



TR-4996: Oracle SI Deployment and Protection in VCF with vVols

NetApp database solutions

NetApp
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TR-4996: Oracle SI Deployment and Protection in VCF with vVols

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The solution provides an overview and details for Oracle deployment and protection in VMware Cloud Foundation (VCF) with vSphere Virtual Volumes (vVols) as primary database storage and Oracle database in a single instance (SI) configuration..

Purpose

VMware vSphere Virtual Volumes (vVols) is a SAN/NAS management and integration framework that exposes virtual disks as native storage objects and enables array-based operations at the virtual disk level. In other words, vVols make SAN/NAS devices VM-aware and unlocks the ability to leverage array-based data services with a VM-centric approach at the granularity of a single virtual disk. vVols allows customers to leverage the unique capabilities of their current storage investments and transition without disruption to a simpler and more efficient operational model optimized for virtual environments that work across all storage types.

This documentation demonstrates the deployment and protection of an Oracle single instance database in a VMware Cloud Foundation environment with vVols as primary database storage in a NetApp ONTAP storage cluster. Oracle database is configured as if it is deployed in local file systems on a local storage system. This technical report focuses on steps in creating vVols in VCF for Oracle deployment. We also demonstrate how to use the NetApp SnapCenter UI tool to backup, restore, and clone an Oracle database for dev/test or other use cases for storage-efficient database operation in VCF.

This solution addresses the following use cases:

- Oracle SI database deployment in VCF with vVols datastore on NetApp ONTAP AFF as primary database storage
- Oracle database backup and restore in VCF with vVols datastore using NetApp SnapCenter UI tool
- Oracle database clone for dev/test or other use cases in VCF with vVols datastore using NetApp SnapCenter UI tool

Audience

This solution is intended for the following people:

- A DBA who would like to deploy Oracle in VCF with vVols datastore on NetApp ONTAP AFF as primary database storage
- A database solution architect who would like to test Oracle workloads in VCF with vVols datastore on NetApp ONTAP AFF storage
- A storage administrator who would like to deploy and manage an Oracle database deployed to VCF with vVols datastore on NetApp ONTAP AFF storage
- An application owner who would like to stand up an Oracle database in VCF with vVol datastore

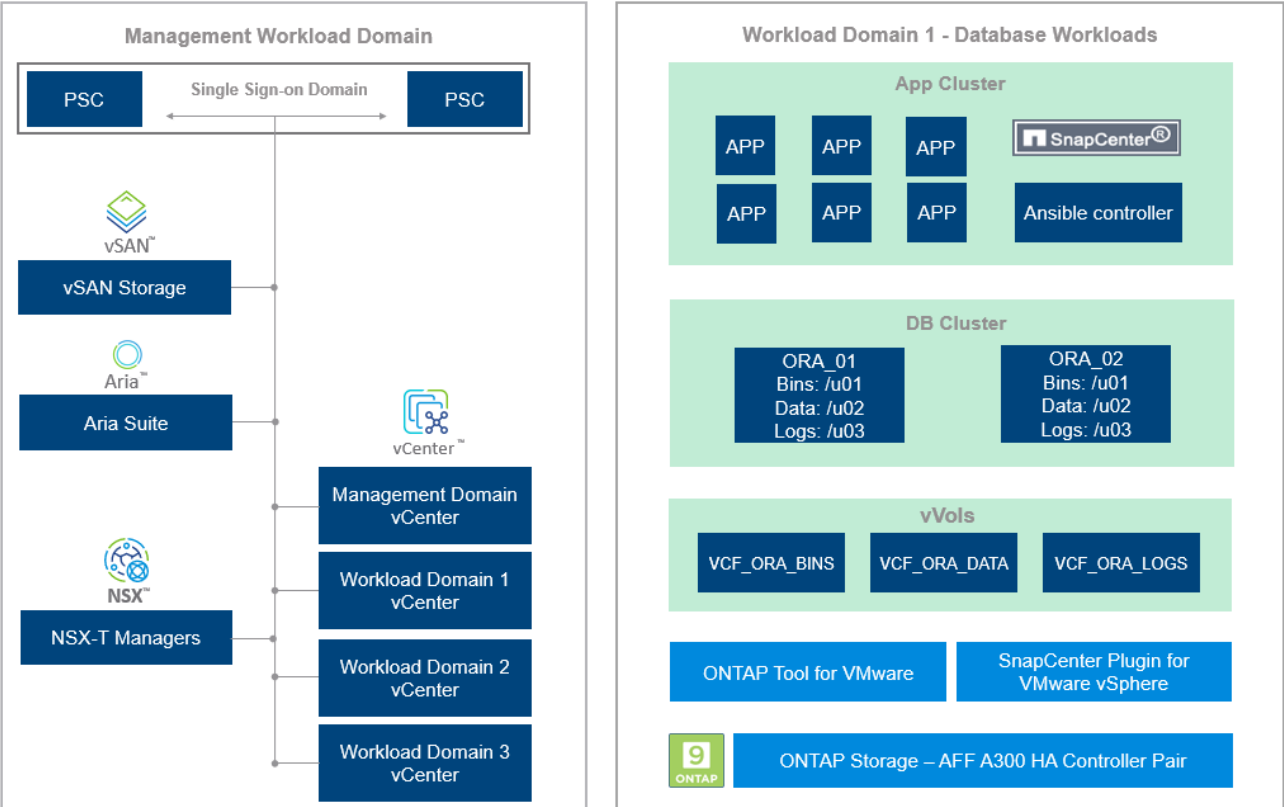
Solution test and validation environment

The testing and validation of this solution was performed in a lab environment with VCF with vVols datastore

on NetApp ONTAP AFF storage that might not match the final deployment environment. For more information, see the section [Key factors for deployment consideration](#).

Architecture

Oracle Single Instance Deployment and Protection in VCF with vVols



NetApp

Hardware and software components

Hardware		
NetApp ONTAP AFF A300	Version 9.14.1P4	DS224 shelf with 24 NVMe disks, total capacity 35.2 TiB
VMware VSphere cluster	Version 8.02	12 CPU(s) x Intel® Xeon® Gold 5218 CPU @ 2.30GHz, 8 nodes (4 management and 4 workload domains)
Software		
RedHat Linux	RHEL-8.6, 4.18.0-372.9.1.el8.x86_64 kernel	Hosting Oracle DB servers, deployed RedHat subscription for testing
Windows Server	2022 Standard, 10.0.20348 Build 20348	Hosting SnapCenter server
Centos Linux	CentOS Linux release 8.5.2111	Hosting Ansible controller

Oracle Database	Version 19.18	Applied RU patch p34765931_190000_Linux-x86-64.zip
Oracle OPatch	Version 12.2.0.1.36	Latest patch p6880880_190000_Linux-x86-64.zip
SnapCenter Server	Version 6.0	Workgroup deployment
SnapCenter Plug-in for VMware vSphere	Version 6.0	Deployed as an ova VM to vSphere cluster
ONTAP tool for VMware vSphere	Version 9.13	Deployed as an ova VM to vSphere cluster
Open JDK	Version java-11-openjdk-11.0.23.0.9-3.el8.x86_64	SnapCenter plugin requirement on DB VMs

Oracle database configuration in VCF

Server	Database	DB Storage
ora_01	NTAP1(NTAP1_pdb1,NTAP1_pdb2 ,NTAP1_pdb3)	vVols datastores on NetApp ONTAP AFF A300
ora_02	NTAP2(NTAP2_pdb1,NTAP2_pdb2 ,NTAP2_pdb3), NTAP1CLN	vVols datastores on NetApp ONTAP AFF A300

Key factors for deployment consideration

- **Protocol for vVols to ONTAP cluster connectivity.** NFS or iSCSI are good choices. The performance levels are equivalent. In this solution demonstration, we used NFS as a storage protocol for vVols connectivity to the underlined ONTAP storage cluster. If VCF infrastructure supports, FC/FCoE, NVMe/FC protocols are also supported for vVols datastores on NetApp ONTAP.
- **Oracle storage layout on vVols datastores.** In our tests and validations, we deployed three vVols datastores for Oracle binary, Oracle data, and Oracle log files. It's good practice to separate different types of Oracle files into their datastore so that database backup, recovery, or clone can be easily managed and executed. Create dedicate vVols for large databases and share vVols for smaller databases or databases with similar QoS profile.
- **Credential for ONTAP storage authentication.** Only use ONTAP cluster-level credentials for the ONTAP storage cluster authentication, including SnapCenter connectivity to the ONTAP storage cluster or ONTAP tool connectivity to the ONTAP storage cluster.
- **Provision storage from vVols datastore to database VM.** Add only one disk at a time to the database VM from the vVols datastore. Adding Multiple disks from vVols datastores at the same time is not supported at this time.
- **Database protection.** NetApp provides a SnapCenter software suite for database backup, restore, and cloning with a user-friendly UI interface. NetApp recommends implementing such a management tool to achieve fast (under a minute) SnapShot backup, quick (minutes) database restore, and database clone.

Solution deployment

The following sections provide step-by-step procedures for Oracle 19c deployment in VCF with vVols datastores on NetApp ONTAP storage in an Oracle single instance configuration.

Prerequisites for deployment

Deployment requires the following prerequisites.

1. A VMware VCF has been setup. For information or instruction on how to create a VCF, please refer to VMware documentation [VMware Cloud Foundation Documentation](#).
2. Provision three Linux VMs, two VMs for Oracle database and one VM for Ansible controller within VCF workload domain. Provision one Windows server VM for running NetApp SnapCenter server. For information on setting up Ansible controller for automated Oracle database deployment, referring to following resources [Getting Started with NetApp solution automation^](#).
3. SnapCenter plugin version 6.0 for VMware vSphere has been deployed in VCF. Refer to following resources for the plugin deployment: [SnapCenter Plug-in for VMware vSphere documentation](#).
4. ONTAP tool for VMware vSphere has been deployed in VCF. Refer to following resources for the ONTAP tool for VMware vSphere deployment: [ONTAP tools for VMware vSphere documentation](#)



Ensure that you have allocated at least 50G in Oracle VM root volume in order to have sufficient space to stage Oracle installation files.

Create storage capability profile

First, create a custom storage capability profile for the underlined ONTAP storage that is hosting the vVols datastore.

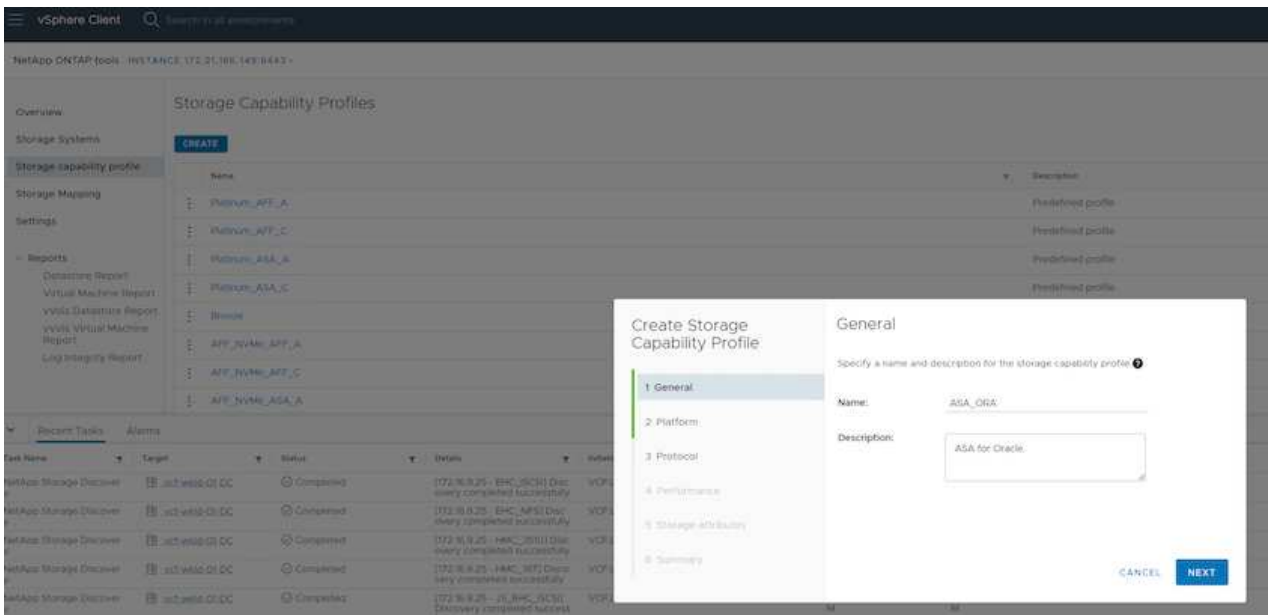
1. From vSphere client shortcuts, open NetApp ONTAP tool. Ensure that ONTAP storage cluster has been added to Storage Systems as part of ONTAP tool deployment.

The screenshot shows the vSphere Client interface. The top navigation bar includes the vSphere Client logo and a search bar. Below the navigation bar, there are several sections: Shortcuts, Inventories, Monitoring, Plugins, and Administration. The Plugins section is highlighted, showing the SnapCenter Plug-in for VMware vSphere and the NetApp ONTAP tools. The Administration section is also visible, showing the Licensing page.

The NetApp ONTAP tools interface is shown below the vSphere Client interface. It includes a header with the vSphere Client logo and a search bar. The main content area displays the Storage Systems table, which lists the storage systems and their details.

Name	Type	IP Address	ONTAP Release	Status	Capacity	NFS VAAI	Supported Protocols
ntapch-4300x9u25	Cluster	172.16.9.25	9.14.1	Normal	43.76%		

2. Click on Storage capability profile to add a custom profile for Oracle. Name the profile and add a brief description.



3. Choose storage controller category: performance, capacity, or hybrid.

Create Storage Capability Profile

- 1 General
- 2 Platform
- 3 Protocol
- 4 Performance
- 5 Storage attributes
- 6 Summary

Platform

Platform: Performance

Asymmetric: ☐

CANCEL

BACK

NEXT

4. Select the protocol.

Create Storage Capability Profile

1 General

2 Platform

3 Protocol

4 Performance

5 Storage attributes

6 Summary

Protocol

Protocol:

Any

CANCEL

BACK

NEXT

5. Define a QoS policy if desired.

Create Storage Capability Profile

1 General

2 Platform

3 Protocol

4 Performance

5 Storage attributes

6 Summary

Performance

☒ None ⓘ

☐ QoS policy group ⓘ

Min IOPS:

Max IOPS:

☐ Unlimited

CANCEL

BACK

NEXT

6. Additional storage attributes for the profile. Be sure that the encryption is enabled on the NetApp controller if you want to have the encryption capability or it may cause issues when applying the profile.

Create Storage Capability Profile

- 1 General
- 2 Platform
- 3 Protocol
- 4 Performance
- 5 Storage attributes
- 6 Summary

Storage attributes

Deduplication:	Yes	▼
Compression:	Yes	▼
Space reserve:	Thin	▼
Encryption:	Yes	▼
Tiering policy (FabricPool):	None	▼

CANCEL

BACK

NEXT

7. Review the summary and finish the storage capability profile creation.

Create Storage Capability Profile

- 1 General
- 2 Platform
- 3 Protocol
- 4 Performance
- 5 Storage attributes
- 6 Summary

Summary

Name:	ASA_ORA
Description:	ASA for Oracle.
Platform:	Performance
Asymmetric:	No
Protocol:	Any
Performance:	None
Space reserve:	Thin
Deduplication:	Yes
Compression:	Yes
Encryption:	Yes
Tiering policy (FabricPool):	None

CANCEL

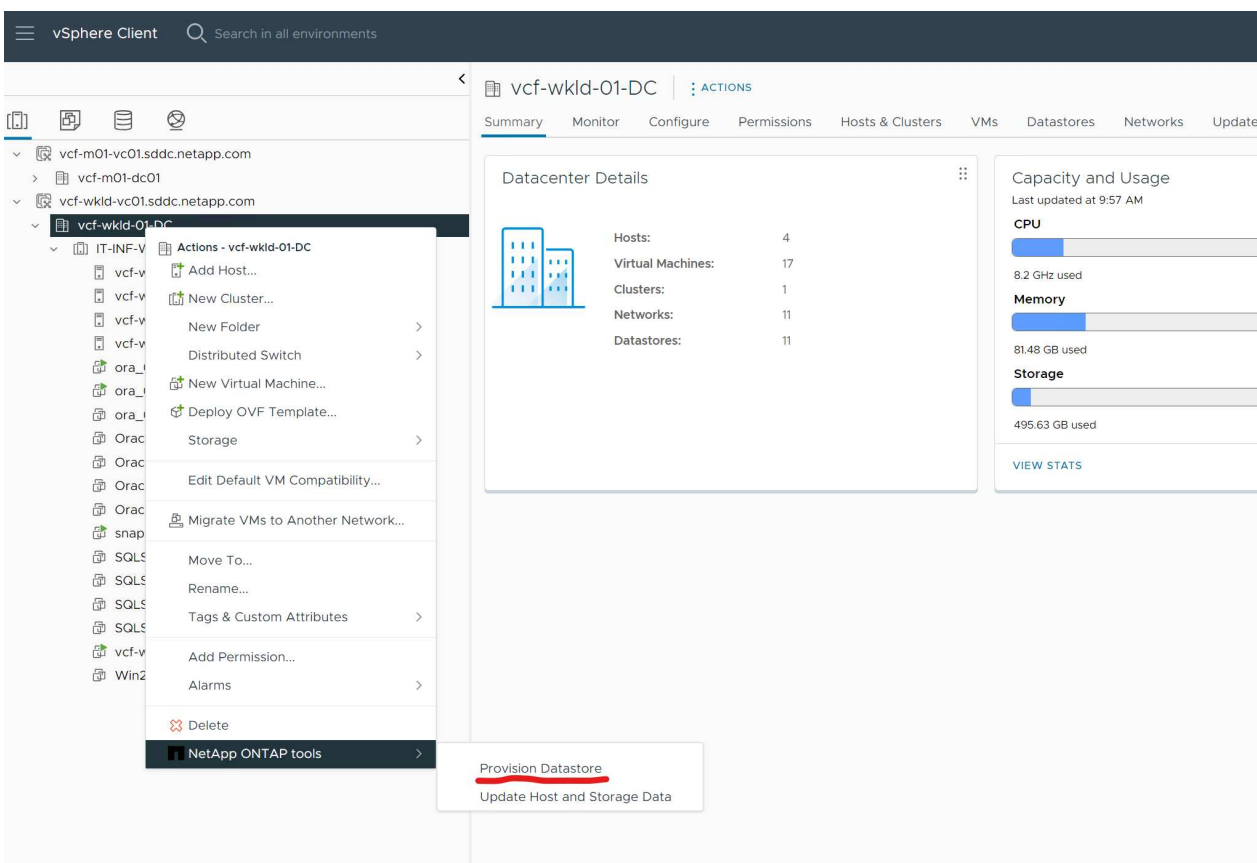
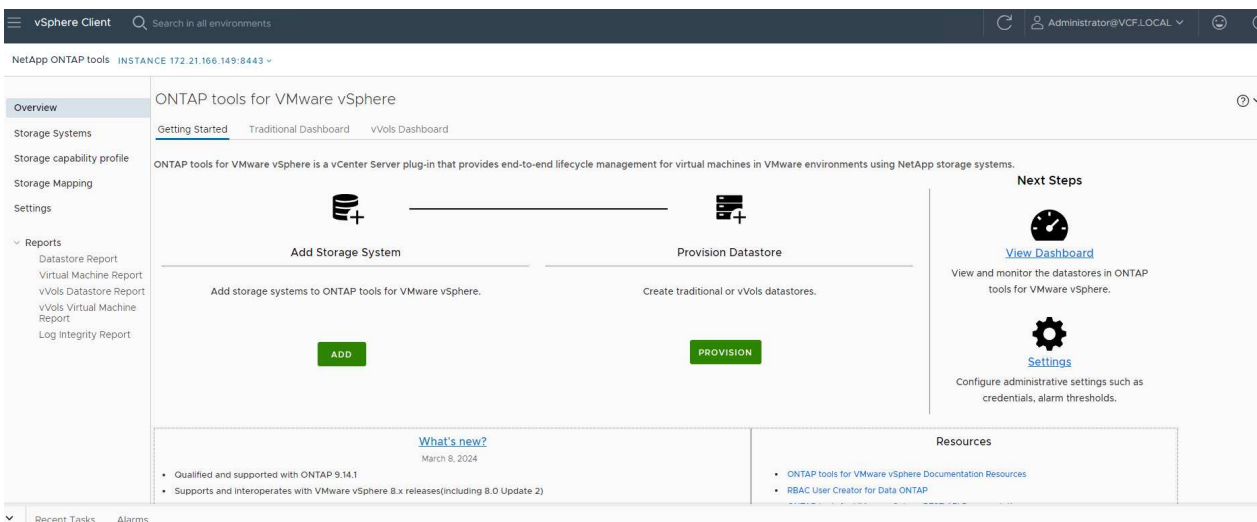
BACK

FINISH

Create and configure vVols datastore

With the prerequisites completed, login to the VCF as an admin user via vSphere client, navigating to workload domain. Do not use built-in VMware storage option to create vVols. Instead, use NetApp ONTAP tool to create vVols. Following demonstrates the procedures to create and configure vVols.

1. The vVols creation workflow can be triggered either from ONTAP tool interface or from VCF workload domain cluster.



2. Filling in general information for datastore including provisioning destination, type, name, and protocol.

New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

General

Specify the details of the datastore to provision.

Provisioning destination: [BROWSE](#)

Type: ☐ NFS ☐ VMFS ☒ vVols

Name:

Description:

Protocol: ☒ NFS ☐ iSCSI ☐ FC / FCoE ☐ NVMe/FC

[CANCEL](#) [NEXT](#)

- Select the custom storage capability profile created from previous step, the Storage system, and Storage VM, where vVols are to be created.

New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

Storage system

Specify the storage capability profiles and the storage system you want to use.

Storage capability profiles:

Storage system:

Storage VM:

[CANCEL](#) [BACK](#) [NEXT](#)

- Choose Create new volumes, fill in the volume name and size and click on ADD then NEXT to move to the summary page.

New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

Storage attributes

Specify the storage details for provisioning the datastore.

Volumes: ☒ Create new volumes ☐ Select volumes

Create new volumes

Name	Size	Storage Capability Profile	Aggregate
 <p>FlexVol volumes are not added.</p>			

Name	Size(GB)	Storage capability profile	Aggregates	Space reserve
vcf_ora_bins	150	ASA_ORA	EHCaggr02 - (17899.73 G	Thin

ADD

CANCEL

BACK

NEXT



You could add more than one volume to a vVols datastore or span a vVols datastore volumes across ONTAP controller nodes for performance.

5. Click **Finish** to create vVols datastore for Oracle binary.

New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

Summary

General

vCenter server:	vcf-wkld-vc01.sddc.netapp.com
Provisioning destination:	vcf-wkld-01-DC
Datastore name:	VCF_ORA_BINS
Datastore type:	vVols
Protocol:	NFS
Storage capability profile:	ASA_ORA

Storage system details

Storage system:	ntaphci-a300e9u25
SVM:	VCN_NFS

Storage attributes

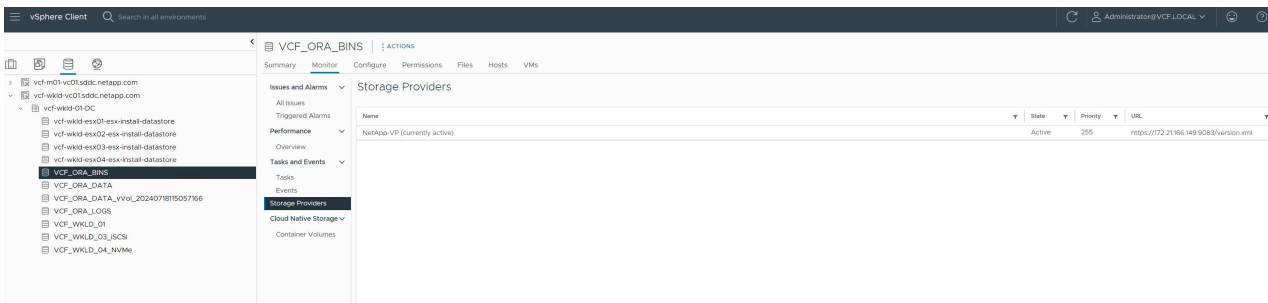
New FlexVol Name	New FlexVol Size	Aggregate	Storage Capability Profile
------------------	------------------	-----------	----------------------------

CANCEL

BACK

FINISH

6. Repeat the same procedures to create vVols datastore for Oracle data and log.



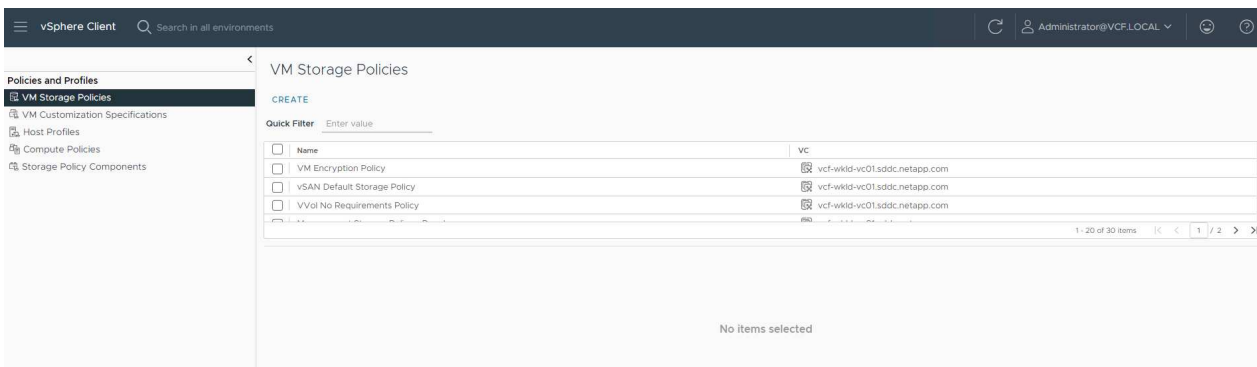


Notice that when an Oracle database is cloned, an additional vVols for Data is added to the vVols list.

Create VM storage policy based on storage capability profile

Before provisioning storage from vVols datastore to database VM, add a VM storage policy based on storage capability profile created from previous step. Following are the procedures.

1. From vSphere client menus, open Policies and Profiles and highlight VM Storage Policies. Click Create to open VM Storage Policies workflow.



2. Name the VM storage policy.

Edit VM Storage Policy

1 Name and description

2 Policy structure

3 NetApp.clustered.Data.ONTAP.VP.vvol rules

4 Storage compatibility

5 Review and finish

Name and description

Name:

vVol_database

Description:

CANCEL

NEXT

3. In Datastore specific rules, check Enable rules for "NetAPP.clustered.Data.ONTAP.VP.vvol" storage

Edit VM Storage Policy

1 Name and description

2 Policy structure

3 NetApp.clustered.Data.ONTAP.VP.vvol rules

4 Storage compatibility

5 Review and finish

Policy structure



Host based services

Create rules for data services provided by hosts. Available data services could include encryption, I/O control, caching, etc. Host based services will be applied in addition to any datastore specific rules.

☐ Enable host based rules

Datastore specific rules

Create rules for a specific storage type to configure data services provided by the datastores. The rules will be applied when VMs are placed on the specific storage type.

☐ Enable rules for "vSAN" storage

☐ Enable rules for "vSANDirect" storage

☐ Enable rules for "VMFS" storage

☒ Enable rules for "NetApp.clustered.Data.ONTAP.VP.vvol" storage

☐ Enable tag based placement rules

Storage topology

Create rules for storage consumption domain topology. The storage topology will be applied to all datastore specific rules.

☐ Enable consumption domain

CANCEL

BACK

NEXT

4. For NetApp.clustered.Data.ONTAP.VP.vvol rules Placement, select the custom storage capacity profile created from the previous step.

Create VM Storage Policy

1 Name and description

2 Policy structure

3 **NetApp.clustered.Data.ONTAP.VP.vvol rules**

4 Storage compatibility

5 Review and finish

NetApp.clustered.Data.ONTAP.VP.vvol rules



Placement Replication Tags

ProfileName ⓘ

ASA_ORA

CANCEL

BACK

NEXT

5. For NetApp.clustered.Data.ONTAP.VP.vvol rules Replication, choose Disabled if vVols are not replicated.

Create VM Storage Policy

1 Name and description

2 Policy structure

3 **NetApp.clustered.Data.ONTAP.VP.vvol rules**

4 Storage compatibility

5 Review and finish

NetApp.clustered.Data.ONTAP.VP.vvol rules



Placement Replication Tags

☒ Disabled

☐ Custom

CANCEL

BACK

NEXT

6. Storage compatibility page displays the compatible vVols datastores in VCF environment.

Create VM Storage Policy

1 Name and description

2 Policy structure

3 NetApp.clustered.Data.ONTAP.VP.
vvol rules

4 **Storage compatibility**

5 Review and finish

Storage compatibility




×

COMPATIBLE INCOMPATIBLE

☐ Expand datastore clusters

Compatible storage 650 GB (650 GB free)

Quick Filter

Name	Datacenter	Type	Free Space	Capacity	Warnings
 VCF_ORA_BINS	vcf-wkld-01-DC	vVol	150.00 GB	150.00 GB	
 VCF_ORA_DATA	vcf-wkld-01-DC	vVol	250.00 GB	250.00 GB	
 VCF_ORA_LOGS	vcf-wkld-01-DC	vVol	250.00 GB	250.00 GB	

Manage Columns

3 items

CANCEL

BACK

NEXT

7. Review and finish to create the VM Storage Policy.

Create VM Storage Policy

1 Name and description

2 Policy structure

3 NetApp.clustered.Data.ONTAP.VP.vvol rules

4 Storage compatibility

5 Review and finish

Review and finish

General

Name vVol_database
Description
vCenter Server vcf-wkld-vc01.sddc.netapp.com

NetApp.clustered.Data.ONTAP.VP.vvol rules

Placement
ProfileName ASA_ORA

CANCEL

BACK

FINISH

8. Validate the VM Storage Policy just created.

The screenshot shows the vSphere Client interface with the 'VM Storage Policies' page. The left sidebar shows the 'Policies and Profiles' section. The main area displays a list of storage policies, with 'vVol_database' selected. The details pane on the right shows the following information:

General
Name: vVol_database
Description: Rule-set 1: NetApp.clustered.Data.ONTAP.VP.vvol
Placement: ASA_ORA
Storage Type: NetApp.clustered.Data.ONTAP.VP.vvol
ProfileName: ASA_ORA

Allocate disks to DB VM from vVols datastores and configure DB storage

From vSphere client, add three disks from the vVols datastores to database VM by editing VM settings. Then, login to VM to format and mount the disks to mount points /u01, /u02, and /u03. The following demonstrates the exact steps and tasks.

1. Add a disk to VM for Oracle binary storage.

Edit Settings | ora_01



Virtual Hardware

VM Options

Advanced Parameters

ADD NEW DEVICE ▾


> CPU	4 ▾	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
▼ New Hard disk *	50	GB ▾
Maximum Size 142.5 GB		
VM storage policy vVol_database ▾		
Location VCF_ORA_BINS ▾		
Disk Provisioning Thin Provision ▾		
Sharing No sharing ▾		
Disk Mode Dependent ▾		

CANCEL

OK

2. Add a disk to VM for Oracle data storage.

ADD NEW DEVICE ▾

> CPU	4 ▾	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> New Hard disk *	50	GB ▾
▼ New Hard disk 2 *	100	GB ▾

Maximum Size 475 GB

VM storage policy vVol_database ▾

Location VCF_ORA_DATA ▾

Disk Provisioning Thin Provision ▾

Sharing No sharing ▾

CANCEL OK

3. Add a disk to VM for Oracle log storage.

ADD NEW DEVICE ▾

> CPU	4 ▾ ⓘ	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> New Hard disk *	50	GB ▾
> New Hard disk 2 *	100	GB ▾
▼ New Hard disk 3 *	100	GB ▾

Maximum Size 285 GB

VM storage policy vVol_database ▾

Location VCF_ORA_LOGS ▾

Disk Provisioning Thin Provision ▾

Sharing No sharing ▾

CANCEL

OK

4. From VM Edit Settings, Advanced Parameters, add Attribute `disk.enableuuid` with Value `TRUE`. The VM needs to be down to add the advanced parameter. Setting this option enables SnapCenter to precisely identify the vVol in your environment.

Virtual Hardware VM Options Advanced Parameters**Advanced Configuration Parameters**

Modify or add configuration parameters as needed for experimental features or as instructed by technical support. Empty values will be removed (supported on ESXi 6.0 and later).

Attribute

Value

ADD

Attribute	Value
sched.cpu.latencySensitivity	normal
tools.guest.desktop.autolock	TRUE
svga.present	TRUE
pciBridge0.present	TRUE
pciBridge4.present	TRUE
pciBridge4.virtualDev	pcieRootPort
pciBridge4.functions	8
pciBridge5.present	TRUE
pciBridge5.virtualDev	pcieRootPort
pciBridge5.functions	8
pciBridge6.present	TRUE

CANCEL

OK

5. Now, restart the VM. Login to VM as an admin user via ssh to review the newly added disk drives.


```
[admin@ora_01 ~]$ sudo fdisk -l
```

```
Disk /dev/sdb: 50 GiB, 53687091200 bytes, 104857600 sectors  
Units: sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sdc: 100 GiB, 107374182400 bytes, 209715200 sectors  
Units: sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
Disk /dev/sdd: 100 GiB, 107374182400 bytes, 209715200 sectors  
Units: sectors of 1 * 512 = 512 bytes  
Sector size (logical/physical): 512 bytes / 512 bytes  
I/O size (minimum/optimal): 512 bytes / 512 bytes
```

```
.  
.  
.
```

6. Partition the drives as a primary and single partition by simply accepting the default choices.

```
sudo fdisk /dev/sdb
```

```
sudo fdisk /dev/sdc
```

```
sudo fdisk /dev/sdd
```

7. Format the partitioned disks as xfs file systems.

```
sudo mkfs.xfs /dev/sdb1
```

```
sudo mkfs.xfs /dev/sdc1
```

```
sudo mkfs.xfs /dev/sdd1
```

8. Mount the drives to mount point /u01, /u02, and /u03.

```
sudo mount -t xfs /dev/sdb1 /u01
```

```
sudo mount -t xfs /dev/sdc1 /u02
```

```
sudo mount -t xfs /dev/sdd1 /u03
```

```
[admin@ora_01 ~]$ df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	7.7G	0	7.7G	0%	/dev
tmpfs	7.8G	0	7.8G	0%	/dev/shm
tmpfs	7.8G	782M	7.0G	10%	/run
tmpfs	7.8G	0	7.8G	0%	/sys/fs/cgroup
/dev/mapper/rhel-root	44G	19G	26G	43%	/
/dev/sda1	1014M	258M	757M	26%	/boot
tmpfs	1.6G	12K	1.6G	1%	/run/user/42
tmpfs	1.6G	4.0K	1.6G	1%	/run/user/1000
/dev/sdb1	50G	390M	50G	1%	/u01
/dev/sdc1	100G	746M	100G	1%	/u02
/dev/sdd1	100G	746M	100G	1%	/u03

9. Add mount points to /etc/fstab so that disk drives will be mounted when VM reboots.

```
sudo vi /etc/fstab
```

```
[oracle@ora_01 ~]$ cat /etc/fstab

#
# /etc/fstab
# Created by anaconda on Wed Oct 18 19:43:31 2023
#
# Accessible filesystems, by reference, are maintained under
# '/dev/disk/'.
# See man pages fstab(5), findfs(8), mount(8) and/or blkid(8) for
# more info.
#
# After editing this file, run 'systemctl daemon-reload' to update
# systemd
# units generated from this file.
#
/dev/mapper/rhel-root    /                    xfs      defaults
0 0
UUID=aff942c4-b224-4b62-807d-6a5c22f7b623 /boot
xfs      defaults      0 0
/dev/mapper/rhel-swap   none                swap     defaults
0 0
/root/swapfile swap swap defaults 0 0
/dev/sdb1                /u01                xfs      defaults
0 0
/dev/sdc1                /u02                xfs      defaults
0 0
/dev/sdd1                /u03                xfs      defaults
0 0
```

Oracle database deployment in VCF

It's recommended to leverage NetApp automation toolkit to deploy Oracle in VCF with vVols. For detailed reference on executing Oracle automated deployment on xfs file systems, refer to TR-4992: [Simplified, Automated Oracle Deployment on NetApp C-Series with NFS](#). Although the TR-4992 covers automated Oracle deployment on the NetApp C-Series with NFS, it's identical to Oracle deployment in VCF with vVols if bypassing NFS file systems mounting to database VM. We would simply skip that with specific tags. Following are step by step procedures.

1. Login to Ansible controller VM as admin user via ssh and clone a copy of automation toolkit for Oracle on NFS.

```
git clone https://bitbucket.ngage.netapp.com/scm/ns-  
bb/na_oracle_deploy_nfs.git
```

2. Stage the following Oracle installation files in /tmp/archive folder on database VM. The folder should allow all user access with 777 permission.

```
LINUX.X64_193000_db_home.zip  
p34765931_190000_Linux-x86-64.zip  
p6880880_190000_Linux-x86-64.zip
```

3. Configure deployment target file - hosts, global variables file - vars/vars.yml, and local DB VM variables file - host_vars/host_name.yml according to instructions in this section of TR-4992: [Parameter files configuration](#). Comment out nfs_lif variable from local DB VM variable file.
4. Set up ssh keyless authentication between Ansible controller and database VMs, which requires to generate a ssh key pair and copy the public key to database VMs admin user root directory .ssh folder authorized_keys file.

```
ssh-keygen
```

5. From Ansible controller, cloned automation toolkit home directory /home/admin/na_oracle_deploy_nf, execute prerequisites playbook.

```
ansible-playbook -i hosts 1-ansible_requirements.yml
```

6. Execute Linux configuration playbook.

```
ansible-playbook -i hosts 2-linux_config.yml -u admin -e  
@vars/vars.yml
```

7. Execute Oracle deployment playbook.

```
ansible-playbook -i hosts 4-oracle_config.yml -u admin -e
@vars/vars.yml --skip-tags "ora_mount_points,enable_dnfs_client"
```

8. Optionally, all above playbooks can be executed from a single playbook run as well.

```
ansible-playbook -i hosts 0-all_playbook.yml -u admin -e
@vars/vars.yml --skip-tags "ora_mount_points,enable_dnfs_client"
```

9. Login to EM express to to validate Oracle after successful playbook execution.

The screenshot shows the Oracle Enterprise Manager Database Express interface. The top section is a blue header with the Oracle logo and the text "ORACLE ENTERPRISE MANAGER DATABASE EXPRESS". Below this is a login form with fields for Username (system), Password (masked), and Container Name. A "Log In" button is present. Below the login form is the Oracle logo and copyright information.

The main dashboard area shows the "Database Home" page for instance NTAP1 (19.18.0.0.0). It includes a "Status" section with details like Up Time (6 days 3 hours 17 minutes 43 seconds), Type (Single Instance (NTAP1)), CDB (3 PDB(s)), Version (19.18.0.0.0 Enterprise Edition), Platform Name (Linux x86 64-bit), Thread (1), Archiver (Started), Last Backup Time (N/A), and Incident(s) (0). The "Performance" section shows a line graph for CPU usage over time. The "Resources" section contains four bar charts: Host CPU, Active Sessions, Memory, and Data Storage. The "SQL Monitor - Last Hour (20 max)" section shows a table of SQL statements with columns for Status, Duration, SQL ID, SQL Plan Hash, User Name, Parallel, Database Time, I/O Requests, and SQL Text.

10. Optionally, execute destroy playbook to remove database from DB VM.

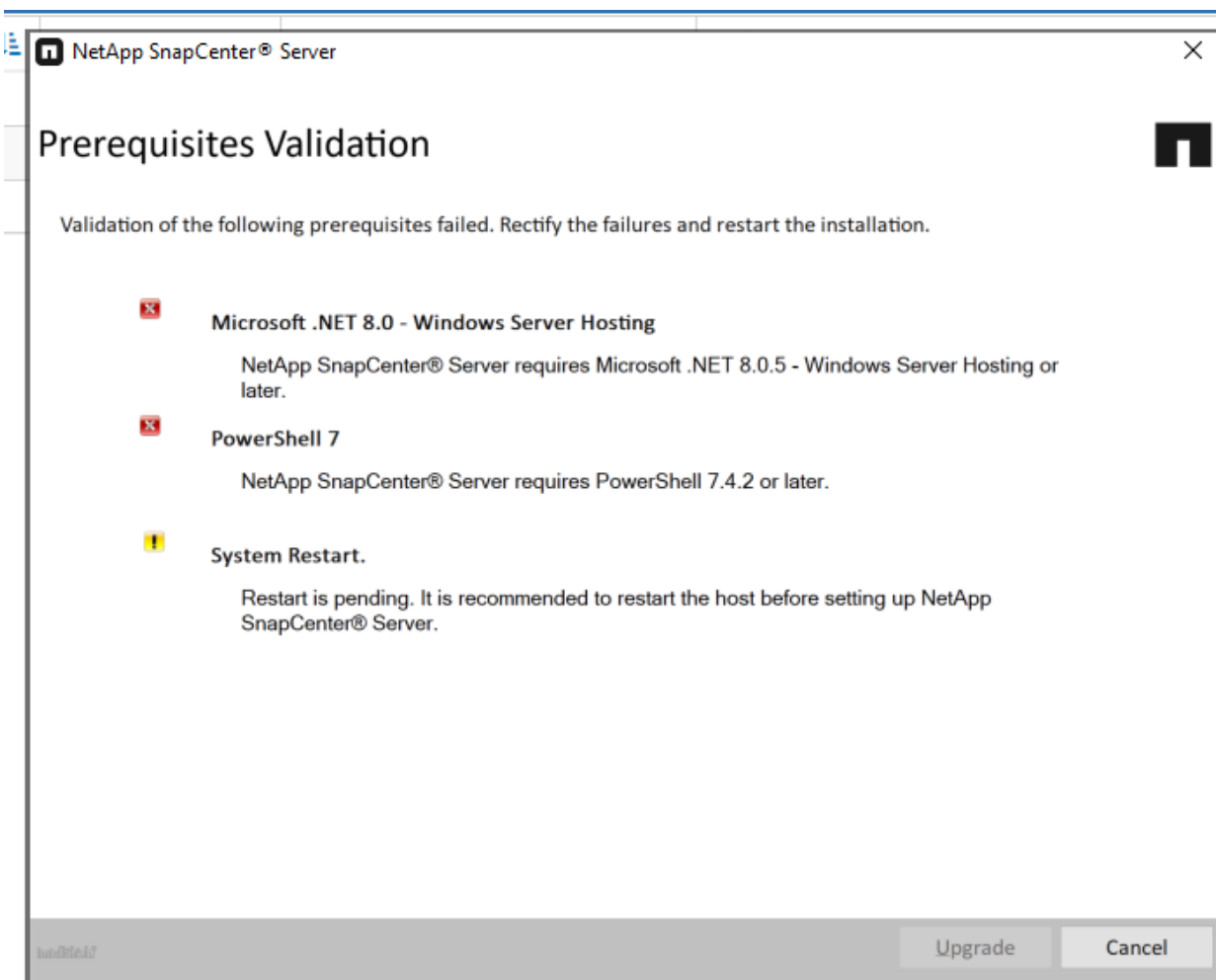
```
ansible-playbook -i hosts 5-destroy.yml -u admin -e @vars/vars.yml
```

Oracle backup, restore, and clone in VCF with SnapCenter

SnapCenter Setup

SnapCenter version 6 has many feature enhancements over version 5, including support for VMware vVols datastore. SnapCenter relies on a host-side plug-in on a database VM to perform application-aware data protection management activities. For detailed information on NetApp SnapCenter plug-in for Oracle, refer to this documentation [What can you do with the Plug-in for Oracle Database](#). The following provides high-level steps to set up SnapCenter version 6 for Oracle database backup, recovery, and clone in VCF.

1. Download the version 6 of SnapCenter software from NetApp support site: [NetApp Support Downloads](#).
2. Login to the SnapCenter hosting Windows VM as administrator. Install prerequisites for SnapCenter 6.0.

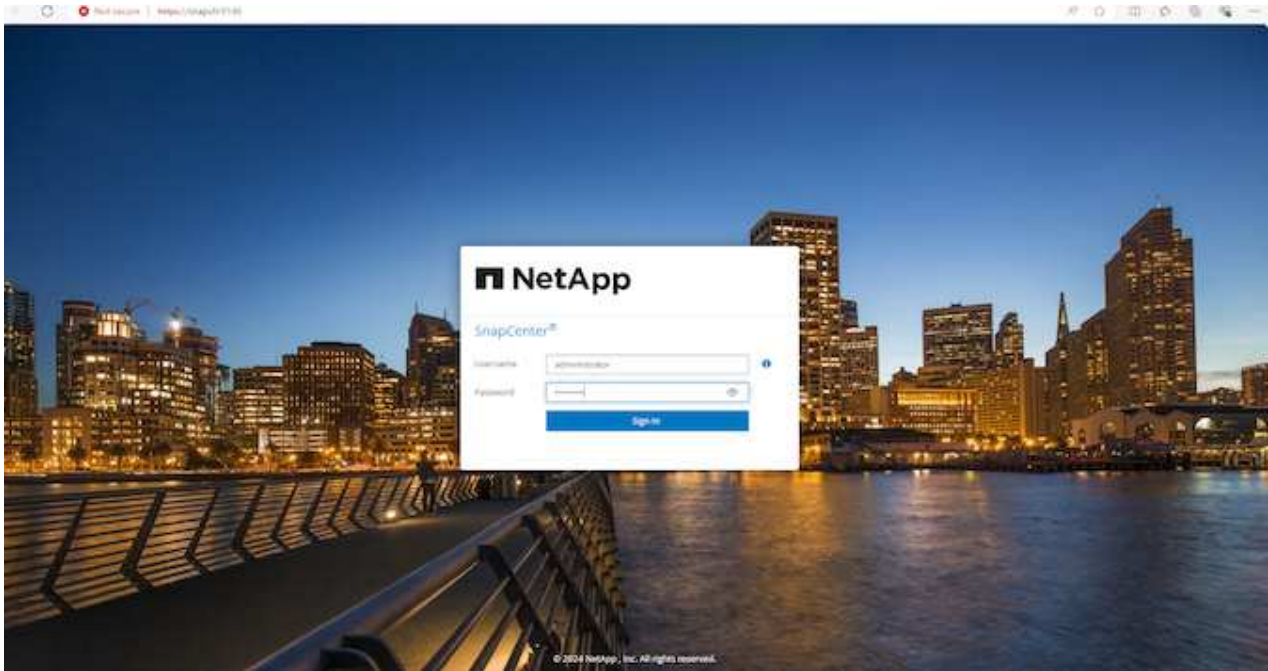


3. As administrator, install latest java JDK from [Get Java for desktop applications](#).

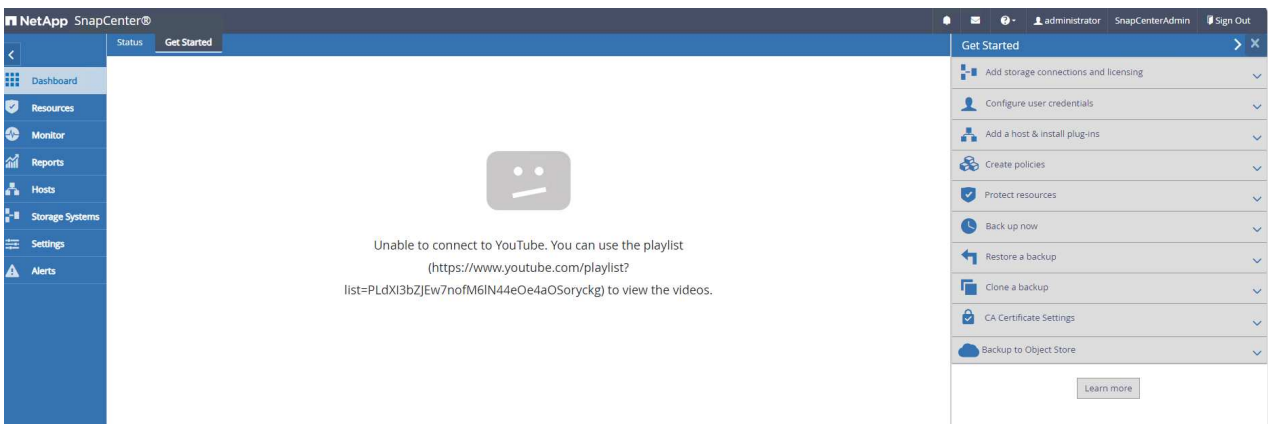


If Windows server is deployed in a domain environment, add a domain user to SnapCenter server local administrators group and run SnapCenter installation with the domain user.

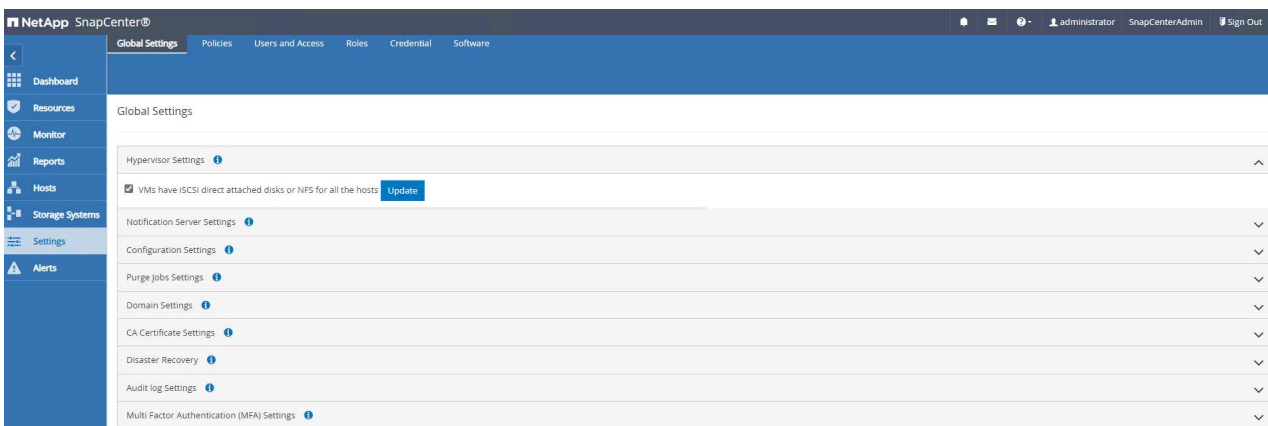
4. Login to SnapCenter UI via HTTPS port 8846 as installation user to configure SnapCenter for Oracle.



5. Review `Get Started` menu to get up to speed on SnapCenter if you are a new user.



6. Update `Hypervisor Settings` in global settings.



7. Add `ONTAP` storage cluster to `Storage Systems` with cluster management IP and authenticated via cluster admin user ID.

NetApp SnapCenter®

ONTAP Storage

ONTAP Storage Connections

There is no match for your search or data is not available.

Set up your policies, global settings, credential and configure roles, permissions, and load balancing

Add Storage System

Storage System: 172.16.9.25

Username: admin

Password: [REDACTED]

Event Management System (EMS) & AutoSupport Settings

☒ Send AutoSupport notification to storage system

☒ Log SnapCenter Server events to syslog

[More Options](#) : Platform, Protocol, Preferred IP etc..

Submit **Cancel** **Reset**

NetApp SnapCenter®

ONTAP Storage

Azure NetApp Files

Type: ONTAP Clusters

Search by Name

ONTAP Storage Connections

Name	IP	User Name	Platform	Controller License
RTP-C503-510K5.cti.gdi.englab.netapp.com	172.16.9.25 ...	admin	AFF	✓

8. Add database VM and vSphere plugin VM `Credential` for SnapCenter access to DB VM and vSphere plugin VM. The credential should have sudo privilege on the Linux VMs. You may create different credentials for different management user IDs for the VMs.

NetApp SnapCenter®

Global Settings Policies Users and Access Roles **Credential** Software

Search by Credential Name

Credential Name	Authentication Mode	Details
admin	Linux	User:admin

9. Add Oracle database VM in VCF to `Hosts` with DB VM credential created in previous step.

NetApp SnapCenter®

Managed Hosts

Search by Name

There is no match for your search or data is not available.

Add Host

Host Type: Linux

Host Name: 10.61.180.18

Credentials: admin

Select Plug-ins to Install SnapCenter Plug-ins Package 6.0 for Linux

☐ IBM DB2 ☐ SAP HANA

☐ MongoDB ☐ SAP MaxDB

☐ MySQL ☐ Storage

☐ Oracle Applications ☐ Unix File Systems

☒ Oracle Database

☐ PostgreSQL

☐ SAP ASE

[More Options](#) : Port, Install Path, Custom Plug-Ins...

Submit **Cancel**

Confirm Fingerprint

Authenticity of the host cannot be determined

Host name	Fingerprint	Valid
ora_01.sddc.netapp.com	ssh-ed25519 256 36:60:E6:D0:2B:F2:F8:90:97:A1:D3:83:40:7E:E3:7A	

Confirm and Submit

Close

NetApp SnapCenter®

Managed Hosts Disks Shares Initiator Groups iSCSI Session

Search by Name

Name	Type	System	Plug-in	Version	Overall Status
ora_01.sddc.netapp.com	Linux	Stand-alone	Oracle Database, UNIX	6.0	Running
ora_02.sddc.netapp.com	Linux	Stand-alone	Oracle Database, UNIX	6.0	Running

View all the alerts and its details.

- Similarly, add NetApp VMware plugin VM to Hosts with vSphere plugin VM credential created in previous step.

NetApp SnapCenter®

Managed Hosts Disks Shares Initiator Groups iSCSI Session

Search by Name

Add Host

Host Type: vSphere

Host Name: 172.21.166.14

Credentials: admin

Submit Cancel

NetApp SnapCenter®

Managed Hosts Disks Shares Initiator Groups iSCSI Session

Search by Name

Name	Type	System	Plug-in	Version	Overall Status
ora_01.sddc.netapp.com	Linux	Stand-alone	Oracle Database, UNIX	6.0	Running
ora_02.sddc.netapp.com	Linux	Stand-alone	Oracle Database, UNIX	6.0	Running
vcsa01.svc.sddc.netapp.com	vSphere	Stand-alone	VMware vSphere	6.0	Running

- Finally, after Oracle database is discovered on DB VM, back to Settings-Policies to create Oracle database backup policies. Ideally, create a separate archive log backup policy to allow more frequent backup interval to minimize data loss in the event of a failure.

Name	Backup Type	Schedule Type	Replication	Verification
Oracle Archive Logs Backup	LOG, ONLINE	Hourly		
Oracle Online Full Backup	FULL, ONLINE	Hourly		

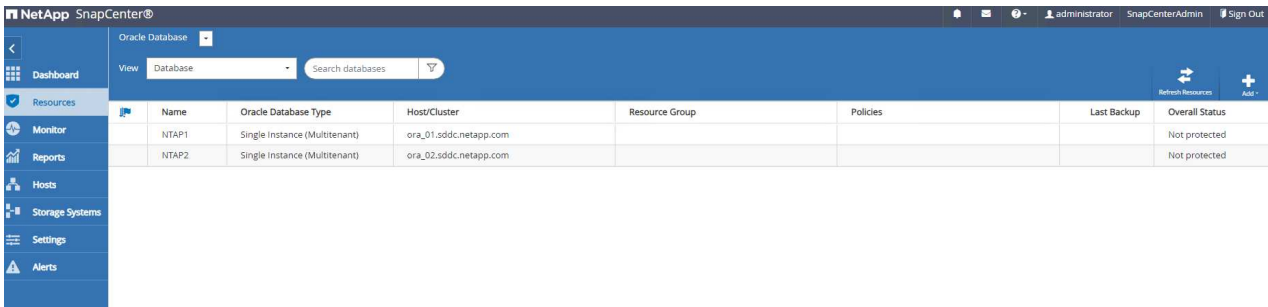


Ensure that the SnapCenter server name can be resolved to the IP address from the DB VM and vSphere plugin VM. Equally, the DB VM name and vSphere plugin VM name can be resolved to the IP address from the SnapCenter server.

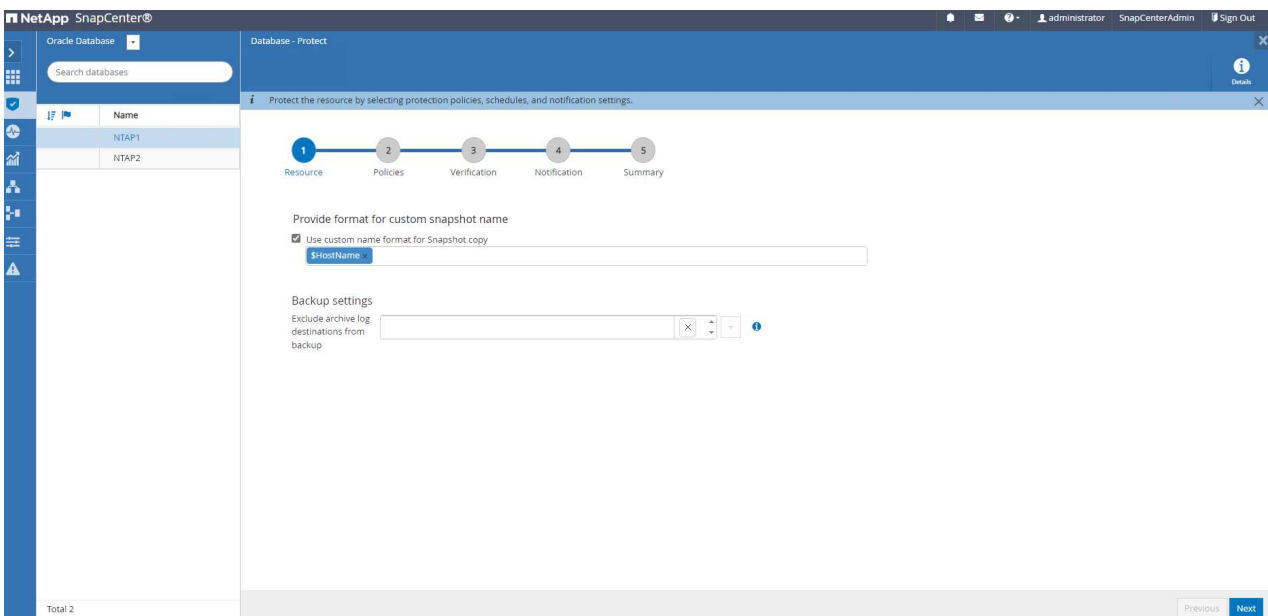
Database backup

SnapCenter leverages ONTAP volume snapshot for much quicker database backup, restore, or clone compared with traditional RMAN based methodology. The snapshots are application-consistent as the database is put in Oracle backup mode before a snapshot.

1. From the **Resources** tab, any databases on the VM are auto-discovered after the VM is added to SnapCenter. Initially, the database status shows as **Not protected**.



2. Click on database to start a workflow to enable protection for the database.



3. Apply backup policy, setup scheduling if needed.

NetApp SnapCenter®

Database - Protect

Search databases

IF Name

NTAP1

NTAP2

Set up your policies, global settings, credential and configure roles, permissions, and load balancing

1 Resource 2 Policies 3 Verification 4 Notification 5 Summary

Select one or more policies and configure schedules

Oracle Online Backup

Configure schedules for selected policies

Policy	Applied Schedules	Configure Schedules
Oracle Online Backup	None	To schedule operations select a policy that has the appropriate schedule associated, or modify the selected policy to allow schedules.

Total 1

Previous Next

4. Setup backup job notification if required.

NetApp SnapCenter®

Database - Protect

Search databases

IF Name

NTAP1

NTAP2

1 Resource 2 Policies 3 Verification 4 Notification 5 Summary

Provide email settings

Select the service accounts or people to notify regarding protection issues.

Email preference: Never

From: From email

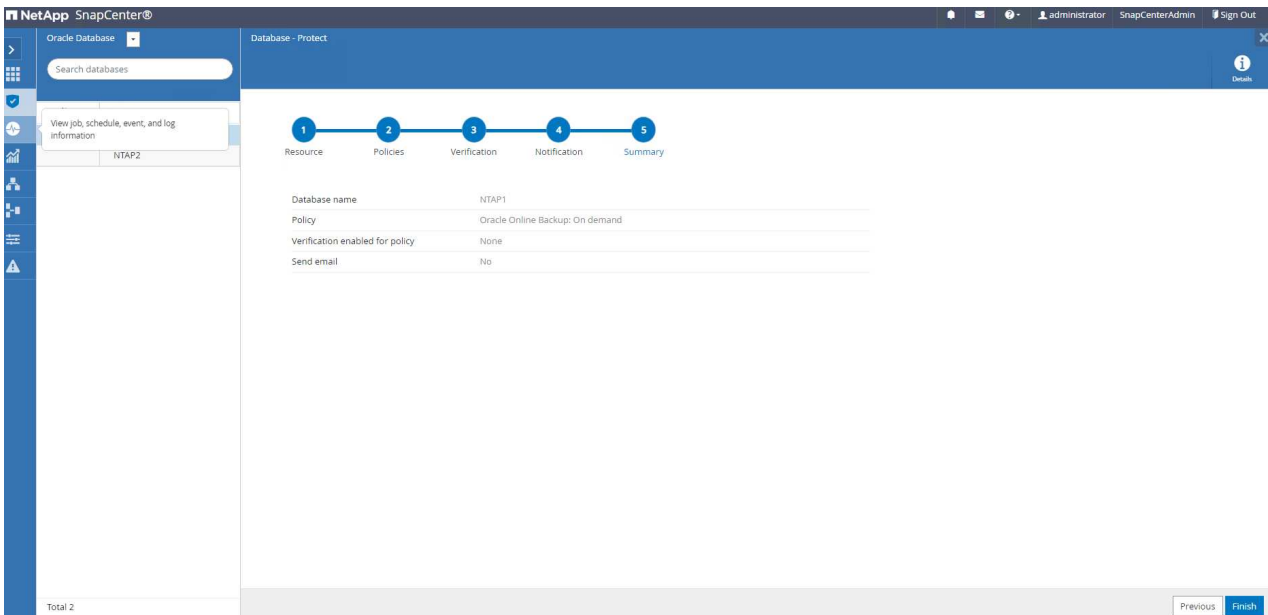
To: Email to

Subject: Notification

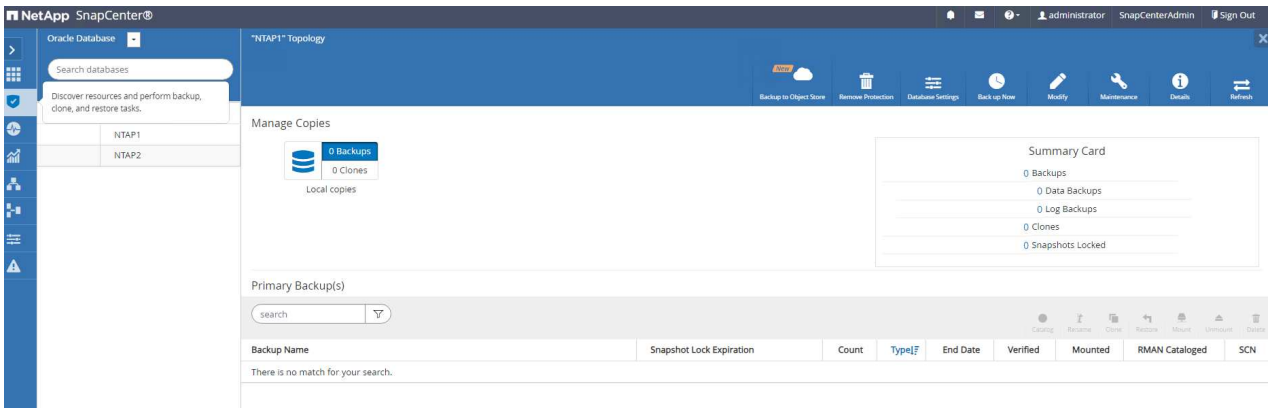
☐ Attach job report

Previous Next

5. Review the summary and finish to enable database protection.



6. On-demand backup job can be triggered by click on Back up Now.



Backup



Create a backup for the selected resource

Resource Name

NTAP1

Policy

Oracle Online Backup



☐ Verify after backup

Cancel

Backup

7. The backup job can be monitored at the `Monitor` tab by clicking on the running job.

Job Details



Backup of Resource Group 'ora_01_sddc_netapp_com_NTAP1' with policy 'Oracle Online Backup'

✓ ▾ Backup of Resource Group 'ora_01_sddc_netapp_com_NTAP1' with policy 'Oracle Online Backup'

✓ ▾ ora_01.sddc.netapp.com

- ✓ ▶ Prescripts
- ✓ ▶ Preparing for Oracle Database Backup
- ✓ ▶ Preparing for File-System Backup
- ✓ ▶ Backup datafiles and control files
- ✓ ▶ Backup archive logs
- ✓ ▶ Finalizing Oracle Database Backup
- ✓ ▶ Finalizing File-System Backup
- ✓ ▶ Postscripts
- ✓ ▶ Data Collection
- ✓ ▶ Send EMS Messages

i Task Name: ora_01.sddc.netapp.com Start Time: 07/16/2024 5:39:33 PM End Time: 07/16/2024 5:40:23 PM

View Logs

Cancel Job

Close

8. Click on database to review the backup sets completed for each database.

NTAP1 Topology

Backup to Cloud Store

Remove Protection

Database Settings

Back up Now

Modify

Maintenance

Details

Refresh

Manage Copies

4 Backups

1 Clone

Local copies

Summary Card

4 Backups

2 Data Backups

2 Log Backups

1 Clone

0 Snapshots Locked

Primary Backup(s)

search

Backup Name	Snapshot Lock Expiration	Count	Type	End Date	Verified	Mounted	RMAN Cataloged	SCN
ora_01_07-18-2024_11.17.20.8165_1		1	Log	07/18/2024 11:17:55 AM	Not Applicable	False	Not Cataloged	2874360
ora_01_07-18-2024_11.17.20.8165_0		1	Data	07/18/2024 11:17:41 AM	Unverified	False	Not Cataloged	2874313
ora_01_07-18-2024_11.09.08.6002_1		1	Log	07/18/2024 11:09:44 AM	Not Applicable	False	Not Cataloged	2873909
ora_01_07-18-2024_11.09.08.6002_0		1	Data	07/18/2024 11:09:30 AM	Unverified	False	Not Cataloged	2873861

Database restore/recovery

SnapCenter provides a number of restore and recovery options for Oracle databases from snapshot backup. In this example, we demonstrate to restore from a older snapshot backup, then roll forward the database to the last available log.

1. First, run a snapshot backup. Then, create a test table and insert a row into table to validate that recovered database from snapshot image before test table creation regains the test table.

```
[oracle@ora_01 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Wed Jul 17 10:20:10
2024
Version 19.18.0.0.0

Copyright (c) 1982, 2022, Oracle. All rights reserved.

Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 -
Production
Version 19.18.0.0.0

SQL> sho pdbs

          CON_ID CON_NAME                                OPEN MODE  RESTRICTED
-----
          2 PDB$SEED                                     READ ONLY  NO
          3 NTAP1_PDB1                                   READ WRITE NO
          4 NTAP1_PDB2                                   READ WRITE NO
          5 NTAP1_PDB3                                   READ WRITE NO
SQL> alter session set container=ntap1_pdb1;

SQL> select * from test;

no rows selected

SQL> insert into test values (1, sysdate, 'test oracle
backup/restore/clone on VMware Cloud Foundation vVols');

1 row created.

SQL> commit;

Commit complete.

SQL> select * from test;
```

```

ID
-----

DT
-----

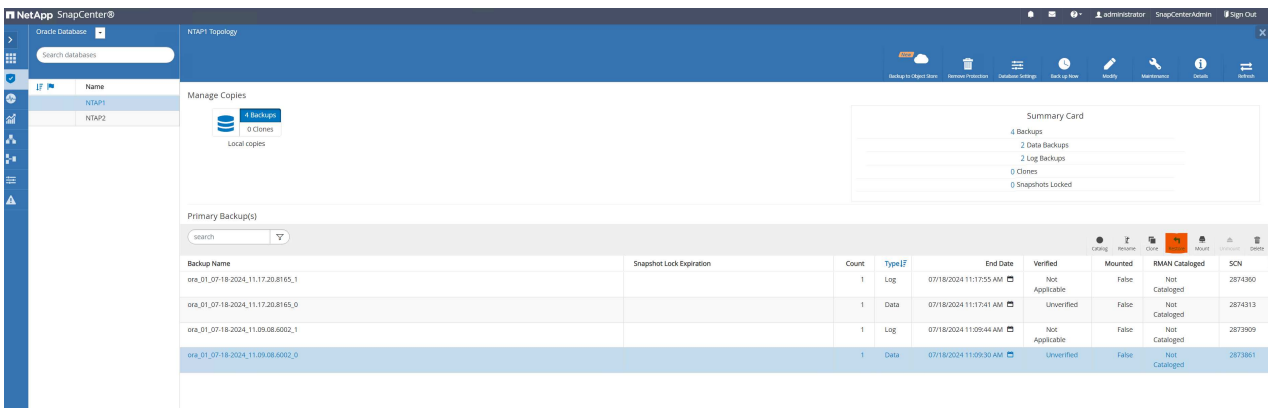
EVENT
-----

1
18-JUL-24 11.15.03.000000 AM
test oracle backup/restore/clone on VMware Cloud Foundation vVols

SQL>

```

- From SnapCenter **Resources** tab, open the database NTAP1 backup topology page. Highlight the snapshot data backup set before the creation of test table. Click on **Restore** to launch restore-recover workflow.



The screenshot shows the NetApp SnapCenter interface for the NTAP1 backup topology. The left sidebar contains navigation icons. The main content area is divided into several sections:

- Manage Copies:** Shows 4 Backups and 0 Clones.
- Summary Card:** Displays statistics: 4 Backups, 2 Data Backups, 2 Log Backups, 0 Clones, and 0 Snapshots Locked.
- Primary Backup(s):** A table listing backup sets with columns for Backup Name, Snapshot Lock Expiration, Count, Type, End Date, Verified, Mounted, RMAN Cataloged, and SCN.

Backup Name	Snapshot Lock Expiration	Count	Type	End Date	Verified	Mounted	RMAN Cataloged	SCN
ora_01-07-18-2024_11.17.20.8165_1		1	Log	07/18/2024 11:17:55 AM	Not Applicable	False	Not Cataloged	2874360
ora_01-07-18-2024_11.17.20.8165_0		1	Data	07/18/2024 11:17:41 AM	Unverified	False	Not Cataloged	2874313
ora_01-07-18-2024_11.09.08.6502_1		1	Log	07/18/2024 11:09:44 AM	Not Applicable	False	Not Cataloged	2873909
ora_01-07-18-2024_11.09.08.6502_0		1	Data	07/18/2024 11:09:30 AM	Unverified	False	Not Cataloged	2873861

- Choose restore scope.

Restore NTAP1



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Restore Scope

- ☒ All Datafiles
- ☐ Pluggable databases (PDBs)
- ☐ Pluggable database (PDB) tablespaces

☐ Control files

Database State

☒ Change database state if needed for restore and recovery

Restore Mode

☒ Force in place restore

In place restore will skip the foreign files(files which are not part of the database) validation check. The Oracle database and the ASM disk group will be restored to the point when the backup was created.

Previous

Next

4. Choose recovery scope to All Logs.

Restore NTAP1

1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Choose Recovery Scope

☒ All Logs

☐ Until SCN (System Change Number)

☐ Date and Time

☐ No recovery

Specify external archive log files locations

Previous

Next

5. Specify any optional pre-scripts to run.

Restore NTAP1



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Specify optional scripts to run before performing a restore job ⓘ

Prescript full path

/var/opt/snapcenter/spl/scripts/ Enter Prescript path

Arguments

Script timeout

60

secs

Previous

Next

6. Specify any optional after-script to run.

Restore NTAP1



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Specify optional scripts to run after performing a restore job ⓘ

Postscript full path

Arguments

☒ Open the database or container database in READ-WRITE mode after recovery

Previous

Next

7. Send a job report if desired.

Restore NTAP1



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Provide email settings

Email preference

From

To

Subject

☐ Attach job report

Previous

Next

8. Review the summary and click on **Finish** to launch the restoration and recovery.

Restore NTAP1



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Summary

Backup name	ora_01_07-16-2024_17.39.32.7534_0
Backup date	07/16/2024 5:40:02 PM
Restore scope	All DataFiles
Recovery scope	All Logs
Options	Change database state if necessary , Open the database or container database in READ-WRITE mode after recovery
Prescript full path	None
Prescript arguments	
Postscript full path	None
Postscript arguments	
Send email	No

Previous

Finish

9. From Monitor tab, open the job to review the details.

Job Details



Restore 'ora_01.sddc.netapp.com\NTAP1'

✓ ▾ Restore 'ora_01.sddc.netapp.com\NTAP1'

✓ ▾ ora_01.sddc.netapp.com

- ✓ ▶ Prescripts
- ✓ ▶ Mount log backups
- ✓ ▶ Pre Restore
- ✓ ▶ Restore
- ✓ ▶ Post Restore
- ✓ ▶ Unmount log backups
- ✓ ▶ Postscripts
- ✓ ▶ Post Restore Cleanup
- ✓ ▶ Data Collection
- ✓ ▶ Send EMS Messages

i Task Name: ora_01.sddc.netapp.com Start Time: 07/18/2024 11:26:50 AM End Time: 07/18/2024 11:40:25 AM

View Logs

Cancel Job

Close

10. From DB VM ora_01, validate that a successful restore/recovery of database rolled forward to its most recent state and recovered the test table.

```
[oracle@ora_01 ~]$ sqlplus / as sysdba
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Thu Jul 18 11:42:58
2024
```

```
Version 19.18.0.0.0
```

```
Copyright (c) 1982, 2022, Oracle. All rights reserved.
```

```
Connected to:
```

```
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 -
Production
```

```
Version 19.18.0.0.0
```

```
SQL> select name, open_mode from v$database;
```

```
NAME          OPEN_MODE
```

```
-----
```

```
NTAP1         READ WRITE
```

```
SQL> alter session set container=ntap1_pdb1;
```

```
Session altered.
```

```
SQL> select * from test;
```

```
          ID
```

```
-----
```

```
DT
```

```
-----
```

```
-----
```

```
EVENT
```

```
-----
```

```
-----
```

```
          1
```

```
18-JUL-24 11.15.03.000000 AM
```

```
test oracle backup/restore/clone on VMware Cloud Foundation vVols
```

```
SQL>
```


In this example, the most recent backup sets is used to clone a database on the DB VM ora_02 in a different software installation and ORACLE_HOME in VCF.

1. Again, open the database NTAP1 backup list. Select the most recent data backup set, click on Clone button to launch database clone workflow.

Backup Name	Snapshot Lock Expiration	Count	Type	End Date	Verified	Mounted	RMAN Cataloged	SCN
ora_01_07-18-2024_11:17:20.8165_1		1	Log	07/18/2024 11:17:55 AM	Not Applicable	False	Not Cataloged	2874350
ora_01_07-18-2024_11:17:20.8165_8		1	Data	07/18/2024 11:17:41 AM	Unverified	False	Not Cataloged	2874313
ora_01_07-18-2024_11:09:08.6002_1		1	Log	07/18/2024 11:09:44 AM	Not Applicable	False	Not Cataloged	2873909
ora_01_07-18-2024_11:09:08.6002_8		1	Data	07/18/2024 11:09:30 AM	Unverified	False	Not Cataloged	2873861

2. Name the clone database SID.

3. Select ora_02 in VCF as the target database clone host. Identical Oracle database software should have been installed and configured on the host.

Clone from NTAP1

1 Name

2 Locations

3 Credentials

4 PreOps

5 PostOps

6 Notification

7 Summary

Select the host to create a clone

Clone host

ora_02.sddc.netapp.com

⊖ Datafile locations ⓘ

/u02_NTAP1CLN

Reset

⊖ Control files ⓘ

/u02_NTAP1CLN/NTAP1CLN/control/control01.ctl

×

+

/u02_NTAP1CLN/NTAP1CLN/control/control02.ctl

×

Reset

⊖ Redo logs ⓘ

Group		Size	Unit	Number of files	
▶ RedoGroup 1	×	200	MB	<u>1</u>	+
▶ RedoGroup 2	×	200	MB	<u>1</u>	+
▶ RedoGroup 3	×	200	MB	<u>1</u>	+

Reset

Previous

Next

4. Select the proper ORACLE_HOME, user and group on the target host. Keep credential at default.

52

Clone from NTAP1



1 Name

2 Locations

3 Credentials

4 PreOps

5 PostOps

6 Notification

7 Summary

Database Credentials for the clone

Credential name for sys user

None



Database port

1521

Oracle Home Settings

Oracle Home

/u01/app/oracle/product/19.0.0/NTAP2

Oracle OS User

oracle

Oracle OS Group

oinstall

Previous

Next

5. You may change clone database parameters to meet configuration or resources requirements for the clone database.

Clone from NTAP1



1 Name

2 Locations

3 Credentials

4 PreOps

5 PostOps

6 Notification

7 Summary

Specify scripts to run before clone operation ⓘ

Prescript full path

/var/opt/snapcenter/spl/scripts/

Enter Prescript path

Arguments

Script timeout

60

secs

Database Parameter settings

processes	320	X	
remote_login_passwordfile	EXCLUSIVE	X	+
sga_target	4G	X	
undo_tablespace	UNDOTBS1	X	

Reset

Previous

Next

6. Choose recovery scope. Until Cancel recovers the clone up to last available log file in the backup set.

Clone from NTAP1

- 1 Name
- 2 Locations
- 3 Credentials
- 4 PreOps
- 5 PostOps
- 6 Notification
- 7 Summary

☒ Recover Database

☒ Until Cancel

☐ Date and Time

Date-time format: MM/DD/YYYY hh:mm:ss

☐ Until SCN (System Change Number)

Specify external archive log locations

☒ Create new DBID

☒ Create tempfile for temporary tablespace

☐ Enter SQL queries to apply when clone is created

☐ Enter scripts to run after clone operation

Previous

Next

7. Review the summary and launch the clone job.

Clone from NTAP1



1 Name	Summary	
2 Locations	Clone from backup	ora_01_07-18-2024_11.17.20.8165_0
3 Credentials	Clone SID	NTAP1CLN
4 PreOps	Clone server	ora_02.sddc.netapp.com
5 PostOps	Exclude PDBs	none
6 Notification	Oracle home	/u01/app/oracle/product/19.0.0/NTAP2
7 Summary	Oracle OS user	oracle
	Oracle OS group	oinstall
	Datafile mountpaths	/u02_NTAP1CLN
	Control files	/u02_NTAP1CLN/NTAP1CLN/control/control01.ctl /u02_NTAP1CLN/NTAP1CLN/control/control02.ctl
	Redo groups	RedoGroup =1 TotalSize =200 Path =/u02_NTAP1CLN/NTAP1CLN/redolog/redo01_01.log RedoGroup =2 TotalSize =200 Path =/u02_NTAP1CLN/NTAP1CLN/redolog/redo02_01.log RedoGroup =3 TotalSize =200 Path =/u02_NTAP1CLN/NTAP1CLN/redolog/redo03_01.log
	Recovery scope	Until Cancel
	Prescript full path	none
	Prescript arguments	
	Postscript full path	none
	Postscript arguments	
	Send email	No

[Previous](#)[Finish](#)

8. Monitor the clone job execution from **Monitor** tab.

Job Details



Clone from backup 'ora_01_07-18-2024_11.17.20.8165_0'

✓ ▼ Clone from backup 'ora_01_07-18-2024_11.17.20.8165_0'

✓ ▼ ora_02.sddc.netapp.com

- ✓ ▶ Prescripts
- ✓ ▶ Query Host Information
- ✓ ▶ Prepare for Cloning
- ✓ ▶ Cloning Resources
- ✓ ▶ FileSystem Clone
- ✓ ▶ Application Clone
- ✓ ▶ Postscripts
- ✓ ▶ Register Clone
- ✓ ▶ Unmount Clone
- ✓ ▶ Data Collection

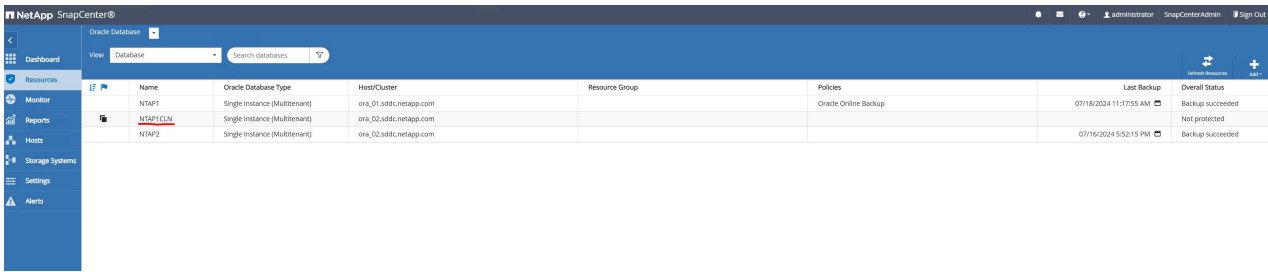
i Task Name: ora_02.sddc.netapp.com Start Time: 07/18/2024 11:50:41 AM End Time: 07/18/2024 12:02:34 PM

View Logs

Cancel Job

Close

9. Cloned database is immediately registered in SnapCenter.



The screenshot shows the NetApp SnapCenter web interface. The top navigation bar includes 'Dashboard', 'Resources', 'Monitor', 'Reports', 'Hosts', 'Storage Systems', 'Settings', and 'Alerts'. The main content area displays a table of Oracle databases. The table has columns for Name, Oracle Database Type, Host/Cluster, Resource Group, Policies, Last Backup, and Overall Status. Three databases are listed: NTAP1, NTAP1CLN (highlighted in red), and NTAP2. All three are 'Single Instance (Multitenant)' and located on 'ora_02.adtic.netapp.com'. The 'Last Backup' for NTAP1 and NTAP2 is '07/18/2024 11:17:55 AM', while for NTAP1CLN it is '07/16/2024 5:52:15 PM'. The 'Overall Status' for all three is 'Backup succeeded'.

Name	Oracle Database Type	Host/Cluster	Resource Group	Policies	Last Backup	Overall Status
NTAP1	Single Instance (Multitenant)	ora_02.adtic.netapp.com		Oracle Online Backup	07/18/2024 11:17:55 AM	Backup succeeded
NTAP1CLN	Single Instance (Multitenant)	ora_02.adtic.netapp.com			07/16/2024 5:52:15 PM	Backup succeeded
NTAP2	Single Instance (Multitenant)	ora_02.adtic.netapp.com			07/18/2024 11:17:55 AM	Backup succeeded

10. From DB VM ora_02, validate the cloned database and query the test table.

```
[oracle@ora_02 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Thu Jul 18 12:06:48
2024
Version 19.18.0.0.0

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Connected to:
Oracle Database 19c Enterprise Edition Release 19.0.0.0.0 -
Production
Version 19.18.0.0.0

SQL> select name, open_mode, log_mode from v$database;

NAME          OPEN_MODE          LOG_MODE
-----
NTAP1CLN      READ WRITE          ARCHIVELOG

SQL> select instance_name, host_name from v$instance;

INSTANCE_NAME
-----
HOST_NAME
-----
NTAP1CLN
ora_02

SQL> show pdbs

          CON_ID CON_NAME                                OPEN MODE RESTRICTED
-----
          2 PDB$SEED                                READ ONLY NO
```

```

        3 NTAP1_PDB1                      READ WRITE NO
        4 NTAP1_PDB2                      READ WRITE NO
        5 NTAP1_PDB3                      READ WRITE NO
SQL> alter session set container=ntap1_pdb1
      2  ;

Session altered.

SQL> select * from test;

          ID
-----
DT
-----
EVENT
-----
          1
18-JUL-24 11.15.03.000000 AM
test oracle backup/restore/clone on VMware Cloud Foundation vVols

SQL>

```

This completes the demonstration of SnapCenter backup, restore, and clone of Oracle database in VCF.

Where to find additional information

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

- [VMware Cloud Foundation](#)
- [SnapCenter software documentation](#)

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