Tags	Policies	Last Backup	Overall Status
✤	Monitor		SQLSRV-01	1		SQL-Daily SQL-Hourly	05/11/2022	Completed
1	Reports					SQL- OnDemand SQL-Weekly		
h	Hosts		501 501 00				02/20/2022	Failed
1	Storage Systems		SQLSRV-02	1		SQL-Daily SQL-Hourly SQL-	03/28/2022	Failed
=	Settings					OnDemand SQL-Weekly		
	Alerts		SQLSRV-03	1		SQL-Daily	05/11/2022	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.

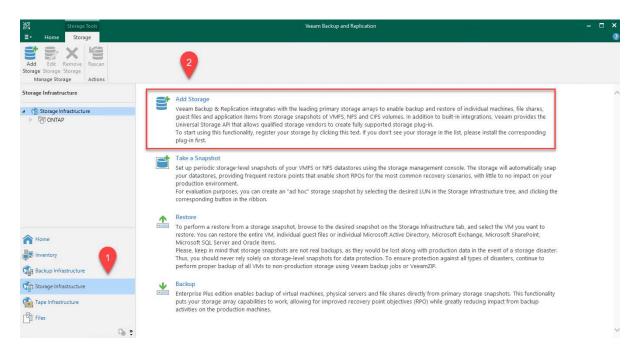
After you deploy and license the software, you can create a scale-out backup repository (SOBR) as target storage for backup jobs. You should also include an S3 bucket as a backup of VM data offsite for disaster recovery.

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.

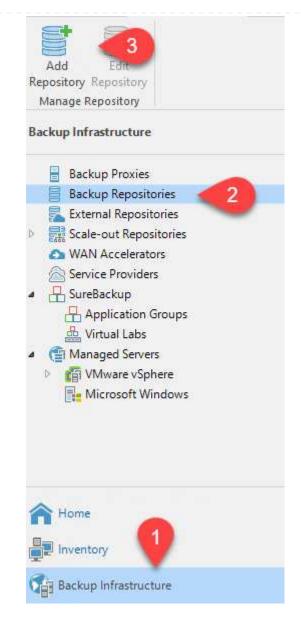
Name	Management server DNS name or IP address:	
Credentials	10.61.181.180	
	Description:	
NAS Filer	Created by SDDC\jpowell at 5/17/2022 10:34 AM.	
Apply		
Summary	Role:	
	<ul> <li>Block or file storage for VMware vSphere</li> <li>Block storage for Microsoft Windows servers</li> <li>✓ NAS filer</li> </ul>	
dd your credenti New NetApp Data ONTA	tials to access the ONTAP cluster.	Cancel
New NetApp Data ONTA	tials to access the ONTAP cluster. AP Storage punt with storage administrator privileges.	Cance
New NetApp Data ONTA Credentials Specify acco	tials to access the ONTAP cluster.	
New NetApp Data ONTA Credentials Specify acco Name	tials to access the ONTAP cluster.	Add
New NetApp Data ONTA Credentials Specify acco Name Credentials	tials to access the ONTAP cluster. AP Storage bunt with storage administrator privileges. Credentials: Manage accounts	
New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer	tials to access the ONTAP cluster.	
New NetApp Data ONTA Credentials Specify acco Name Credentials	tials to access the ONTAP cluster. AP Storage bunt with storage administrator privileges. Credentials: Manage accounts	
New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer	tials to access the ONTAP cluster.	
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New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply	tials to access the ONTAP cluster.	
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New NetApp Data ONTA Credentials Specify acco Name Credentials NAS Filer Apply	tials to access the ONTAP cluster.	

New NetApp Data ONTAP Storag	je	×
NAS Filer Specify how this store	age can be accessed by file backup jobs.	
Name	Protocol to use:	
Credentials	NFS NFS	
NAS Filer	Create required export rules automatically Volumes to scan:	
Apply	All volumes	Choose
Summary	Backup proxies to use:	
	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.

Add Edit Remove Storage Storage Storage	Kescan
Manage Storage	Actions
Storage Infrastructure	
Generation     Storage Infrastructur     Generation     Generation	ire
器 E13A300	
▲ 器 OTS-HC-Clus	ter
▷ 💷 svm_nfs-A	
⊿ 😐 svm0	
iscsi_D	atastore
Sqdb_v	ol2
> aldb_v	ol1
⊳ 🦰 svm0_n	oot

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



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

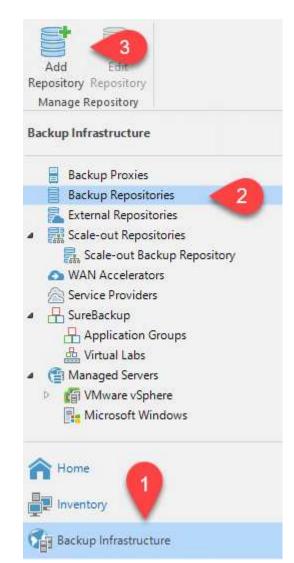
Type in UNC path to share (mapped drives are not supported), specify share access credentials and how backup jobs should write data to this share.

 $\times$ 

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

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.



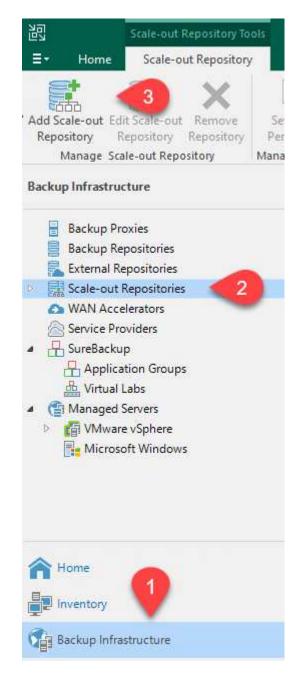
On-prem object storage system or a cloud object storage provider. Object storage can only be used as a Capacity Tier of scale-out backup repositories, backing up directly to object storage is not currently supported.

- 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.

Name	Credentials:	
Account	💦 AKIAX4H43ZT557HXQT2W (last edited: 107 days ago)	~ Add
Bucket	AWS region:	oud accounts
	Global	
	Use the following gateway server:	
	veeam.sddc.netapp.com (Backup server)	
		erver is specified, all scale-

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.

Performance Tier         Select backup repositories to use as the landing zone and for the short-term retention.         Name         Performance Tier         Extents:         Name         Question         Performance Tier	New Scale-out Backup Reposite	ory	×
Performance Tier Add	Performance Tier Select backup repo	sitories to use as the landing zone and for the short-term retention.	
Performance Tier	Name		
Kemov	Performance Tier	BaVBRReno2	
Placement Policy	Placement Policy		(emove

- 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.

	New Scale-out Backup Repositor	у	$\times$
		e to copy backups to for redundancy and DR purposes. Older backups can be moved to object storage long-term retention costs while preserving the ability to restore directly from offloaded backups.	
	Name	Extend scale-out backup repository capacity with object storage:	
	Performance Tier	Amazon S3 Repo V 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 Create additional copy of your backups for added redundancy by having all backups copied t	
	Archive Tier	the capacity tier as soon as they are created on the performance tier.	0
	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 completely while preserving the ability to restore directly from offloaded backups.	y
		Move backup files older than 14 💂 days (your operational restore window) Override	
		Encrypt data uploaded to object storage     Password:	
		< Previous Next > Finish Cancel	
6.	Finally, select Apply an	d Finish to finalize creation of the SOBR.	

#### 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/*.

↔ swagger		
SnapCenter A	PI	
[ Base URL: /api ]		
https://snapcenter.sddc.netapp.com;8146	3/Content/swagger/SnapCenter.yaml	
	sing the SnapCenter API. ion of "SnapCenter Plug-in for VMware vSphere" API's, please use _port}/api/swagger-ui.html	
Expand the Auth section a		
		Ň
Expand the Auth section a	and click Try it Out.	
Auth	and click Try it Out.	eturns a token that is used to

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

TokenNeverExpires		
boolean	Token never expires	
(query)	false v	
UserOperationContext *	user credentials	
object		
(body)	Edit Value Model	
	<pre>{     "UserOperationContext": {         "User": {             "Name": "localhost\\scadmin",             "Passphrase": "MetApp321",             "Rolename": "SnapCenterAdmin"         }     } }</pre>	
		11.
	Cancel	
	Parameter content type	
	application/json v	

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
	"PluginName": null,
	"HostId": 0,
	"RoleId": null,
	"JobIds": null
	- bi
	"User": (
	"Token":
	*KlYxOg==tsV6EDdtdAmAYpe8q5SG6wcoGaSjm4E6jrNy5CsY63HRD5LkoZLIESRNAhpGJJ0UUQynENdgtVGDZnvx+I/ZJZIn5M1NZrj0
	CLfGTApg1GmcagT08bgb5bMTx07EcdrAidzAXUDb3GyLGKtW0GdwKzSeUwKj3uVupnk1E31skK6PRBv9RS8j0gBQvo4v4RL0hhThhwFh
	9/23nFeJVP/p1Ev4vrV/zeZVTUHPH0H069XRe5cuW9nwyj4b015Y5FN3XDkjQ
	"Name": "SCAdmin",
	"TokenHashed": null,
	"Type": "",
	"TokenTime": "2022-03-22T14:21:57.3665661-07:00",
	"Id": "1",
	"FullName": "SCAdmin",
	"Host": null,
	"Author": null,
	"UserName": "",
	"Domain": "", Downl
	"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 Fetch all the existing SnapCenter Server DR Backups. POST /4.6/disasterrecovery/server/backup Starts the SnapCenter Server DR 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 Starts 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.

POST	/4.6/disasterrecovery/server/backup Starts the SnapCenter Server DR backup.
Starts and crea	ates a new SnapCenter Server DR backup.
Parameters	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.

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

# Monitor the backup job from SnapCenter

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.

зпар	Center 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'	
4	Disaster recovery backup of 'sqlsrv-04.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-01.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-05.sddc.netapp.com'	
4	Disaster recovery backup of 'oraclesrv_09.sddc.netapp.com'	
1	Disaster recovery backup of 'sqlsrv-06.sddc.netapp.com'	
~	Disaster recovery backup of 'sqlsrv-07.sddc.netapp.com'	
0 Tas	k Name: SnapCenter Server disaster recovery backup Start Time: 03/23/2022 10:27:11 AM End Time: 03/23/2 7 AM	2022

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

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	Parameters to take for Restore
(body)	Edit Value Model
	<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.

<	Jobs	Schedules	Events Logs
Dashboard	search	by name	
Resources	Jobs - F	ilter	
Monitor	ID	Status	Name
Reports	20482	4	SnapCenter Server Disaster Recovery
	20481	4	SnapCenter Server disaster recovery backup
Hosts	20480	×	SnapCenter Server disaster recovery backup
- Storage Systems	20475	~	Backup of Resource Group 'SQLSRV-09' with policy 'SQL-Hourly'
E Settings	20474	~	Backup of Resource Group 'SQLSRV-05' with policy 'SQL-Hourly'
	20473	2	Backup of Resource Group 'OracleSrv_06' with policy 'Oracle-Hourly'
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.

Name	Description
Token * required string	User authorization token
(header)	KIYxOg==rMXzS7EPIGRzTXjfton6Q+JoNGpueQt
SmSetDisasterRecoverySettingsRequest * required object	Parameters to enable or disable the DR mode
(body)	Edit Value Model
	<pre>{     "EnableDisasterRecovery": true }</pre>
(i) See comments regarding additi	onal procedures.

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.

	ackup Repository type of backup repository you want to add.	
	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 Capacit Tier of scale-out backup repositories, backing up directly to object storage is not currently supported.	ty

2. Select Amazon S3 as the Object Storage type.

	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.
	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.

- Amazon Cloud Storage Services Select the type of Amazon storage you want to use as a backup repository.
   Amazon S3 Adds Amazon S3 storage. Both Standard and Infrequent Access (IA) storage classes are supported.
   Amazon S3 Glacier Adds Amazon S3 Glacier storage. Both Amazon S3 Glacier and Glacier Deep Archive are supported.
   AWS Snowball Edge Adds AWS Snowball Edge appliance to enable seeding of backups into Amazon S3 object storage.
- 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.

×

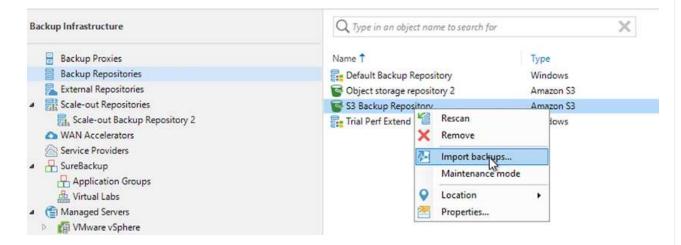
Specify AWS	account to use for connecting to Amazon S3 storage bucket.
Name	Credentials:
Account	🖗 AKIAX4H43ZT53YJXPY2Y (last edited: 33 days ago) 🗸 Add
ucket	Manage cloud accounts AWS region:
	Global
	Use the following gateway server:
	Use the following gateway server: EC2AMAZ-3POTKQV (Backup server)

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

Name	Data center:	
	US East (N. Virginia)	
Account	Bucket:	
Bucket	ehcveeamrepo	Browse
Summary	Folder:	
Summary	RTP	Browse
	<ul> <li>Limit object storage consumption to: 10 Construction TB</li> <li>This is a soft limit to help control your object storage spend. If the specified already running backup offload tasks will be allowed to complete, but no n</li> <li>Make recent backups immutable for: 30 Construction days</li> <li>Protects backups from modification or deletion by ransomware, hackers or</li> </ul>	ew tasks will be started

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.

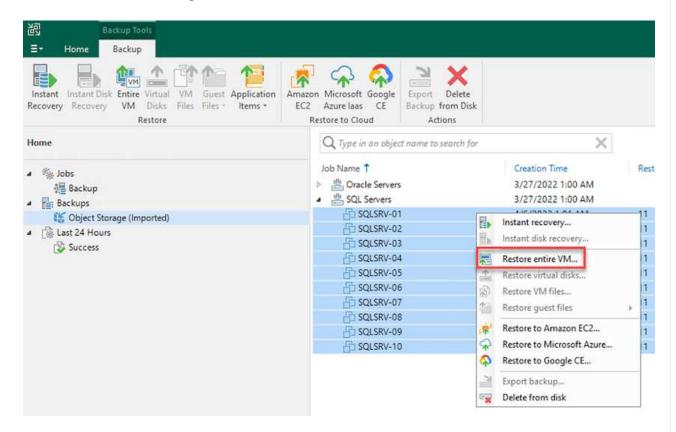
Import Backups Import Please wait v	vhile we're preparing object storage repository.	×
Import	Message Starting infrastructure item update process	Duration 0:00:16
Summary	Creating database records for repository	0:00:04
	< Previous Ne	xt > Finish Cancel

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:	and an end of the second s	
og				
Message				Duration
💙 Starting I	packup repositories synchronization			
C Enumera	ting repositories			
💙 Found 1	repository			
🕑 Processir	ng capacity tier extent of S3 Backup Repo	ository 2		0:03:23
🕑 S3 Backu	p Repository: added 2 unencrypted			0:03:20
🕑 Importin	g backup 2 out of 2			0:03:15
🕑 Backup r	epositories synchronization completed s	successfully		
				Close

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.



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

/irtual Machines	Virtual machines to restor	511		
Restore Mode	Name		Restore point	Add
ummary	SQLSRV-04	62.7 GB	less than a day ago (1:03 AM	Point
				Remove

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.

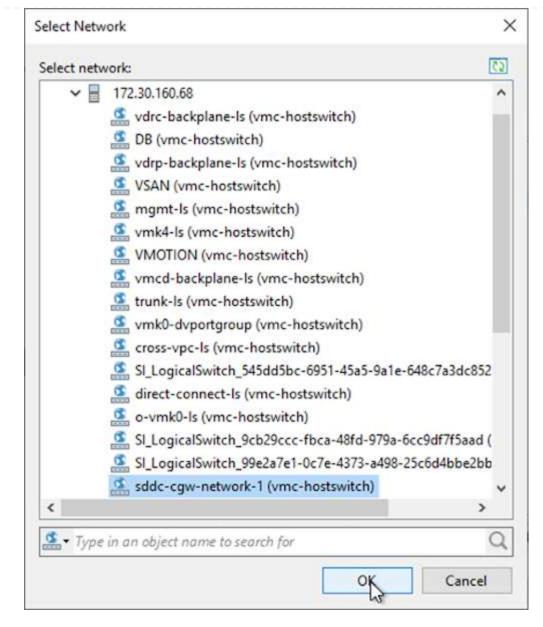
Host			
By default, origin Host. Use multi-s Virtual Machines Restore Mode	<ul> <li>✓ (☐ Hosts</li> <li>✓ (☐ vcenter.sddc-35-171-99-106.vmwarevmc.com</li> <li>✓ (☐ SDDC-Datacenter</li> <li>☐ 172.30.161.4</li> </ul>	(3)	ting desired VM and clickir
Host	> 暗 Cluster-1		əst or cluster
Resource Pool			
Datastore			
Folder			
Network			
Secure Restore			
Summary			
	Type in an object name to search for	Q	Host
	OK	Cancel	Finish 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 Generation SQLSRV-04	Size	Datastore	Disk type
Host	Configuration files		WorkloadDatastore (VM	
1051	Hard disk 1 (SQLSR	100 GB	WorkloadDatastore (VM	Same as source
Resource Pool				
Datastore				
Folder				
Vetwork				
ecure Restore				
ummary				
	Select multiple VMs to apply sett	tings in hulk	D	atastore Disk Type.

# 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	Not connected	
Host	Management 181 (DSwitch) Bata - A - 3374 (DSwitch)	Not connected	
Resource Pool	Data - B - 3375 (DSwitch)	Not connected	
Datastore			
Folder			
Network			
Secure Restore			
Summary			



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	NFS IP address
svm-045c077375d3d9799.fs-0ae40e08acc0dea67.fsx.us-east-1.amazonaws.com	198.19.254.53
iSCSI DNS name	iSCSI IP addresses
iscsi.svm-045c077375d3d9799.fs-0ae40e08acc0dea67.fsx.us-east-1.amazonaws.com 日	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.

CSI Init	iator Proper	ties			
Targets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration
	t portals system will lo	ok for Targets on fo	blowing portals:		Refresh
Addr	ress	Port	Adapter	I	P address
To ac	dd a target p	ortal, <mark>click</mark> Discover	Portal.	Disco	over Portal
	moure a tare	et portal, select the	address above and		Remove

Discover Target Portal	
Enter the IP address or DNS nan want to add.	ne and port number of the portal you
	f the discovery of the trends parts of the
To change the default settings o the Advanced button.	The discovery of the target portal, dick
	Port: (Default is 3260.)

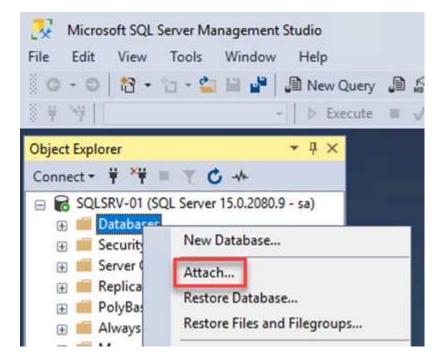
5. On the Target tab, click Connect, select Enable Multi-Path if appropriate for your configuration and then click OK to connect to the target.

argets	Discovery	Favorite Targets	Volumes and Devices	RADIUS	Configuration	
	Connect					
		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
Discov	ered targets					
					Refresh	
Name				Status		1
		netapp:sn.5918b03	3f9ef411ecb007495	1922		
					1	
					1	
		dvanced options, s	elect a target and then		1 Connect	7
	nect using a onnect.	dvanced options, se	elect a target and then		1 Connect	]
dick Co	onnect.		elect a target and then		1	
dick Co			elect a target and then		1 Connect	]
th Co	onnect.		elect a target and then		1	
dick Co th Fc Ta se	onnect. onnect To Ta arget name:	arget	elect a target and then 9ef411ecb0074956fb75	f45c:vs.6	1	
dick Co th Fc Ta Se 19 Fc	onnect. onnect To Ta arget name: 2-08.com.ne	arget tapp:sn.5918b03f9	9ef411ecb0074956fb75	f45c:vs.6	1	
dick Co th Fc Ta Se 19 Fc	onnect. onnect To Ta arget name: 2-08.com.ne Add this con	arget tapp:sn.5918b03f9	9ef411ecb0074956fb75 f Favorite Targets.		1	
dick Co th Fc Ta Se 19 Fc	onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak	arget tapp:sn.5918b03f9	9ef411ecb0074956fb75 If Favorite Targets. natically attempt to rest		1	
dick Cr Tc Cc th Cc Fc Ta Se 19 Fc 19 th	onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e	arget tapp:sn.5918b03f9 nection to the list o the system auton every time this comp	9ef411ecb0074956fb75 If Favorite Targets. natically attempt to rest		1	
dick Cr Tc Cc th Cc Fc Ta Se 19 Fc 19 th	onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak	arget tapp:sn.5918b03f9 nection to the list o the system auton every time this comp	9ef411ecb0074956fb75 If Favorite Targets. natically attempt to rest		1	
dick Cr Tc Cc th Cc Fc Ta Se 19 Fc Ta Se 19 Fc Ta Se 19 Fc Ta	onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e Enable multi	arget tapp:sn.5918b03f9 nection to the list o the system auton every time this comp	Pef411ecb0074956fb75 of Favorite Targets. natically attempt to rest puter restarts.	ore the	×	
dick Cr Tc Cc th Cc Fc Ta Se 19 Fc Ta Se 19 Fc Ta Se 19 Fc Ta	onnect. onnect To Ta arget name: 2-08.com.ne Add this con This will mak connection e	arget tapp:sn.5918b03f9 nection to the list o the system auton every time this comp	9ef411ecb0074956fb75 If Favorite Targets. natically attempt to rest	ore the	1	

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	
CD-ROM	Help	2011 L

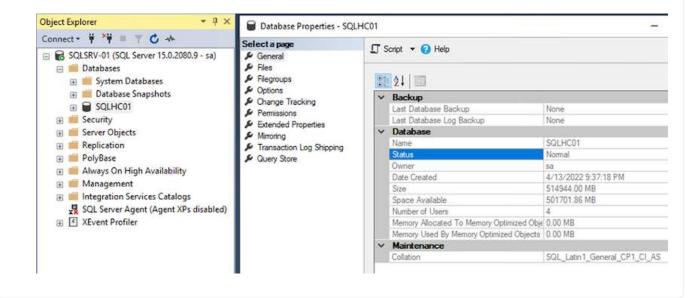
1. From the SQL Server VM, open Microsoft SQL Server Management Studio and select Attach to start the process of connecting to the database.



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	MSSQL15.MSSQLSERV	EF 🖒		R
C: C: SRECYCLE.BIN SRECYCLE.BIN MSSQL 2019 MSSQL 15.MSS MSSQL DATA System Volume Infor F:		SQLHC01_01.mdf			
File name: SQL	HC01_01.mdf		Database Data	Files(*.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.

NetApp SnapCenter®							
<		Global Settings Policies Users and Access					
	Dashboard						
0	Resources	Global Settings					
•	Monitor						
<b>m</b>	Reports	Hypervisor Settings 🚯					
A	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 FSx ONTAP 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
                      aggrl
                                  online
                                             DP
                                                       100GB
                                                               93.12GB
                                                                          68
ora svm dest
         oraclesrv 03 u02 dest
                                             DP
                                                       200GB
                                                               34.98GB
                                                                         82%
                      aggrl
                                  online
ora svm dest
         oraclesrv 03 u03 dest
                                             DP
                                                       150GB
                                                               33.37GB
                                                                         778
                      aggrl
                                  online
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 o	your data to lower-cos	t capacity pool st	orage.
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 Volumes Volume Name ÷	State ÷	Storage VM 💠	Disk Type
	oraclesrv_02_ u02_dest	• Online	ora_svm_dest	SSD
	oraclesrv_02_ u03_dest	• Online	ora_svm_dest	SSD
	oraclesrv_03_ u01_dest	• 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.

scount 🗸	Information mc	onn
	Edit	
	Clone	
	Restore from Snapshot copy	r.
	Create a Snapshot copy	8
Capacity Pool U	Mount Command	
0 B	Change Tiering Policy	
0 B	Delete	
	Snapshot	
	Mount Volume NFS oraclesrv_03_u01_dest	
Go to your linux m	achine and enter this mount command	
Mount Command		
mount 198 19 2	54.180:/oraclesrv_03_u01_dest <dest_d< td=""><td>i 🗇 Cop</td></dest_d<>	i 🗇 Cop

- 3. Mount the NFS file system to the Oracle Linux Server. The directories for mounting the NFS share already exist on the Oracle Linux host.
- 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 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 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 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 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 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 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 ONTAP as a backup repository.
- Backup and restore of Microsoft SQL Server application data using FSx ONTAP as a backup repository.
- Backup and restore of Oracle application data using FSx ONTAP as a backup repository.

# NFS Datastores Using Amazon FSx ONTAP

All virtual machines in this solution reside on FSx ONTAP supplemental NFS datastores. Using FSx 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 ONTAP as a backup repository, and perform restores of SQL Server and Oracle VMs and databases:

- 1. Create the FSx 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 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

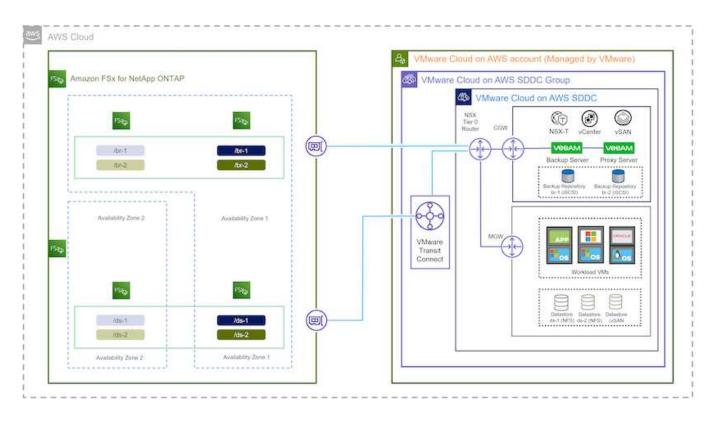
The purpose of this solution is to demonstrate data protection of virtual machines running in VMware Cloud and located on NFS Datastores hosted by FSx ONTAP. This solution assumes the following components are configured and ready for use:

- 1. FSx 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 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 ONTAP NFS datastores.
- 6. Linux and Windows file server VMs with VMDKs residing on FSx 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 ONTAP. This solution assumes the following components are already configured and ready for use:

- Microsoft Windows VM's located on an FSx ONTAP NFS Datastore
- · Linux (CentOS) VM's located on an FSx ONTAP NFS Datastore
- Microsoft SQL Server VM's located on an FSx ONTAP NFS Datastore
  - Two databases hosted on separate VMDK's
- Oracle VM's located on an FSx 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 ONTAP. In addition, a separate FSx ONTAP file system is used to host iSCSI volumes that will be used for Veeam backup repositories.

We will go over FSx 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 ONTAP refer to the FSx 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.

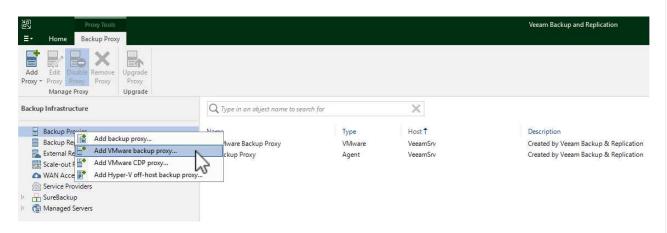
The Veeam Data Mover is a component of the Veeam Proxy Server and utilizes a Transport Mode as a method for obtaining VM data from the source and transferring it to the target. The transport mode is specified during the configuration of the backup job. It is possible to increase the efficiency backups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

Server	Choose server:	
san su	VeeamSrv (Backup server)	Add New
Traffic Rules	Proxy description:	-
Apply Summary	Created by VEEAMSRV\Administrator at 12/22/2022 9:11 PM.	
	Transport mode:	
	Automatic selection	Choose
	Connected datastores:	
	Automatic detection (recommended)	Choose
	Max concurrent tasks:	

- $\circ$  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
redentials	Starting infrastructure item update process	0:00:03
redentials	Collecting hardware info	
eview	Detecting operating system	
	🖉 Detecting OS version	
Apply	🖉 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**.

Choose a se	Transport Mode	× ux servers added to the
Managed Se	Backup proxy transport mode:	lux servers added to the
erver 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>	Choose

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.

X

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

	Select Objects	×	
1	Select objects:	62	er
0	<ul> <li>Center.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	T
	OK	Cancel	Finis

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.

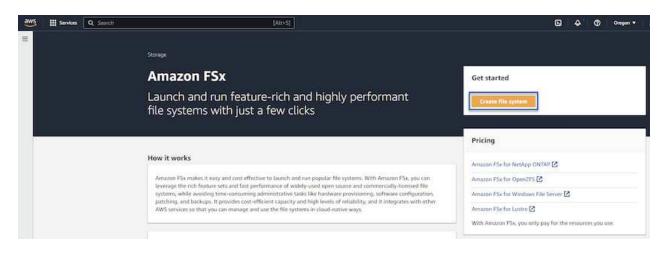
	Throttling is global,	control encryption an with set bandwidth spl	d throttling of lit equally acro	network traffic ba ss all backup prox	ased on the destination. des falling into the rule.
Traffic Rules		ork traffic rules apply to			-
Apply	Name Internet	Encryption Enabled	Throttling Disabled	Time period	West
Summary					
	Manage network tra	ffic 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 ONTAP file system, mounting iSCSI LUNs to the Veeam servers and creating Backup Repositories.

Create an FSx 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

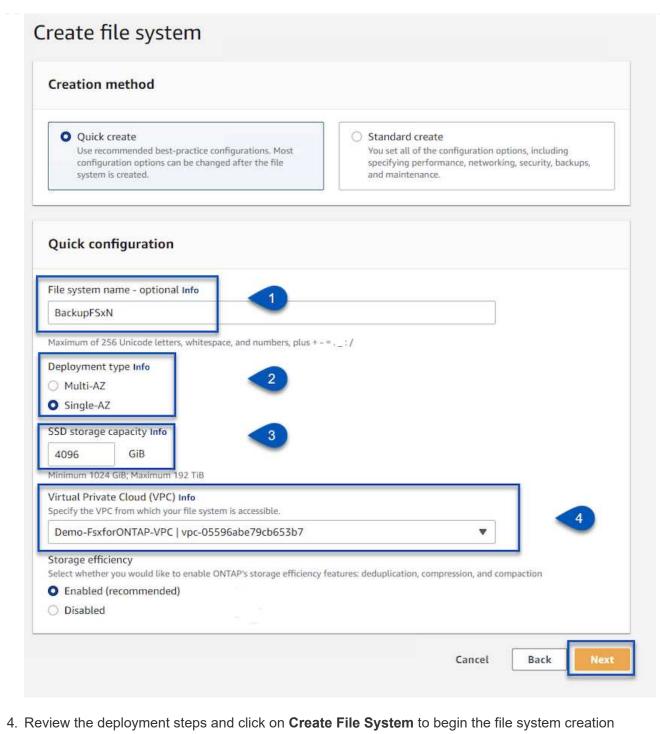


2. Select Amazon FSx ONTAP and then Next to continue.

#### Select file system type

Amazon F5x for NetApp ONTAP	Amazon FSx for OpenZFS	Amazon FSx for Windows File Server	<ul> <li>Amazon FSx for Lustre</li> </ul>
FSXa	FSX <sub>z=</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			
	ure-rich, high-performance, and highly-reliable	storage built on NetApp's popular ONTAP file system an	d fully managed by AWS.
nazon FSx for NetApp ONTAP provides feat		storage built on NetApp's popular ONTAP file system an nning on AWS or on-premises) via industry-standard NF	
nazon F5x for NetApp ONTAP provides feat Broadly accessible from Linux, Windows, a Provides ONTAP's popular data manageme	nd macOS compute instances and containers (ru int capabilities like Snapshots, SnapMirror (for d	nning on AWS or on-premises) via industry-standard NF ata replication), FlexClone (for data cloning), and data c	S, SMB, and iSCSI protocols.
nazon F5x for NetApp ONTAP provides feat Broadly accessible from Linux, Windows, a Provides ONTAP's popular data managem Delivers hundreds of thousands of IOPS w	nd macOS compute instances and containers (nu int capabilities like Snapshots, SnapMirror (for d th consistent sub-millisecond latencies, and up 1	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.	S, SMB, and iSCSI protocols.
Broadly accessible from Linux, Windows, a Provides ONTAP's popular data managem Delivers hundreds of thousands of IOPS w Offers highly-available and highly-durable	nd macOS compute instances and containers (nu ent capabilities like Snapshots, SnapMirror (for d th consistent sub-millisecond latencies, and up i multi-AZ SSD storage with support for cross-re	nning on AWS or on-premises) via industry-standard NF ata replication), FlexClone (for data cloning), and data c	S, SMB, and ISCSI protocols. ompression / deduplication.

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



process.

Create and configure the iSCSI LUNs on FSx 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 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 ONTAP, see the FSx 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 Target Portal	×	nfiguration
inter the IP address or DNS name and port number of the port vant to add. o change the default settings of the discovery of the target po	10/1 1/48	resh
e Advanced button.		Idress
P address or DNS name: Port: (Default is 32	60.)	
10.49.0.154 3260		
Advanced QK	Cancel	Portal
then dick Remove.	Re	nove
iSNS servers		
iSNS servers The system is registered on the following iSNS servers:	Rei	fresh
	Re	fresh
The system is registered on the following iSNS servers:	Re	fresh
The system is registered on the following iSNS servers:		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	Discoverv	Favorite Targets	Volumes and Devices	RADIUS	Configuration	
Quick Co						
To disco	over and log	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	
Name iqn. 19	92-08.com.i	netapp:sn.d9aad3c	d818011edbfcd87a	Status Inactive		
0.625362	92-08.com.i	netapp:sn.d9aad3d	d818011edbfcd87a	8130.445 V		
iqn. 19	nect using a	7. 20	elect a target and then	Inactive	Connect	
To conr dick Co	nect using a	dvanced options, se	elect a target and then	Inactive	Connect Disconnect	
To conr dick Co To comp then dia	nect using a nnect. oletely disco ck Disconner get propertie	dvanced options, se onnect a target, sel	elect a target and then	Inactive		

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.

🗢 🔿 🖄 📰 🔽 📷 🗩 🗹		[1+[	T	Els Cartan	Chatan			
<ul> <li>System Tools</li> <li>Task Scheduler</li> <li>Event Viewer</li> <li>Shared Folders</li> <li>Local Users and Groups</li> <li>Performance</li> <li>Device Manager</li> <li>Storage</li> <li>Windows Server Backup</li> <li>Disk Management</li> <li>Services and Applications</li> </ul>	<	me Wizard on a on this part ther you war ot format this at this volume e system: ocation unit s lume fabel: Perform a qu	tition, yo nt to form volume with th ize:	e following sett NTFS Default Backup_	it first. e, and if so, wha tings: Target	t settings you want to use.	×	hary 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** 



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:			
Server	veeamproxy.demozone.com (Crea	ted by VEEAMSRV\Administrator at 12	/22/2022 9 🗸	Add New
Server	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.

Vame	The following components will be processed on se	rver veeamproxy.demozone.com:
ierver Repository	Component name Transport vPower NFS	Status already exists will be installed
Mount Server	Mount Server	will be installed
bummary	Search the repository for existing backups and in the case of the system index data to the system index data to the case of the system index data to the case of the system index data to the system	

## 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 ac	count w	ith SYSDE	A privileges: 🄇		
🔧 Use	guest OS	creden	tials		~	Add
				Manage	accounts	
Archived	d logs:					
() Do n	ot delete	archive	d logs			
Dele	te logs ol	der thar	n: 24 📑	hours		
O Dele	te logs ov	/er:	10	GB		
🗌 Back	up logs e	every:	15	minutes		
Reta	in log ba	ckups:				
۱ ا	Intil the o	orrespo	nding im	age-level backu	ip is deleted	
OK	leep only	last 1	5 🌻 da	ys of log back	ıba	
Log	shipping	servers;				
Aut	omatic se	election				Choose

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		×	
	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			
	Use monthly full backup from the following month:	January	$\sim$	
				Ve recommend to m d off-site.
-	ove As Default OK	Cance		

#### **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...** 

Backup Tools =- Home Backup			Vec	am Backup and Replication	
Instant Disk Entre Virtual VM Guest Application . Recovery Recovery VM Subs Files Files - Items - Restore	Amazon Microsoft Google EC2 Azue las CE Restore to Cloud				
lome	Q. Type in an object name to search for				
™n Jobs ₩n Backups	Job Name 1 SQL Server Backups	Creation Time 1/10/2023 9:05 PM	Restore Points	Repository Repository - Veeam Server	Platform VMware
Last 24 Hours	instant recovery		2		
	Restore application itemi     Restore to Amazon EC2     Restore to Microsoft Azure     Restore to Google CE	<ul> <li>Microsoft SQL Set</li> </ul>	ver databases		
	Export backup Export backup Delete from disk				

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

Restore Poin Choose the r	nt restore point to restore from.		
Restore Point Reason Summary	VM name: sql_srv_wkld_1 VM size: 43.9 GB O Restore from the latest available backup Restore from this restore point:	Original ho	st; vcenter.sddc-44-235-223-88.vm
	Created	Туре	Backup
	Iess than a day ago (9:44 PM Tuesday Iess than a day ago (9:07 PM Tuesday	Increment Full	SQL Server Backups SQL Server Backups
	< P	revidus N	ext > Browse Cancel

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 S	erver Database Restore
-----------------	------------------------

ore Point	Summary: VM name: sql_srv_wkld_1
imary	Restore point: 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.

à ≣• Home	Databas	e				sql_srv_wk	ld_1 as of less than a day ago (9:07 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SQL Server
Instant Recovery * Instant Recovery Databases	Publish Database •	Restore Database * Resto		Export Backup +	Export	Export Schema *	
SQLSRV-0     SQLSRV-0		A CONTRACTOR OF A CONTRACT	and the second second	000000000000000000000000000000000000000	Name Backu of the stat	: p created:	DATA_01 1/10/2023 9:07 PM /10/2023, 9:07 PM to SQLSRV-01
-	Publish c Restore c Restore s	iatabase 🕨	nstan	t recovery t	Avail	aserver able Restor ailable	e Period
	Export ba	es 🕨			Primar	base Files y database file SQL 2019\MSSG	QL15.MSSQLSERVER\MSSQL\DATA\DATA_01.mdf
					E:\MSS E:\MSS E:\MSS	GQL 2019\MSS( GQL 2019\MSS(	and log files QL15.MSSQLSERVER\MSSQL\LOGS\DATAlog.ldf QL15.MSSQLSERVER\MSSQL\DATA\DATA_02.ndf QL15.MSSQLSERVER\MSSQL\DATA\DATA_03.ndf QL15.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

63

Specify database switchover scheduling options Specify switchover type: Auto Switchover will be performed automatically with minimal possible dowr ready.	
<ul> <li>Auto</li> <li>Switchover will be performed automatically with minimal possible dowr</li> </ul>	
Switchover will be performed automatically with minimal possible dowr	
Switchover will be performed automatically with minimal possible dowr	
	ntime once the database is
() Manual	
Switchover can be performed manually at any point in time after the dat	tahace is ready
switchover can be performed mandally at any point in time after the dat	abase is ready.
O Scheduled at: 1/10/2023 10:16 PM	
x recovery process can be menitored from Vecam Explorer	Cancel
sql_snv_widd_1 as of less than a day ago (0:07 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SC Home Instant Recovery	
eq(_srv_widd_1 as of less than a day ago (3607 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SC	
Home     Instant Recovery       Home     Instant Recovery       Instant Recovery     Instant Recovery       Instant Recovery     Instant Recovery Info	
Home     Instant Recovery       Home     Instant Recovery       Instant Recovery     Instant Recovery       Instant Recovery     Instant Recovery       Instant Recovery     Instant Recovery       Instant Recovery     Status       Status     Status	
None         to(_snr_wkid_1 as of less than a day ago (0:07 PM Tuisidey 1/10/2023) - Veaam Explorer for Microsoft SC           None         Instant Recovery         Instant Recovery Info         Instant Recovery Info           Instant Recovery (1)         Status	
teg(_snr_wkid_1 as of less than a day ago (0:07 PM Tuesday 1/10/2023) - Veeen Explorer for Microsoft SC           Home         Instant Recovery           Switchovery         Testry         Cancel           Instant Recovery (1)         Status         Sarting (restored)-           Status         Status         Status           Default Instance         Datus         U/10/2023 907 PM	
toj, srv, wild 1 as of less than a day age (9:07 PM Tuesday 1/10/2023) - Vesam Explorer for Microsoft SC       Home     Instant Recovery       None     Instant Recovery Info       Instant Recovery (1)     Status       Status     Status       DATA 01     SQL Serven       QUSR-01     Target name:       Default     Target name:       Under status     Unitarit Recovery (1)	
Note:         Instant Recovery           Switchow:         Recovery           Instant Recovery (I)         Status           Data of Council         Status	
teg(jnc,widd,1 ax of less than a day ago (0:07 PM Tuesday 1/10/2023) - Veeen Explorer for Microsoft SC           Word         Instant Recovery           Switchowyr         Retry         Cancel           Instant Recovery         Instant Recovery Info         Sartus           Sartus         Sartus         Sartus           AGA 50         SQLSR-01         SQLSR-01           DATA, 01         Target point in time         Un2023 907 PM           Method and         Sartus         SqLSR-01           DATA, 02         Sartus         SqLSR-01           BATA, 03         Sartus         SqLSR-01           BATA, 01         BATA, 02         Sartus           BATA, 02         Sartus         SqLSR-04	
Home       Instant Recovery         Winder       Instant Recovery Info         Instant Recovery (1)       Status         Add All       Status         Add All       Status         Containt Recovery (1)       Status         Data Recovery (1)       Status         Data Recovery (1)       Status         Data Baccevery (1)       Status         Data Baccevery (1)       Status         Data Baccevery (1)       Status         Data Baccevery (1)       Status         Status       Status         Data Baccevery (1)       Status         Data Baccevery (1)       Status         Status       Status         Status       Status         Status       Status         Data Baccevery (1)       Status         Status       Status         Status       Status         Data Baccevery       Inspective Status         Database Files       Batus         Database Files       Status         Status       Persteret	
tog, un, wild 1 as of less than a day age (9:07 PM Tuesday 1/10/2023) - Veeam Explorer for Microsoft SC         None         Instant Recovery Info         Status         Data, ga         Data, ga         Status         Status         Data, ga         Status         Data, ga         Status         Status         Status	
Instant Recovery           Instant Recovery         Instant Recovery Info           Instant Recovery (1)         Status         Stat	
Instant Recovery         Instant Recovery Info         Status         Instant Recovery Info         Status         Status         Data Recovery Info         Status         Status         Data Recovery Info         Status         Status         Status         Status         Data Recovery Info         Status         Status         Status         Status         Data Recovery Info         Status         Status         Data Recovery Info         Status         Data Recovery Info         Status         Status <td< td=""><td></td></td<>	
None       Instant Recovery         Wind       Instant Recovery Info         Status       Status         Data_01       Target point in time         Database Files       Status         Status       Periotent         Pinnary diatase file       Envisory Status Mark Status Apple (Jointal Data, 01 and Envisory, 2019/MSSQL Status MSSQL Status Apple (Jointal Data, 01 and Envisory, 2019/MSSQL Status MSSQL Status Apple (Jointal Data, 01 and Envisory, 2019/MSSQL Status MSSQL Status Apple (Jointal Data, 0, 01 and Envisory, 2019/MSSQL Status MSSQL Status Apple (Jointal Data, 0, 01 and Envisory, 2019/MSSQL Status MSSQL Status MSSQL Status Apple (Jointal Data, 0, 01 a	X. Serve
Ideal       Instant Recovery         Instant Recovery       Instant Recovery Info         Status       Status         Instant Recovery (1)       Status         Oddault Instance       Status         Data 02       Status         Status       Status         Status       Status         Status       Status         Status       Status         Status       Status         Data 02       Status         Data 02       Status         Data 02       Status         Data 02       Status         Primary Withdus file       Eventory Status 15.MSSCLISENSERIMEMISSCLINDATA_01.mdf         Status       Perioterd         Primary Withdus file       Eventory Status 15.MSSCLISENSERIMEMISSCLINDATA_02.mdf         Eventory Status 2019.MSSCLISENSERIMEMISSCLINDATA_02.mdf         Eventory Status 2019.MSSCLISENSERIMEMISSCLINDATA_02.mdf         Eventory Status 2019.MSSCLISENSERIMEMISSCLINDATA_02.mdf	X Serve
Instant Recovery Info Manne Instant Recovery Info Manne Recovery Info Manne Recovery Info Manne Recovery Info Manne Recovery Info Manne Server Status	

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.

## **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...**.

Backup Tools E Home Backup			Veeam Backup and Replication
Instant Disk Entire Virtual VM Guest Application Instant Disk Files Files * Instance Virtual VM Guest Application Restore	Amazon Microsoft Google EC2 Azure laas CC Restore to Cloud		
lome	Q. Type in an object name to search for	×	
No Jobs	Job Name 1	Creation Time Restore Points	Repository
·종 Jobs 호텔 Backup	▲ 🖉 Oracle Backups	1/20/2023 2:24 PM	Repository - Veeam Serve
Fill Backups	ora_srv_01	1/20/2023 6:00 PM 6	
The Disk	ara_srv_02	1/20/2023 6:02 PM 4	
Last 24 Hours	> SQL Serve	**20/2023 6:01 PM 5	
Success	SQL Serve     Instant recovery     Instant disk recovery	10/2023 9:05 PM	Repository - Veeam Serve
🕅 Warning			
Failed	Restore entire VM		
	Restore virtual disks		
	Restore VM files		
	Restore guest files		
	1 Restore application items	Fa Oracle databases	
	Restore to Amazon EC2	5	
	Restore to Microsoft Azur		
	Restore to Google CE		
	Export backup		
	Delete from disk		

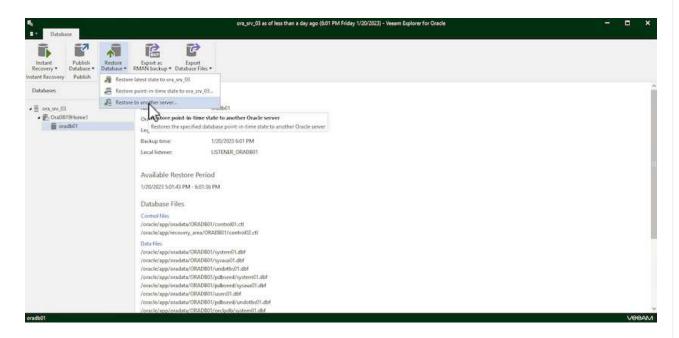
2. In the Oracle Database Restore Wizard select a restore point from the list and click on **Next**.

Restore Point Reason	VM name: ora_srv_03 VM size: 38.5 GB	Original ho	ost: vcenter.sddc-44-235-223-88.vm.
Summary	O Restore from this restore point:		
	Created	Туре	Backup
	Iess than a day ago (6:01 PM Friday 1/ Iess than a day ago (5:01 PM Friday 1/	Increment	Oracle Backups Oracle Backups
	Iss than a day ago (4:02 PM Friday 1/		Oracle Backups
	🕑 less than a day ago (3:47 PM Friday 1/		Oracle Backups
	(5) less than a day ago (2:47 PM Friday 1/	Full	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 res	store point settings, and click Browse to exit the wizard and open Veeam Explorer for Oracle, where you will be abl bases 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)
	1
	< Previous Next > Browse Cancel
	12

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 war	nt to restore the database to:	
Restore to the point in tin	ne of the selected image-level backup	
Restore to a specific point	t in time (requires redo log backups)	
5:01 PM 1/20/2023		6:01 PM 1/20/202
	Friday, January 20, 2023 6:01	PM
Perform restore to th	e specific transaction	
	v major database transactions around t ient in time right before the unwanted	
🤼 To enable this fur	nctionality, 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**.

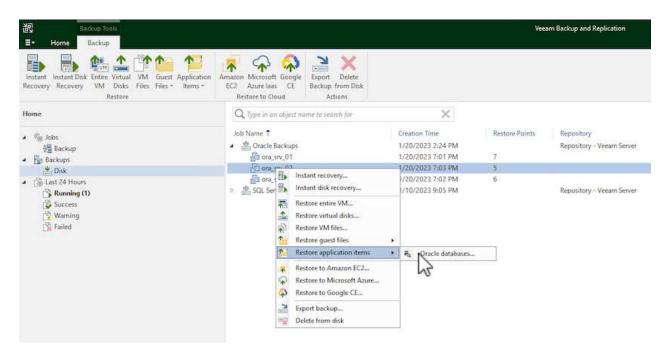
Server:	ora_srv_01	*	SSH port:	22	< >
Account:	oracle			Advan	iced
assword:	[Click here to change the password]				
Private	key is required for this connection		10		
Private	key:			Brow	/5E
Passph	rase:				

Control files	^
/oracle/app/oradata/oradb01/control01.ctl	
/oracle/app/recovery_area/oradb01/control02.ctl	11
Data files	
/oracle/app/oradata/oradb01/system01.dbf	
/oracle/app/oradata/oradb01/sysaux01.dbf	
/oracle/app/oradata/oradb01/undotbs01.dbf	
/oracle/app/oradata/oradb01/pdbseed/system01.dbf	
/oracle/app/oradata/oradb01/pdbseed/sysaux01.dbf	
/oracle/app/oradata/oradb01/users01.dbf	~

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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 VM size: 38.1 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 (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/		Oracle Backups
	Iess than a day ago (4:03 PM Friday 1/ Iess than a day ago (3:49 PM Friday 1/	Increment Full	Oracle Backups Oracle Backups
	C less than a day ago (3.43 PWF hday 1/	run	Unacle 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.
- 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 a RMAN bac	IS	Export Database Files •	
nstant Recovery	Publis	h to another s	erver	Expo	rt	
Databases		1	Datab	ase In	fo	
ora_srv_02			Name:		,	oradb01
OraDB19Home1		Oracle S	SID:		oradb01	
ora 🖉	db01		Log mo	de:		ARCHIVELOG
			Backup	time:		1/20/2023 7:03 PM
			Local lis	tener:	1	LISTENER_ORADB01

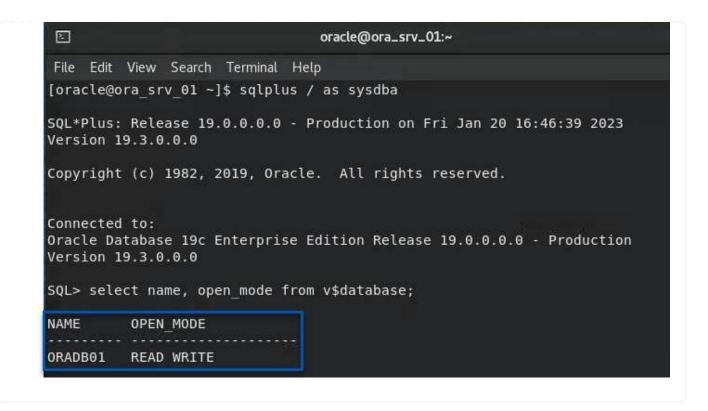
- 5. In the Publish wizard, specify the restore point at which to publish the database from and click **Next**.
- 6. Finally, specify the target linux file system location and click on **Publish** to begin the restore process.

estore to a different lo	ocation:	
)racle Home:	/oracle/app/product/19c	Browse
ilobal Database Name	oradb01.demozone.com	
)racle 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 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 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 ONTAP User Guide
- Veeam Help Center Technical Documentation
- VMware Cloud on AWS Support. Considerations and Limitations

# TR-4955: Disaster Recovery with FSx 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 ONTAP. DRO

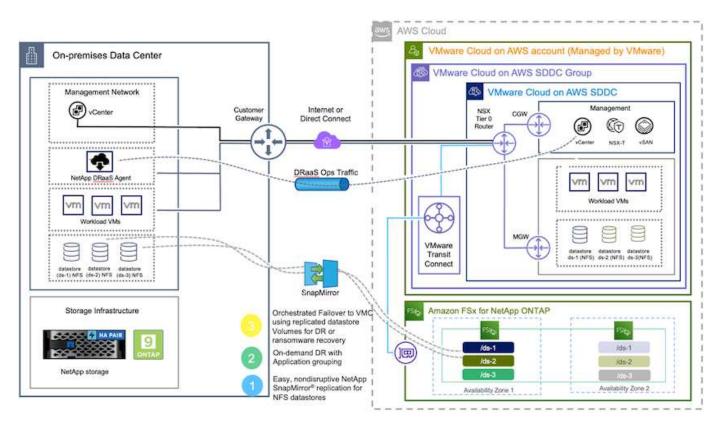
automates the recovery from the SnapMirror level, through VM registration to VMC, to network mappings directly on NSX-T. This feature is included with all VMC environments.

Niyaz Mohamed, NetApp

# 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 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 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 ONTAP

Amazon FSx 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 ONTAP.

## Deploy and configure SnapMirror to FSx ONTAP

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

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+ Add Warking Environment	C Enable Services	(i)
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Azure Blob Storage	Amazon S3	Classification Enable ()
Bioriegie 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.

NetApp     Orchestrator     Apped Instance and RD	FSX <sub>®</sub>
Username .	
Kogin .	

## **DRO** configuration

After FSx 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 ONTAP.

NetApp recommends deploying the DRO agent in AWS and also to the same VPC where FSx 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 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 ONTAP

NetApp Disaster Recovery Orchestrator 🍇 Da	shboard   Discover   Resource Groups   Replication Plans   Job Monitoring	<b>≜</b> ☆• ?• ₽•
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	Source Destination	
	Continue	

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Cloud Destination Cloud 1 1 • 44.235.223.88 ② Success •••		Site Name	≎ Site Type 👳	Location 👳	vCenter 🗘   Storage 🗘	VM List	Discovery Status		l).
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On Prem         Source         On Prem         1         1         View VM List         • 172.21.253.160         Success         •••		On Prem	Source	On Prem	1 1	View VM List	• 172.21.253.160	⊘ Success	

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

Back		VM List Site: On Prem J vCenter: 172.21	1253.160		
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38 vive				٩	Create Resource Group
VM Name	C VM Status	₩ VM State (1)	TotaStore	C CPU	C Memory (MB) C
#300-vcsa02	10 Not Protected	() Powered On	A300_NF5_D504	16	65538
PFSense	0 Not Protected	() Powered On	A300_NFS_DS04	4	8192
		() Powered On	A300_NFS_DS04	4	16384
PFSense260	0 Not Protected				
	Not Protected     Not Protected	() Powered On	A300_NFS_DS04	4	8192
PFSense260		() Powered On () Powered On	A300_NFS_D504	4	8192

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.

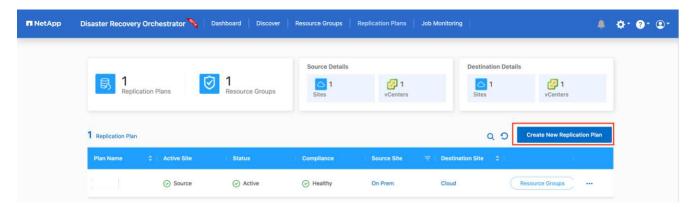
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	Resource Group		1 P	1 3 vCenter Virtu	al Machines
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	Resource Group Name	C   Site Name		😇 💿 VM List	36 - C
	DemoRG1	On Prem	172.21.253.160	View VM List	)

#### **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.



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       •         Recovery Mapping         Source Site       •         Select Source Site       •         Source vCenter       •         Select Source vCenter       •         Select Source vCenter       •         Select Source vCenter       •	Create New Replication Plan	Replication Plan and Site Details     Select Resource	Groups (3) Set Execution Order (4) Set VM D	Details
Recovery Mapping         Source Site       Destination Site         Select Source Site       Select Destination Site         Source vCenter       Destination vCenter		Replication	Plan Details	
Source Site     Destination Site       Select Source Site     Select Destination Site       Source vCenter     Destination vCenter		Plan Name		0
Source Site     Destination Site       Select Source Site     Select Destination Site       Source vCenter     Destination vCenter				
Select Source Site     Select Destination Site       Source vCenter     Destination vCenter		Recovery	/ Mapping	
Source vCenter Destination vCenter				
		Pre-requisite - You must configure SnapMirror relat	ionships between the source site and target site to	×
Pre-requisite - You must configure SnapMirror relationships between the source site and target site to ×		Create successful replication plan		

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

Create New Replication Plan	<ol> <li>Replication Plan and Site Details</li> </ol>	Select Resource	Groups (3) Set Execution Order	(4) Set VM Details	
		Replication	Plan Details		
	Plan Name			0	
	DemoRP				
		Recovery	Mapping		
	Source Site	0	Destination Site	0	
	On Prem	×.	Cloud	Ψ.	
	Source vCenter	0	Destination vCenter	0	
	172.21.253.160	•	44.235.223.88	<b>.</b>	
		Cluster I	Mapping		
	Source Site Resource	O Destination	on Site Resource		
	TempCluster	•	Cluster-1 ~	Add	
	Source Resource	Destination	Resource		
	A300-Cluster01	Cluster-1		Delete	

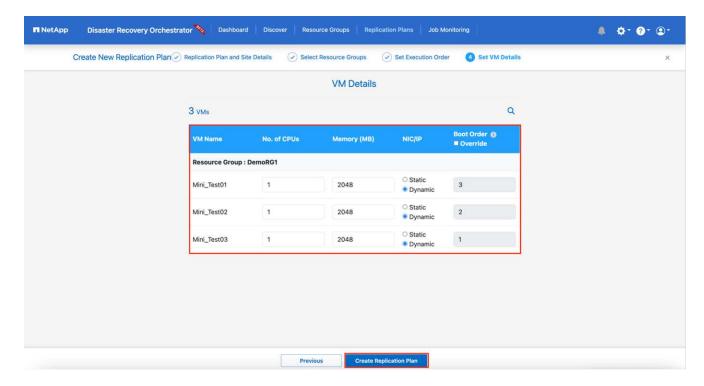
- 4. Select Resource Group Details and click Continue.
- 5. Set the execution order for the resource group. This option enables you to select the sequence of operations when multiple resource groups exist.
- 6. After you are done, select the network mapping to the appropriate segment. The segments should 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.

Create New Replication Plan	Replication Plan and Site Details	Select Resource Groups Set Execution Order (4) Set VM Da	Details
		Replication Plan Details	
		Select Execution Order	
	Resource Group Name	Execution Order 💿	
	DemoRG1	3	
	No more	Network Mapping Source/Destination network resources available for mapping	
	No more	12212/2010/01/2017/2017	
	Source Resource	e Source/Destination network resources available for mapping Destination Resource	
	Contract Contractory Contractory	P Source/Destination network resources available for mapping	
	Source Resource	e Source/Destination network resources available for mapping Destination Resource	
	Source Resource	e Source/Destination network resources available for mapping Destination Resource sddc-cgw-network-1 Delete	

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.



9. Click Create Replication Plan.

			Source Details		Destination Details	
B 2 Replica	ation Plans	7 1 Resource Groups	Sites 1	Centers	Control 1 Sites	Centers
					_	
2 Replication Plans					0.0	Create New Replication Plan
2 Replication Plans	Active Site	Status	Compliance	Source Site	Q O	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**.

n NetApp	Disaster Recovery	Orchestrator 🔌 🛛	Dashboard Discover	Resource Groups	Replication Plans	Job Monitoring		.¢. Ø.	•
	B 2 Replica	ition Plans	1 Resource Groups	Source Details	Centers	Destination 1 Sites	n Details		
	2 Replication Plans	9				٩	Create New Replication	Plan	
	Plan Name	C Active Site	Status	Compliance	Source Site	😇 🛛 Destination Site 😂			
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							Edit Plan Failover		
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	latest snap								
		snapshot ()							
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The replication plan can be monitored in the task menu:

■ NetApp Disaster F	ecovery Orchestrator 💊   Dashboard   Discover   Resource Groups   Replication Plans   Job Monitoring Failover Steps Replication Plan: DemoRP	ļ	♦ ☆· @· @·
~	Breaking SnapMirror relationships (in parallel)	() Success	11.3 Seconds 🕡
~	Mounting volumes and creating datastores (in parallel)	© Success	34.7 Seconds ()
~	Registering VMs (in parallel)	⊘ Success	13.2 Seconds 🕕
~	Powering on VMs in protection group - DemoRG1 - in target	⊘ Success	95.8 Seconds ()
~	Updating replication status	⊘ Success	0.5 Seconds 🕕

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 Reserve Chapter	1 Automor Pie	219	Provented UNA	0 214 Uptiment	
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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**.

	olication Plans	1 Resource Groups	Source Details	Centers		stination Details	2 1 vCenters	
2 Replication P	lans					Q D Cre	ate New Replication Plan	J
Plan Name DemoRP	Active Site     O	Status () Running In Failover M	Compliance	On Prem	고 문 Destination S		rce Groups	
DemoRP	⊘ Source	Active	Healthy	On Prem	Cloud	Resou	Plan Details Reverse Data Sync	
tApp Disaster Recov	ery Orchestrator 🗞	Dashboard Discover	Resource Groups	Replication Plans	Job Monitoring		Failback	¢- @-
tApp Disaster Recov Back	ery Orchestrator 🗞 📔	Dashboard Discover	Resource Groups Reverse Data Replication P	a Sync Steps	Job Monitoring		Failback	¢- 0-

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

			Source Details		Destination Details	5
B 2 Repl	ication Plans	Resource Groups	Sites 1	Centers	Sites 1	Centers
2 Replication Pla	ins				Q 0	Create New Replication Pla
2 Replication Pla	C   Active Site	Status	Compliance	Source Site 👳		Create New Replication Pla
			Compliance	Source Site 👳	Destination Site	Create New Replication Pl

NetApp	Disaster Reco	overy Orchestrator 💊 Dashboard Discover Resource Groups Replication Plans Job Monitoring		≜ \$* <b>@</b> * <b>©</b> *
	Back	Failback Steps Replication Plan: DemoRP		
	~	Powering off VMs in protection group - DemoRG1 - in target	C In progress	- 0
	~	Unregistering VMs in target (in parallel)	✓ Initialized	- ©
	~	Unmounting volumes in target (in parallel)	✓ Initialized	- ©
	~	Breaking reverse SnapMirror relationships (in parallel)	<ul> <li>Initialized</li> </ul>	- ©
	~	Updating VM networks (in parallel)	✓ Initialized	- ©
	~	Powering on VMs in protection group - DemoRG1 - in source	✓ Initialized	- ©
	~	Deleting reverse SnapMirror relationships (in parallel)	<ul> <li>Initialized</li> </ul>	- 0
	~	Resuming SnapMirror relationships to target (in parallel)	✓ Initialized	- 0

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 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.

Plans       Protected       Unprotected         Environments       Immersive View ()         Vorteter Summary       Immersive View ()         Vorteter Summary       Immersive View ()         Image Environments       Image Environments         Image Environments       Image Environments         Vorteter Summary       Image Environments         Image Environments	Plans     Protected       Environments     Immensive View ()       Venter Summary     Immensive View ()       Image: Custers     22       Custers     22       Image: Custers     22       Image: Custers     23       Image: Custers     45	2 Sites	1	8 2	<b>a</b> 219	Protected VMs	0 216	
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Virtual Environments       Storage Environments         vCenter Summary       Image: Clusters         Image: Clusters       Image: Clusters	Virtual Environments Storage Environments     vCenter Summary	Environments		Topology Canvas			Immersive View ()	
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#### 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 ONTAP for Disaster recovery to VMware Cloud on AWS

Amazon FSx ONTAP integration with VMware Cloud on AWS is an AWS-managed 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.

Author: Niyaz Mohamed - NetApp Solutions Engineering

## Overview

For those customers looking to use VMware Cloud on AWS SDDC as the disaster recovery target, FSx 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 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 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**

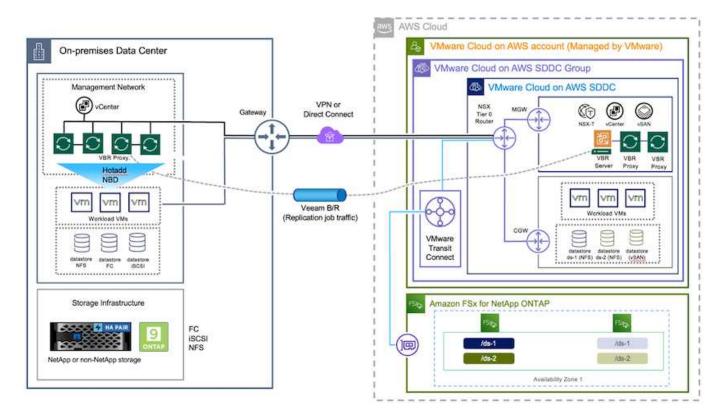
This document describes how to use FSx ONTAP datastore and Veeam Backup and replication to set up disaster recovery for on-premises VMware VMs to VMware Cloud on AWS using the VM replication functionality.

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 ONTAP Deployment Guide to deploy, configure VMware Cloud on AWS SDDC and FSx 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 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 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 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 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		nemme
-countration	TestVeeam23	Virtual Machine	883 MB		
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	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:
	Ener course	10. 11. 1.		v	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 ONTAP datastore for VM replicas. Then Click **Next**.

Choose
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Choose
Choosen

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

Name	Network mapping:		10.7
Virtual Machines	Source network Source network VM_3508 (vDS-Switch0) SVM_3510 (vDS-Switch0)	Target network SepSeg SegmentTemp	Add Edit
Destination Network		segment emp	Remove
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
Network	Automatic selection	Choose
lob Settings	Guest QS credentials:	
Data Transfer		Add
	Manage accounts	
Suest Processing	Customize guest OS credentials for individual machines and operating systems	Credentials
Schedule	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.

記 王・ Home		Veeam Backup and Replication -
Backup Replication COP Job - Job - Policy Pimary Jobs	General	and 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**.

ome	Q Type in an object name	to search for		$\times$		
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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:

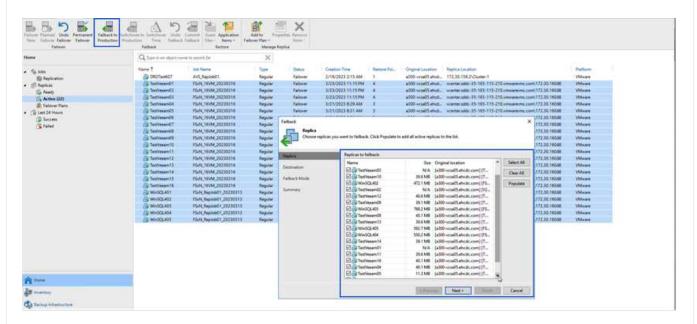
• Failback to production - switch back to the original VM and transfer all changes that took place while the VM replica was running to the original VM.



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 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

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