



TR-4997: Oracle RAC Deployment and Protection in VCF with vVols

NetApp database solutions

NetApp
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TR-4997: Oracle RAC 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 Real Application Clusters (RAC) 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.

In [TR-4996](#), we demonstrated single instance Oracle database deployment and protection in VCF with vVols. This documentation demonstrates the deployment and protection of an Oracle RAC database in a VMware Cloud Foundation environment with vVols as primary database storage in a NetApp ONTAP storage cluster. The Oracle RAC 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 RAC deployment. We also demonstrate Oracle RAC database deployment in VCF on vVols with NetApp automation toolkit and RAC database protection with NetApp SnapCenter UI tool.

This solution addresses the following use cases:

- Oracle RAC 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

Audience

This solution is intended for the following people:

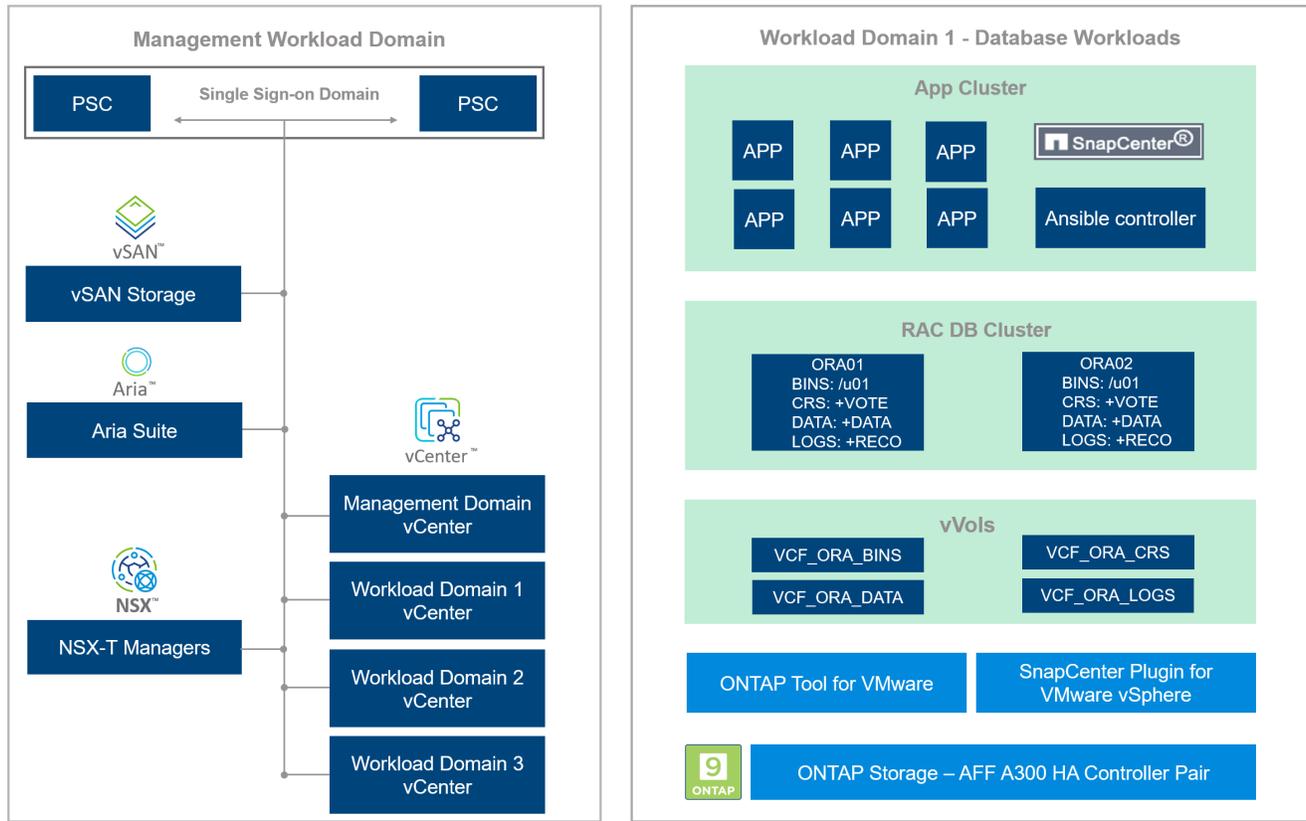
- A DBA who would like to deploy Oracle RAC in VCF with vVols datastore on NetApp ONTAP AFF as primary database storage
- A database solution architect who would like to test Oracle RAC workloads in VCF with vVols datastore on NetApp ONTAP AFF storage
- A storage administrator who would like to deploy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

Solution test and validation environment

The testing and validation of this solution was performed in a lab environment in 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 RAC Database 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 Grid Infrastructure	Version 19.18	Applied RU patch p34762026_190000_Linux-x86-64.zip

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 RAC database configuration in VCF

RAC Node	Database	DB Storage
ora01	NTAP(NTAP_pdb1,NTAP_pdb2,NTAP_pdb3)	vVols datastores (VCF_ORA_BINS, VCF_ORA_CRG, VCF_ORA_DAT1, VCF_ORA_DAT2, VCF_ORA_LOGS) on NetApp ONTAP AFF A300
ora02	NTAP(NTAP_pdb1,NTAP_pdb2,NTAP_pdb3)	vVols datastores (VCF_ORA_BINS, VCF_ORA_CRG, VCF_ORA_DAT1, VCF_ORA_DAT2, VCF_ORA_LOGS) 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 iSCSI 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 five vVols datastores for Oracle binary, Oracle cluster registry/vote, Oracle data, and Oracle log files. It's good practice to separate different types of Oracle files into their own datastores 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.
- **Oracle storage redundancy.** Use `Normal Redundancy` for critical Oracle RAC cluster registry/vote files so that three vote files on three ASM disk failgroups provide optimal cluster protection and the cluster registry is mirrored among the ASM disk failgroups. Use `External Redundancy` for Oracle binary, data, and log files to optimize storage utilization. The underlined ONTAP RAID-DP provides data protection when `External Redundancy` is employed.

- **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 with a user-friendly UI interface. NetApp recommends implementing such a management tool to achieve fast SnapShot backup, quick database restore and recovery.

Solution deployment

The following sections provide step-by-step procedures for Oracle 19c database deployment in VCF with vVols datastores on NetApp ONTAP storage in an Oracle RAC 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 RAC database cluster 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. Oracle RAC database VMs should have provisioned at least two network interfaces - one for Oracle RAC private interconnect and one for apps or public data traffic.
4. 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](#).
5. 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](#)

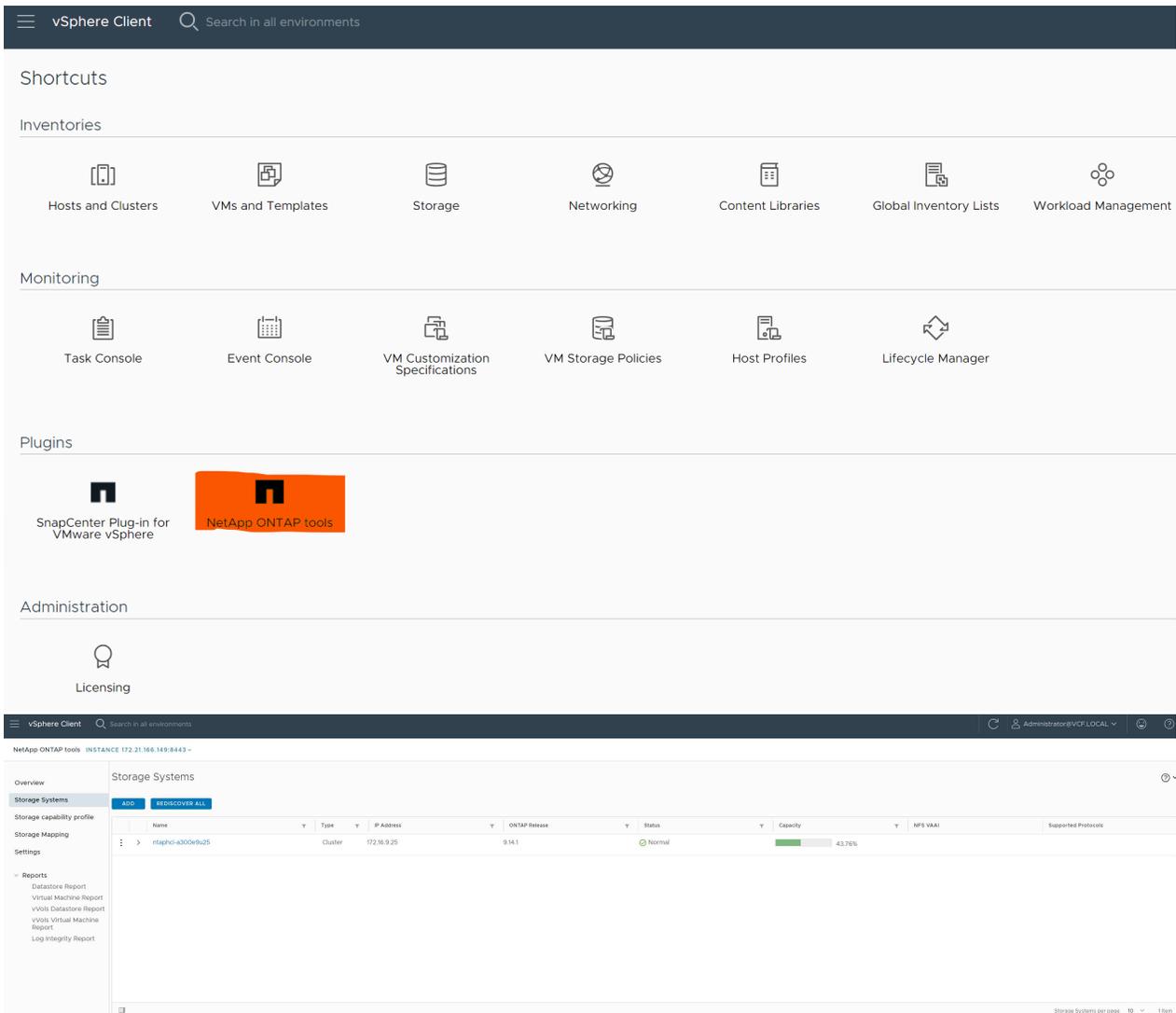


Ensure that you have allocated at least 50G in Oracle VM root volume in order to have sufficient space to stage Oracle installation files.

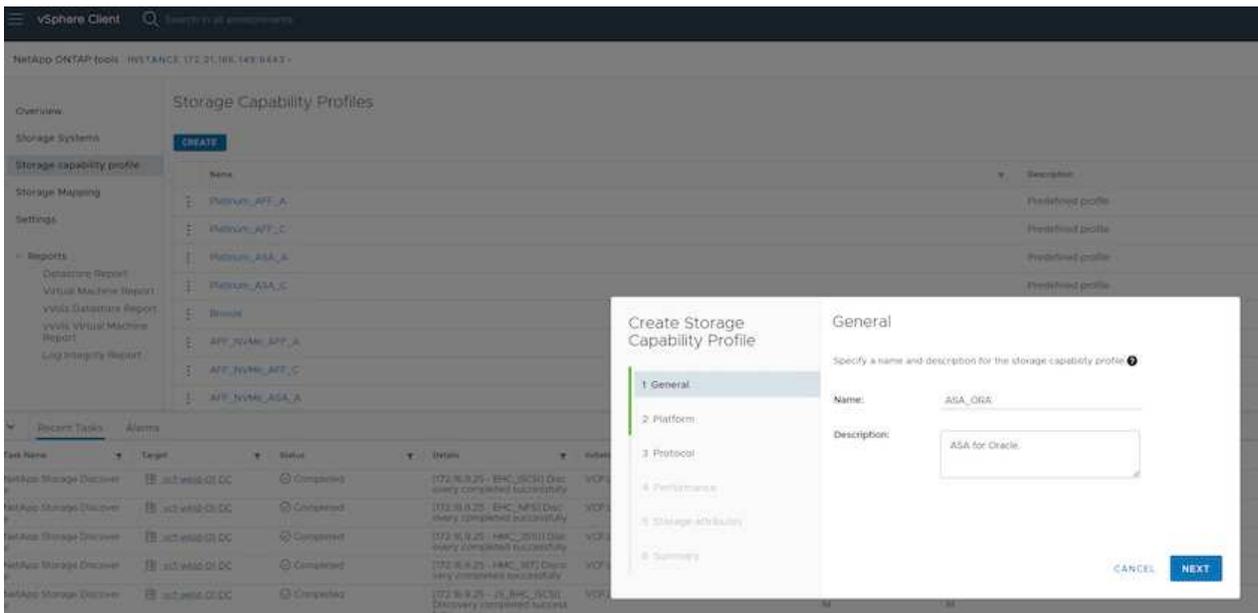
Create storage capability profile

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

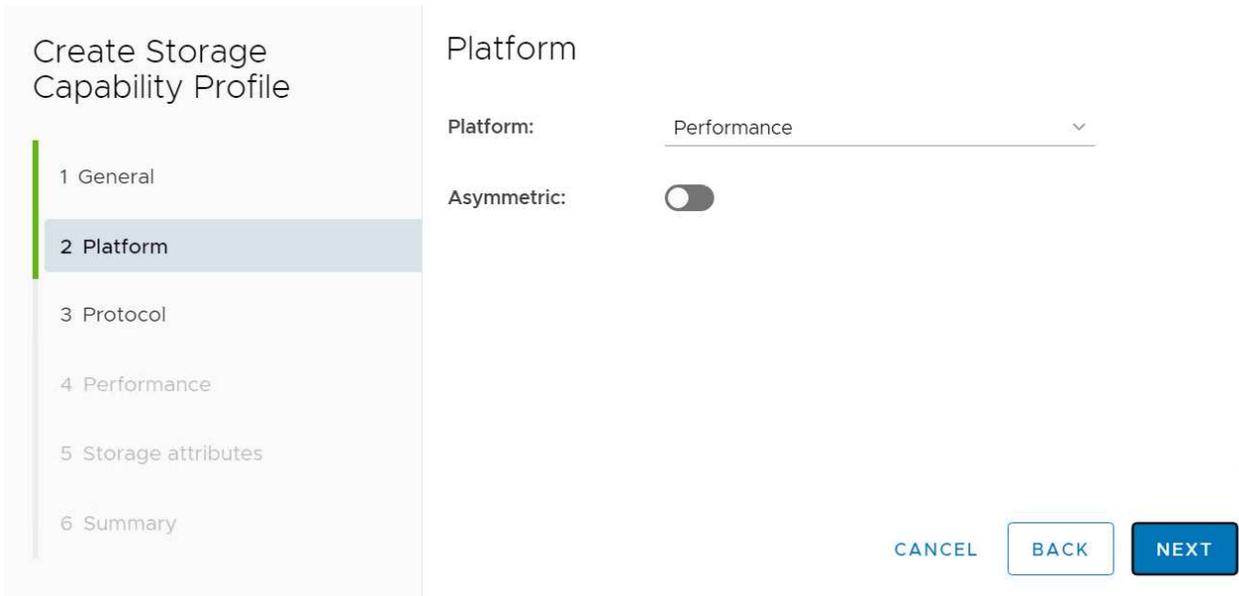
1. From vSphere client shortcuts, open NetApp ONTAP tool. Ensure that ONTAP storage cluster has been added to Storage Systems as part of ONTAP tool deployment.



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.



4. Select the protocol.

Create Storage Capability Profile

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

Protocol

Protocol:

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

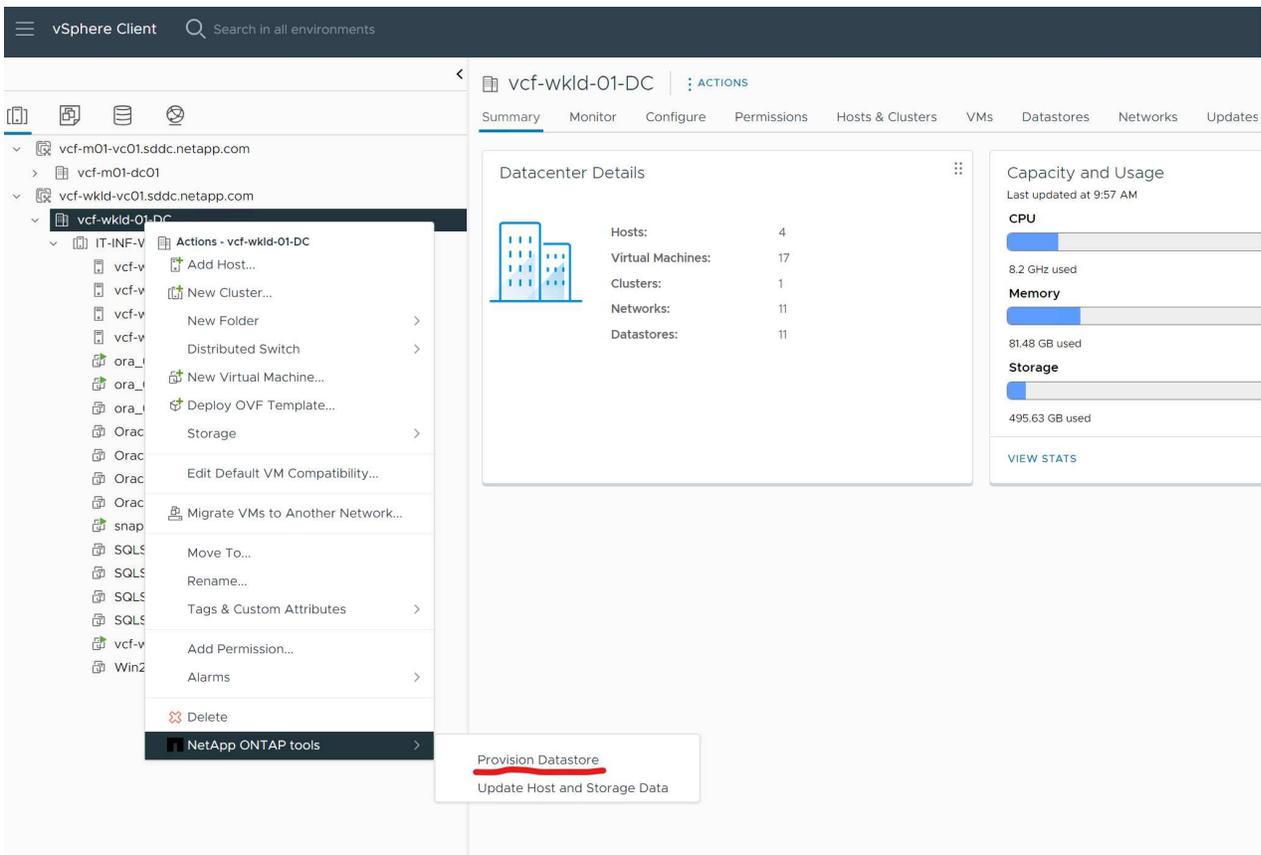
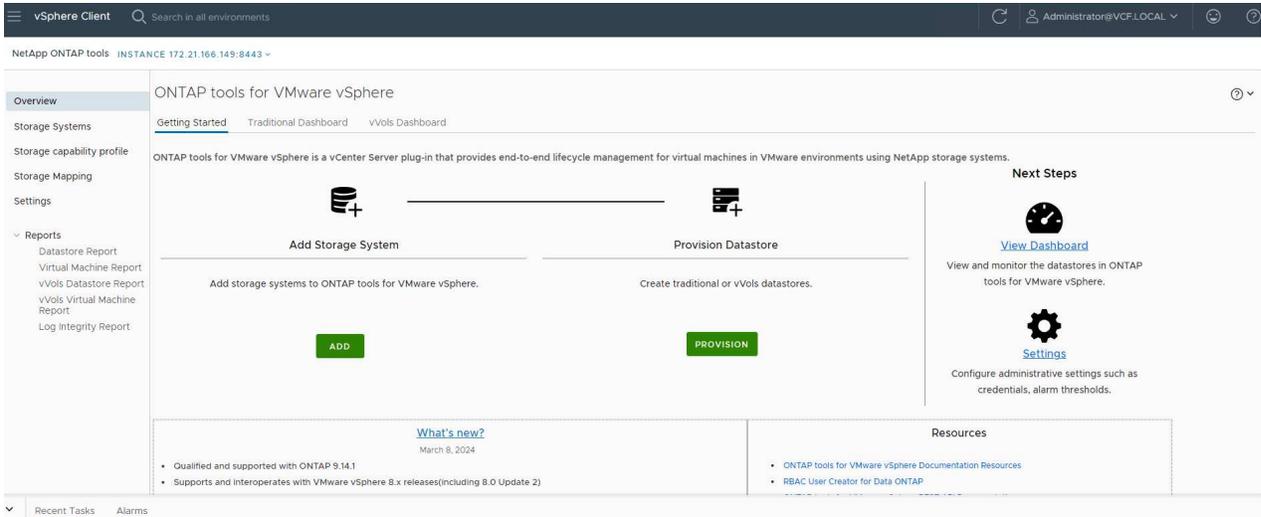
BACK

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](#)

3. 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:
FAH_Max20
iSCSI_Thin_Dedup_Asymmetric_Compress_PERF_NO
Custom profiles
ASA_ORA

Storage system:

Storage VM:

[CANCEL](#)

[BACK](#)

[NEXT](#)

4. 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
 FlexVol volumes are not added.			

Name	Size(GB)	Storage capability profile	Aggregates	Space reserve
vcf_ora_bins	150	ASA_ORA	EHCAGgr02 - (17714.69 Gi	Thin

New Datastore

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

Storage attributes

Volumes: Create new volumes Select volumes

Create new volumes

Name	Size	Storage Capability Profile	Aggregate
vcf_ora_bins	150 GB	ASA_ORA	EHCAGgr02

1 - 1 of 1 Item

Name	Size(GB)	Storage capability profile	Aggregates	Space reserve
		ASA_ORA	EHCAGgr02 - (17714.69 Gi	Thin

Default storage capability profile: ASA_ORA

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: iSCSI
Storage capability profile: ASA_ORA

Storage system details

Storage system: ntaphci-a300e9u25
SVM: VCF_ISCSI

Storage attributes

New FlexVol Name	New FlexVol Size	Aggregate	Storage Capability Profile
vcf_ora_bins	150 GB	EHCAGgr02	ASA_ORA

6. Create datastore for Oracle cluster registry or CRS.

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
vcf_ora_crs1	25 GB	ASA_ORA	EHCAGgr01
vcf_ora_crs2	25 GB	ASA_ORA	EHCAGgr02

1 - 2 of 2 Items

Name	Size(GB) ⓘ	Storage capability profile	Aggregates	Space reserve
<input type="text"/>	<input type="text"/>	ASA_ORA	EHCAGgr02 - (17651.8 GB)	Thin



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

7. Create datastore for Oracle data. Ideally, create separate datastores on each ONTAP controller node and employ Oracle ASM to stripe data across controller nodes to maximize utilization of ONTAP storage cluster capacity.

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
vcf_ora_dat1	200 GB	ASA_ORA	EHCAGgr01

1 - 1 of 1 Item

Name	Size(GB) ⓘ	Storage capability profile	Aggregates	Space reserve
<input type="text"/>	<input type="text"/>	ASA_ORA	EHCAGgr02 - (17467.05 G)	Thin

Default storage capability profile: ASA_ORA

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
vcf_ora_dat2	200 GB	ASA_ORA	EHCAGgr02

1 - 1 of 1 item

Name	Size(GB)	Storage capability profile	Aggregates	Space reserve
		ASA_ORA	EHCAGgr02 - (17467.05 G	Thin

ADD

Default storage capability profile: ASA_ORA

CANCEL

BACK

NEXT

8. Create datastore for Oracle log. Given sequential nature of Oracle log writing, it is good just place it on a single ONTAP controller node.

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
vcf_ora_logs	250 GB	ASA_ORA	EHCAGgr02

1 - 1 of 1 item

Name	Size(GB)	Storage capability profile	Aggregates	Space reserve
		ASA_ORA	EHCAGgr02 - (17467.05 G	Thin

ADD

Default storage capability profile: ASA_ORA

CANCEL

BACK

NEXT

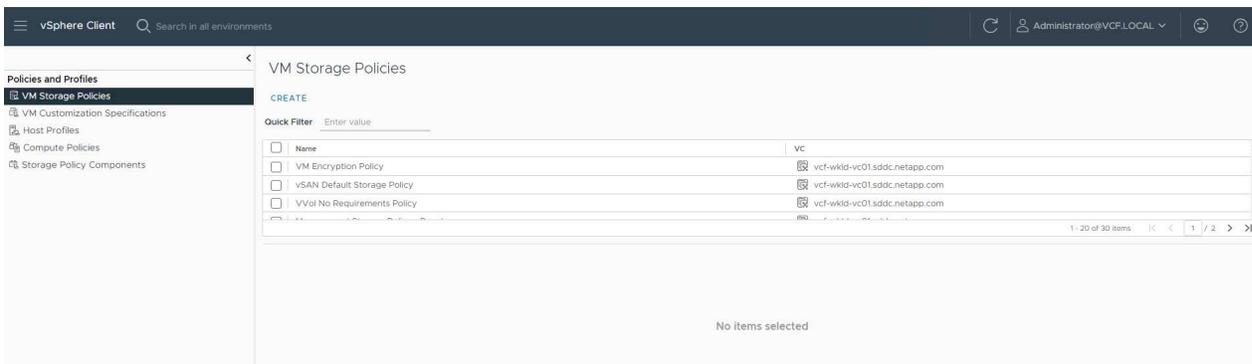
9. Validate the Oracle datastores after deployment.

The screenshot shows the vSphere Client interface for a datastore named 'vcf-wkld-01-DC'. The left sidebar shows a tree view of the environment, with the 'vcf-wkld-01-DC' folder expanded. Under this folder, several datastores are listed, including 'vcf_ora_logs', which is highlighted with a red box. The main pane shows the 'Datacenter Details' for 'vcf-wkld-01-DC', including Hosts (4), Virtual Machines (17), Clusters (1), Networks (11), and Datastores (12). The 'Capacity and Usage' section shows CPU (66.8 GHz free), Memory (453.01 GB free), and Storage (11.44 TB free). The 'Tags' section shows 'No tags assigned'.

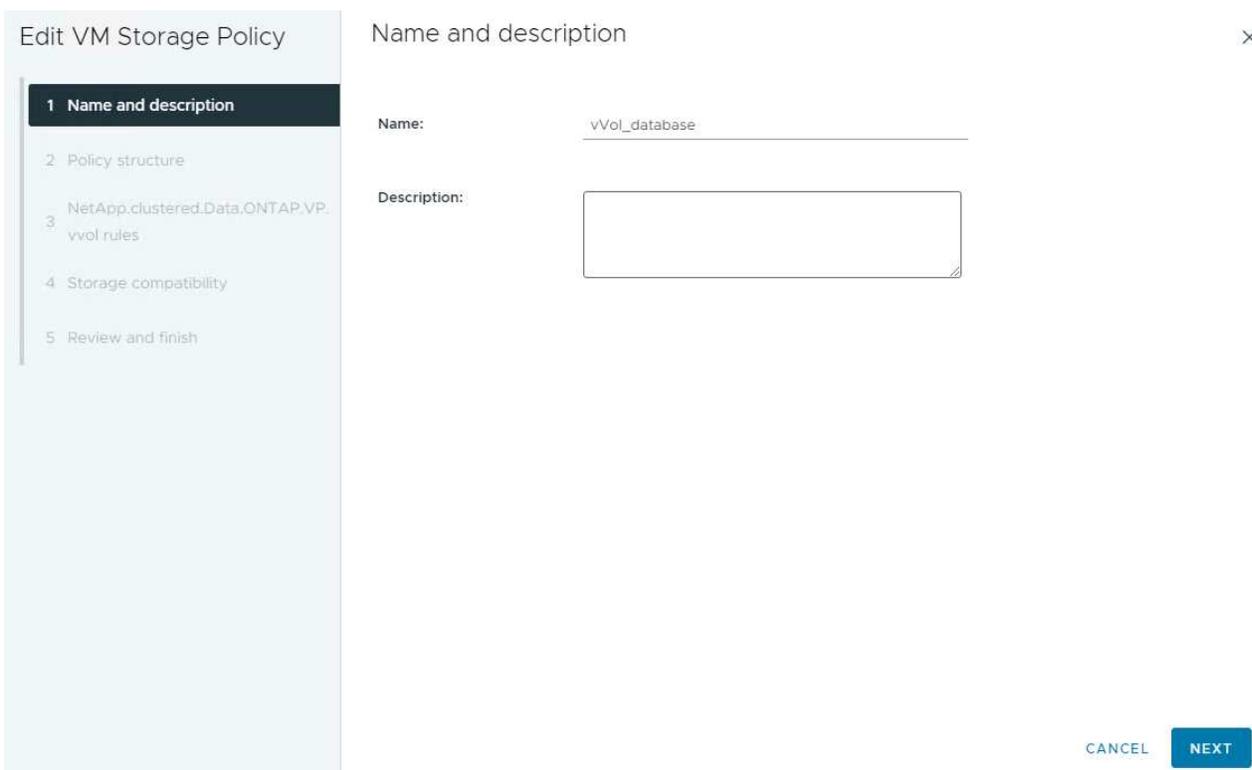
Create VM storage policy based on storage capability profile

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.



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.

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

Storage compatibility

×

COMPATIBLE INCOMPATIBLE

Expand datastore clusters

Compatible storage 850 GB (849.99 GB free)

Quick Filter

Name	Datacenter	Type	Free Space	Capacity	Warnings
VCF_ORA_BINS	vcf-wkld-01-DC	vVol	149.99 GB	150.00 GB	
VCF_ORA_DAT1	vcf-wkld-01-DC	vVol	200.00 GB	200.00 GB	
VCF_ORA_DAT2	vcf-wkld-01-DC	vVol	200.00 GB	200.00 GB	
VCF_ORA_LOGS	vcf-wkld-01-DC	vVol	250.00 GB	250.00 GB	
VCF_ORA_CRS	vcf-wkld-01-DC	vVol	50.00 GB	50.00 GB	

Manage Columns

5 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. On the left, the 'Policies and Profiles' sidebar is visible, with 'VM Storage Policies' selected. The main area displays a list of VM Storage Policies. The policy 'vVol_database' is highlighted. Below the list, the details for the selected policy are shown:

Rules	VM Compliance	VM Template	Storage Compatibility
General			
Name	vVol_database		
Description	vCenter Server: vcf-wkld-vc01.sddc.netapp.com		
Rule-set 1: NetApp.clustered.Data.ONTAP.VP.vvol			
Placement	ProfileName: ASA_ORA		
Storage Type	NetApp.clustered.Data.ONTAP.VP.vvol		
ProfileName	ASA_ORA		

Allocate disks to RAC VMs from vVols datastores and configure DB storage

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

1. Before allocating disks from datastore to database VM, login to VMware ESXi hosts to validate and ensure multi-writer are enabled (GBLAllowMW value set to 1) on ESXi level.

```
[root@vcf-wkld-esx01:~] which esxcli
/bin/esxcli
[root@vcf-wkld-esx01:~] esxcli system settings advanced list -o
/VMFS3/GBLAllowMW
  Path: /VMFS3/GBLAllowMW
  Type: integer
  Int Value: 1
  Default Int Value: 1
  Min Value: 0
  Max Value: 1
  String Value:
  Default String Value:
  Valid Characters:
  Description: Allow multi-writer GBLs.
  Host Specific: false
  Impact: none
[root@vcf-wkld-esx01:~]
```

2. Add a new, dedicate SCSI controller for use with Oracle RAC disks. Disable SCSI bus sharing.

ADD NEW DEVICE ▾

> CPU	4 ▾ ⓘ	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> SCSI controller 0	VMware Paravirtual	⋮
▼ New SCSI controller *	VMware Paravirtual	⋮
Change Type	VMware Paravirtual ▾	
SCSI Bus Sharing	None ▾	
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On
> Video card	Specify custom settings ▾	
> Other	Additional Hardware	

CANCEL

OK

3. From RAC node 1 - ora01, add a disk to VM for Oracle binary storage without sharing.

> CPU	4 ▾ ⓘ	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
▾ New Hard disk *	50	GB ▾
Maximum Size	150 GB	
VM storage policy	vVol_database ▾	
Location	VCF_ORA_BINS ▾	
Disk Provisioning	Thin Provision ▾	
Sharing	No sharing ▾	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾	SCSI(1:0) New Hard disk ▾
> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected ⋮
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected ⋮
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On ⋮
> Video card	Specify custom settings ▾	
> Other	Additional Hardware	

CANCEL OK

4. From RAC node 1, add three disks to VM for Oracle RAC CRS storage and enable multi-writer sharing.

ADD NEW DEVICE ▾

> CPU	4 ▾ 	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> Hard disk 2	50	GB ▾
▾ New Hard disk *	10	GB ▾
Maximum Size	50 GB	
VM storage policy	vVol_database ▾	
Location	VCF_ORA_CR5 ▾	
Disk Provisioning	Thin Provision ▾	
Sharing	Multi-writer ▾	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾	SCSI(1:1) New Hard disk ▾
> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On
> Video card	Specify custom settings ▾	
> Other	Additional Hardware	

CANCEL

OK

ADD NEW DEVICE ▾

> CPU	4 ▾ 	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> Hard disk 2	50	GB ▾
> Hard disk 3	10	GB ▾
▾ New Hard disk *	10	GB ▾
Maximum Size	49.98 GB	
VM storage policy	vVol_database ▾	
Location	VCF_ORA_CRG ▾	
Disk Provisioning	Thin Provision ▾	
Sharing	Multi-writer ▾	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾	SCSI(1:2) New Hard disk ▾
> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected ⋮
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected ⋮
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On ⋮
▾ Video card	Specify custom settings ▾	

CANCEL

OK

ADD NEW DEVICE ▾

> CPU	4 ▾ ⓘ	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> Hard disk 2	50	GB ▾
> Hard disk 3	10	GB ▾
> Hard disk 4	10	GB ▾
▾ New Hard disk *	10	GB ▾
Maximum Size	49.99 GB	
VM storage policy	vVol_database ▾	
Location	VCF_ORA_CRS ▾	
Disk Provisioning	Thin Provision ▾	
Sharing	Multi-writer ▾	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾ SCSI(1:3) New Hard disk ▾	
> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected ⋮
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected ⋮
> CD/DVD drive 1	Client Device ▾	<input type="checkbox"/> Connect At Power On ⋮

CANCEL OK

5. From RAC node 1, add two disks each from each datastore for data to VM for shared Oracle data storage.

> CPU	4 ▾ 
> Memory	16 <input type="text"/> GB ▾
▾ Hard disks *	6 total 170 GB
> Hard disk 1	50 <input type="text"/> GB ▾ 
> Hard disk 2	50 <input type="text"/> GB ▾ 
> Hard disk 3	10 <input type="text"/> GB ▾ 
> Hard disk 4	10 <input type="text"/> GB ▾ 
> Hard disk 5	10 <input type="text"/> GB ▾ 
▾ New Hard disk *	40 <input type="text"/> GB ▾ 
Maximum Size	200 GB
VM storage policy	vVol_database ▾
Location	VCF_ORA_DAT1 ▾
Disk Provisioning	Thin Provision ▾
Sharing	Multi-writer ▾
Disk Mode	Independent - Persistent ▾
Virtual Device Node	SCSI controller 0 ▾ SCSI(0:1) New Hard disk ▾
> SCSI controller 0	VMware Paravirtual 
> SCSI controller 1	VMware Paravirtual 

CANCEL OK

> Hard disk 1	50	GB	⋮
> Hard disk 2	50	GB	⋮
> Hard disk 3	10	GB	⋮
> Hard disk 4	10	GB	⋮
> Hard disk 5	10	GB	⋮
> Hard disk 6	40	GB	⋮
▼ New Hard disk *	40	GB	⋮
<p>Maximum Size 199.98 GB</p> <p>VM storage policy vVol_database</p> <p>Location VCF_ORA_DAT1</p> <p>Disk Provisioning Thin Provision</p> <p>Sharing Multi-writer</p> <p>Disk Mode Independent - Persistent</p> <p>Virtual Device Node SCSI controller 1 SCSI(1:5) New Hard disk</p>			
> SCSI controller 0	VMware Paravirtual		⋮
> SCSI controller 1	VMware Paravirtual		⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt	<input checked="" type="checkbox"/> Connected	⋮
> Network adapter 2	vlan-180	<input checked="" type="checkbox"/> Connected	⋮
> CD/DVD drive 1	Client Device	<input checked="" type="checkbox"/> Connect At Power On	⋮
> Video card	Specify custom settings		

CANCEL

OK

> CPU	4	GB
> Memory	16	GB
Hard disks * 8 total 250 GB		
> Hard disk 1	50	GB
> Hard disk 2	50	GB
> Hard disk 3	10	GB
> Hard disk 4	10	GB
> Hard disk 5	10	GB
> Hard disk 6	40	GB
> Hard disk 7	40	GB
New Hard disk *	40	GB
Maximum Size	200 GB	
VM storage policy	vVol_database	
Location	VCF_ORA_DAT2	
Disk Provisioning	Thin Provision	
Sharing	Multi-writer	
Disk Mode	Independent - Persistent	
Virtual Device Node	SCSI controller 1	SCSI(1:6) New Hard disk
> SCSI controller 0	VMware Paravirtual	
> SCSI controller 1	VMware Paravirtual	

CANCEL

OK

> Hard disk 1	50	GB	⋮
> Hard disk 2	50	GB	⋮
> Hard disk 3	10	GB	⋮
> Hard disk 4	10	GB	⋮
> Hard disk 5	10	GB	⋮
> Hard disk 6	40	GB	⋮
> Hard disk 7	40	GB	⋮
> Hard disk 8	40	GB	⋮
∨ New Hard disk *	40	GB	⋮
Maximum Size	199.98 GB		
VM storage policy	vVol_database		
Location	VCF_ORA_DAT2		
Disk Provisioning	Thin Provision		
Sharing	Multi-writer		
Disk Mode	Independent - Persistent		
Virtual Device Node	SCSI controller 1 SCSI(1:8) New Hard disk		
> SCSI controller 0	VMware Paravirtual		⋮
> SCSI controller 1	VMware Paravirtual		⋮
> Network adapter 1	vcf-wkld-01-HT-INF-WKLD-01-vds-01-pg-mgmt	<input checked="" type="checkbox"/> Connected	⋮
> Network adapter 2	vlan-180	<input checked="" type="checkbox"/> Connected	⋮

CANCEL

OK

6. From RAC node 1, add two disks to VM from logs datastore for shared Oracle log files storage.

> Hard disk 2	50	GB	⋮
> Hard disk 3	10	GB	⋮
> Hard disk 4	10	GB	⋮
> Hard disk 5	10	GB	⋮
> Hard disk 6	40	GB	⋮
> Hard disk 7	40	GB	⋮
> Hard disk 8	40	GB	⋮
> Hard disk 9	40	GB	⋮
∨ New Hard disk *	80	GB	⋮

Maximum Size 250 GB
VM storage policy vVol_database ∨
Location VCF_ORA_LOGS ∨
Disk Provisioning Thin Provision ∨
Sharing Multi-writer ∨
Disk Mode Independent - Persistent ∨
Virtual Device Node SCSI controller 1 ∨ SCSI(1:9) New Hard disk ∨

> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ∨	<input checked="" type="checkbox"/> Connected ⋮
> Network adapter 2	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ∨	<input checked="" type="checkbox"/> Connected ⋮

CANCEL

OK

> Hard disk 3	10	GB	⋮
> Hard disk 4	10	GB	⋮
> Hard disk 5	10	GB	⋮
> Hard disk 6	40	GB	⋮
> Hard disk 7	40	GB	⋮
> Hard disk 8	40	GB	⋮
> Hard disk 9	40	GB	⋮
> Hard disk 10	80	GB	⋮
∨ New Hard disk *	80	GB	⋮
Maximum Size	249.98 GB		
VM storage policy	vVol_database		
Location	VCF_ORA_LOGS		
Disk Provisioning	Thin Provision		
Sharing	Multi-writer		
Disk Mode	Independent - Persistent		
Virtual Device Node	SCSI controller 1 SCSI(1:10) New Hard disk		
> SCSI controller 0	VMware Paravirtual		⋮
> SCSI controller 1	VMware Paravirtual		⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt	<input checked="" type="checkbox"/> Connected	⋮
> Network adapter 2	vlan-180	<input checked="" type="checkbox"/> Connected	⋮

CANCEL

OK

7. From RAC node 2, add a disk to VM for Oracle binary storage without sharing.

> CPU	4 ▾ ⓘ	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
▾ New Hard disk *	50	GB ▾
Maximum Size	149.99 GB	
VM storage policy	vVol_database ▾	
Location	VCF_ORA_BINS ▾	
Disk Provisioning	Thin Provision ▾	
Sharing	No sharing ▾	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾ SCSI(1:0) New Hard disk ▾	
> SCSI controller 0	VMware Paravirtual	
> SCSI controller 1	VMware Paravirtual	
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On
> Video card	Specify custom settings ▾	
> Other	Additional Hardware	

CANCEL OK

8. From RAC node 2, add other shared disks by selecting Existing Hard Disks option and enable multi-writer sharing for each shared disk.

Select File



[← GO BACK TO DATASTORES](#)

Filter by a folder name

- ▼ VCF_ORA_CRS
 - ▼ ora_01
 - .sdd.sf

Folders per page 1000

File Type: Compatible Virtual Disks(*.vmdk, *.dsk, *.raw)

	Name	Size	Modified
<input checked="" type="radio"/>	ora_01.vmdk	10,485,760 K B	07/30/2024, 1:55:17 PM
<input type="radio"/>	ora_01_1.vmdk	10,485,760 K B	07/30/2024, 2:03:05 PM
<input type="radio"/>	ora_01_2.vmdk	10,485,760 K B	07/30/2024, 2:06:13 PM

Manage Columns

3 items

CANCEL

OK

> CPU	4 ▾ i	
> Memory	16	GB ▾
> Hard disk 1	50	GB ▾
> Hard disk 2	50	GB ▾
▾ New Hard disk *	10	GB ▾
Maximum Size	4.83 TB	
VM storage policy	vVol_database ▾	
Sharing	Multi-writer ▾	
Disk File	[VCF_ORA_CRS] naa.600a0980383043595a2b506b67777a70/ora_01.vmdk	
Disk Mode	Independent - Persistent ▾	
Virtual Device Node	SCSI controller 1 ▾	SCSI(1:1) New Hard disk ▾
> SCSI controller 0	VMware Paravirtual	⋮
> SCSI controller 1	VMware Paravirtual	⋮
> Network adapter 1	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt ▾	<input checked="" type="checkbox"/> Connected ⋮
> Network adapter 2	vlan-180 ▾	<input checked="" type="checkbox"/> Connected ⋮
> CD/DVD drive 1	Client Device ▾	<input checked="" type="checkbox"/> Connect At Power On ⋮
> Video card	Specify custom settings ▾	
> Other	Additional Hardware	

CANCEL OK

9. 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. This should be done on all RAC nodes.

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

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

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

```

[admin@ora01 ~]$ sudo lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                  8:0    0   50G  0 disk
├─sda1                8:1    0   600M  0 part /boot/efi
├─sda2                8:2    0    1G   0 part /boot
└─sda3                8:3    0  48.4G  0 part
   └─rhel-root        253:0    0  43.4G  0 lvm  /
      └─rhel-swap    253:1    0    5G   0 lvm  [SWAP]
sdb                  8:16    0   50G  0 disk
sdc                  8:32    0   10G  0 disk
sdd                  8:48    0   10G  0 disk
sde                  8:64    0   10G  0 disk
sdf                  8:80    0   40G  0 disk
sdg                  8:96    0   40G  0 disk
sdh                  8:112   0   40G  0 disk
sdi                  8:128   0   40G  0 disk
sdj                  8:144   0   80G  0 disk
sdk                  8:160   0   80G  0 disk
sr0                  11:0    1 1024M  0 rom
[admin@ora01 ~]$

```

```

[admin@ora02 ~]$ sudo lsblk
NAME                MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda                  8:0    0   50G  0 disk
├─sda1                8:1    0   600M  0 part /boot/efi
├─sda2                8:2    0    1G   0 part /boot
└─sda3                8:3    0  48.4G  0 part
   └─rhel-root        253:0    0  43.4G  0 lvm  /
      └─rhel-swap    253:1    0    5G   0 lvm  [SWAP]
sdb                  8:16    0   50G  0 disk
sdc                  8:32    0   10G  0 disk
sdd                  8:48    0   10G  0 disk
sde                  8:64    0   10G  0 disk
sdf                  8:80    0   40G  0 disk
sdg                  8:96    0   40G  0 disk
sdh                  8:112   0   40G  0 disk
sdi                  8:128   0   40G  0 disk
sdj                  8:144   0   80G  0 disk
sdk                  8:160   0   80G  0 disk
sr0                  11:0    1 1024M  0 rom
[admin@ora02 ~]$

```

- From each RAC node, partition the Oracle binary disk (/dev/sdb) as a primary and single partition by simply accepting the default choices.

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

12. Format the partitioned disks as xfs file systems.

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

13. Mount the disk to mount point /u01.

```
[admin@ora01 ~]$ df -h
```

Filesystem	Size	Used	Avail	Use%	Mounted on
devtmpfs	7.7G	36K	7.7G	1%	/dev
tmpfs	7.8G	1.4G	6.4G	18%	/dev/shm
tmpfs	7.8G	34M	7.7G	1%	/run
tmpfs	7.8G	0	7.8G	0%	/sys/fs/cgroup
/dev/mapper/rhel-root	44G	29G	16G	66%	/
/dev/sda2	1014M	249M	766M	25%	/boot
/dev/sda1	599M	5.9M	593M	1%	/boot/efi
/dev/sdb1	50G	24G	27G	47%	/u01
tmpfs	1.6G	12K	1.6G	1%	/run/user/42
tmpfs	1.6G	0	1.6G	0%	/run/user/54331
tmpfs	1.6G	4.0K	1.6G	1%	/run/user/1000

14. 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
```

Oracle RAC deployment in VCF

It's recommended to leverage NetApp automation toolkit to deploy Oracle RAC in VCF with vVols. Read the included instruction (README) carefully and configure deployment parameter files such as deployment target file - hosts, global variables file - vars/vars.yml, and local DB VM variables file - host_vars/host_name.yml by following instructions in the toolkit. Following is the step by step procedures.

1. Login to Ansible controller VM as admin user via ssh and clone a copy of automation toolkit for Oracle RAC deployment in VCF with vVols.

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

2. Stage the following Oracle installation files in /tmp/archive folder on RAC node 1 database VM. The folder should allow all user access with 777 permission.

```
LINUX.X64_193000_grid_home.zip  
p34762026_190000_Linux-x86-64.zip  
LINUX.X64_193000_db_home.zip  
p34765931_190000_Linux-x86-64.zip  
p6880880_190000_Linux-x86-64.zip
```

3. 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
```

4. Configure the user defined target host parameters files. Following is an example of typical configuration for target hosts file - hosts.

```
#Oracle hosts  
[oracle]  
ora01 ansible_host=10.61.180.21  
ansible_ssh_private_key_file=ora01.pem  
ora02 ansible_host=10.61.180.22  
ansible_ssh_private_key_file=ora02.pem
```

5. Configure the user defined local host specific parameters files. Following is an example of typical configuration for local host_name.yml file - ora01.yml.

```

# Binary lun
ora_bin: /dev/sdb

# Host DB configuration
ins_sid: "{{ oracle_sid }}"
asm_sid: +ASM1

```

6. Configure the user defined global parameters file. Following is an example of typical configuration for global parameters file - vars.yml

```

#####
###
### ONTAP env specific config variables
###
#####
###

# ONTAP storage platform: on-prem, vmware-vvols
ontap_platform: vmware-vvols

# Prerequisite to create five vVolss in VMware vCenter
# VCF_ORA_BINS - Oracle binary
# VCF_ORA_CRS - Oracle cluster registry and vote
# VCF_ORA_DAT1 - Oracle data on node1
# VCF_ORA_DAT2 - Oracle data on node2
# VCF_ORA_LOGS - Oracle logs on node1 or node2

# Oracle disks are added to VM from vVols: 1 binary disk, 3 CRS
disks, 4 data disks, and 2 log disks.

#####
##
### Linux env specific config variables
###
#####
##

redhat_sub_username: XXXXXXXX
redhat_sub_password: "XXXXXXXX"

# Networking configuration
cluster_pub_ip:
  - {ip: 10.61.180.21, hostname: ora01}
  - {ip: 10.61.180.22, hostname: ora02}

```

```

cluster_pri_ip:
- {ip: 172.21.166.22, hostname: ora01-pri}
- {ip: 172.21.166.24, hostname: ora02-pri}

cluster_vip_ip:
- {ip: 10.61.180.93, hostname: ora01-vip}
- {ip: 10.61.180.94, hostname: ora02-vip}

cluster_scan_name: ntap-scan
cluster_scan_ip:
- {ip: 10.61.180.90, hostname: ntap-scan}
- {ip: 10.61.180.91, hostname: ntap-scan}
- {ip: 10.61.180.92, hostname: ntap-scan}

#####
#
### DB env specific install and config variables
###
#####
#

# Shared Oracle RAC storage
ora_crs:
- { device: /dev/sdc, name: ora_crs_01 }
- { device: /dev/sdd, name: ora_crs_02 }
- { device: /dev/sde, name: ora_crs_03 }

ora_data:
- { device: /dev/sdf, name: ora_data_01 }
- { device: /dev/sdg, name: ora_data_02 }
- { device: /dev/sdh, name: ora_data_03 }
- { device: /dev/sdi, name: ora_data_04 }

ora_logs:
- { device: /dev/sdj, name: ora_logs_01 }
- { device: /dev/sdk, name: ora_logs_02 }

# Oracle RAC configuration

oracle_sid: NTAP
cluster_name: ntap-rac
cluster_nodes: ora01,ora02
cluster_domain: solutions.netapp.com
grid_cluster_nodes: ora01:ora01-vip:HUB,ora02:ora02-vip:HUB

```

```
network_interface_list: ens33:10.61.180.0:1,ens34:172.21.166.0:5
memory_limit: 10240
```

```
# Set initial password for all required Oracle passwords. Change
them after installation.
initial_pwd_all: "XXXXXXXX"
```

7. From Ansible controller, cloned automation toolkit home directory
/home/admin/na_oracle_deploy_rac, execute prerequisites playbook to setup ansible prerequisites.

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

8. Execute Linux configuration playbook.

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

9. Execute Oracle deployment playbook.

```
ansible-playbook -i hosts 4-oracle_config.yml -u admin -e
@vars/vars.yml
```

10. 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
```

Oracle RAC deployment validation in VCF

This section provides details on Oracle RAC deployment validation in VCF to ensure all Oracle RAC resources are fully deployed, configured, and functioning as expected.

1. Login to RAC VM as admin user to validate Oracle grid infrastructure.

```
[admin@ora01 ~]$ sudo su
[root@ora01 admin]# su - grid
[grid@ora01 ~]$ crsctl stat res -t
-----
-----
Name          Target  State          Server          State
details
-----
-----
Local Resources
-----
-----
ora.LISTENER.lsnr
          ONLINE  ONLINE         ora01           STABLE
          ONLINE  ONLINE         ora02           STABLE
ora.chad
          ONLINE  ONLINE         ora01           STABLE
          ONLINE  ONLINE         ora02           STABLE
ora.net1.network
          ONLINE  ONLINE         ora01           STABLE
          ONLINE  ONLINE         ora02           STABLE
ora.ons
          ONLINE  ONLINE         ora01           STABLE
          ONLINE  ONLINE         ora02           STABLE
ora.proxy_advm
          OFFLINE OFFLINE        ora01           STABLE
          OFFLINE OFFLINE        ora02           STABLE
-----
-----
Cluster Resources
-----
-----
ora.ASMNET1LSNR_ASM.lsnr(ora.asmgroup)
    1      ONLINE  ONLINE         ora01           STABLE
    2      ONLINE  ONLINE         ora02           STABLE
ora.DATA.dg(ora.asmgroup)
    1      ONLINE  ONLINE         ora01           STABLE
    2      ONLINE  ONLINE         ora02           STABLE
ora.LISTENER_SCAN1.lsnr
    1      ONLINE  ONLINE         ora01           STABLE
```

```

ora.LISTENER_SCAN2.lsnr
  1      ONLINE  ONLINE      ora02      STABLE
ora.LISTENER_SCAN3.lsnr
  1      ONLINE  ONLINE      ora02      STABLE
ora.RECO.dg(ora.asmgroup)
  1      ONLINE  ONLINE      ora01      STABLE
  2      ONLINE  ONLINE      ora02      STABLE
ora.VOTE.dg(ora.asmgroup)
  1      ONLINE  ONLINE      ora01      STABLE
  2      ONLINE  ONLINE      ora02      STABLE
ora.asm(ora.asmgroup)
  1      ONLINE  ONLINE      ora01
Started,STABLE
  2      ONLINE  ONLINE      ora02
Started,STABLE
ora.asmnet1.asmnetwork(ora.asmgroup)
  1      ONLINE  ONLINE      ora01      STABLE
  2      ONLINE  ONLINE      ora02      STABLE
ora.cvu
  1      ONLINE  ONLINE      ora02      STABLE
ora.ntap.db
  1      ONLINE  ONLINE      ora01
Open,HOME=/u01/app/o

racle2/product/19.0.

0/NTAP,STABLE
  2      ONLINE  ONLINE      ora02
Open,HOME=/u01/app/o

racle2/product/19.0.

0/NTAP,STABLE
ora.ora01.vip
  1      ONLINE  ONLINE      ora01      STABLE
ora.ora02.vip
  1      ONLINE  ONLINE      ora02      STABLE
ora.qosmserver
  1      ONLINE  ONLINE      ora02      STABLE
ora.scan1.vip
  1      ONLINE  ONLINE      ora01      STABLE
ora.scan2.vip
  1      ONLINE  ONLINE      ora02      STABLE
ora.scan3.vip
  1      ONLINE  ONLINE      ora02      STABLE
-----

```

```
[grid@ora01 ~]$
```

2. Validate Oracle ASM.

```
[grid@ora01 ~]$ asmcmd
ASMCMDD> lsdg
State      Type      Rebal  Sector  Logical_Sector  Block      AU
Total_MB  Free_MB  Req_mir_free_MB  Usable_file_MB  Offline_disks
Voting_files  Name
MOUNTED   EXTERN   N      512     512    4096    1048576
163840    163723          0      163723          0
N  DATA/
MOUNTED   EXTERN   N      512     512    4096    1048576
163840    163729          0      163729          0
N  RECO/
MOUNTED   NORMAL   N      512     512    4096    4194304
30720     29732    10240   9746          0
Y  VOTE/
ASMCMDD> lsdsk
Path
AFD:ORA_CRS_01
AFD:ORA_CRS_02
AFD:ORA_CRS_03
AFD:ORA_DATA_01
AFD:ORA_DATA_02
AFD:ORA_DATA_03
AFD:ORA_DATA_04
AFD:ORA_LOGS_01
AFD:ORA_LOGS_02
ASMCMDD> afd_state
ASMCMDD-9526: The AFD state is 'LOADED' and filtering is 'ENABLED' on
host 'ora01'
ASMCMDD>
```

3. List cluster nodes.

```
[grid@ora01 ~]$ olsnodes
ora01
ora02
```

4. Validate OCR/VOTE.

```

[grid@ora01 ~]$ ocrcheck
Status of Oracle Cluster Registry is as follows :
    Version                :                4
    Total space (kbytes)    :            901284
    Used space (kbytes)     :            84536
    Available space (kbytes) :            816748
    ID                      :       118267044
    Device/File Name        :            +VOTE
                                Device/File integrity check
succeeded

                                Device/File not configured

                                Device/File not configured

                                Device/File not configured

                                Device/File not configured

Cluster registry integrity check succeeded

Logical corruption check bypassed due to non-privileged
user

[grid@ora01 ~]$ crsctl query css votedisk
##  STATE      File Universal Id                File Name Disk group
--  -
  1.  ONLINE    1ca3fcb0bd354f8ebf00ac97d70e0824 (AFD:ORA_CRS_01)
[VOTE]
  2.  ONLINE    708f84d505a54f58bf41124e09a5115a (AFD:ORA_CRS_02)
[VOTE]
  3.  ONLINE    133ecfcedb684fe6bfdc1899b90f91c7 (AFD:ORA_CRS_03)
[VOTE]
Located 3 voting disk(s).
[grid@ora01 ~]$

```

5. Validate Oracle listener.

```

[grid@ora01 ~]$ lsnrctl status listener

LSNRCTL for Linux: Version 19.0.0.0.0 - Production on 16-AUG-2024
10:21:38

Copyright (c) 1991, 2022, Oracle. All rights reserved.

```

```

Connecting to (DESCRIPTION=(ADDRESS=(PROTOCOL=IPC) (KEY=LISTENER)))
STATUS of the LISTENER
-----
Alias                LISTENER
Version              TNSLSNR for Linux: Version 19.0.0.0.0 -
Production
Start Date           14-AUG-2024 16:24:48
Uptime                1 days 17 hr. 56 min. 49 sec
Trace Level           off
Security              ON: Local OS Authentication
SNMP                  OFF
Listener Parameter File
/u01/app/grid/19.0.0/network/admin/listener.ora
Listener Log File
/u01/app/oracle/diag/tnslnr/ora01/listener/alert/log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc) (KEY=LISTENER)))

  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp) (HOST=10.61.180.21) (PORT=1521)))

  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp) (HOST=10.61.180.93) (PORT=1521)))

  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcps) (HOST=ora01.solutions.netapp.co
m) (PORT=5500)) (Security=(my_wallet_directory=/u01/app/oracle2/produc
t/19.0.0/NTAP/admin/NTAP/xdb_wallet)) (Presentation=HTTP) (Session=RAW
))
Services Summary...
Service "+ASM" has 1 instance(s).
  Instance "+ASM1", status READY, has 1 handler(s) for this
service...
Service "+ASM_DATA" has 1 instance(s).
  Instance "+ASM1", status READY, has 1 handler(s) for this
service...
Service "+ASM_RECO" has 1 instance(s).
  Instance "+ASM1", status READY, has 1 handler(s) for this
service...
Service "+ASM_VOTE" has 1 instance(s).
  Instance "+ASM1", status READY, has 1 handler(s) for this
service...
Service "1fbf0aaa1d13cb5ae06315b43d0ab734.solutions.netapp.com" has
1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "1fbf142e7db2d090e06315b43d0a6894.solutions.netapp.com" has
1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this

```

```
service...
Service "1fbf203c3a46d7bae06315b43d0ae055.solutions.netapp.com" has
1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "NTAP.solutions.netapp.com" has 1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "NTAPXDB.solutions.netapp.com" has 1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "ntap_pdb1.solutions.netapp.com" has 1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "ntap_pdb2.solutions.netapp.com" has 1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
Service "ntap_pdb3.solutions.netapp.com" has 1 instance(s).
  Instance "NTAP1", status READY, has 1 handler(s) for this
service...
The command completed successfully
[grid@ora01 ~]$
```

```
[grid@ora01 ~]$ tnsping ntap-scan
```

```
TNS Ping Utility for Linux: Version 19.0.0.0.0 - Production on 16-
AUG-2024 12:07:58
```

```
Copyright (c) 1997, 2022, Oracle. All rights reserved.
```

```
Used parameter files:
```

```
/u01/app/grid/19.0.0/network/admin/sqlnet.ora
```

```
Used EZCONNECT adapter to resolve the alias
```

```
Attempting to contact
```

```
(DESCRIPTION=(CONNECT_DATA=(SERVICE_NAME=)) (ADDRESS=(PROTOCOL=tcp) (H
OST=10.61.180.90) (PORT=1521)) (ADDRESS=(PROTOCOL=tcp) (HOST=10.61.180.
91) (PORT=1521)) (ADDRESS=(PROTOCOL=tcp) (HOST=10.61.180.92) (PORT=1521)
))
```

```
OK (10 msec)
```

6. Change to oracle user to validate the clustered database.

```
[oracle@ora02 ~]$ sqlplus / as sysdba
```

```
SQL*Plus: Release 19.0.0.0.0 - Production on Fri Aug 16 11:32:23
```

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, log_mode from v\$database;

NAME	OPEN_MODE	LOG_MODE
NTAP	READ WRITE	ARCHIVELOG

SQL> show pdbs

CON_ID	CON_NAME	OPEN MODE	RESTRICTED
2	PDB\$SEED	READ ONLY	NO
3	NTAP_PDB1	READ WRITE	NO
4	NTAP_PDB2	READ WRITE	NO
5	NTAP_PDB3	READ WRITE	NO

SQL> select name from v\$datafile

2 union

3 select name from v\$controlfile

4 union

5 select member from v\$logfile;

NAME

+DATA/NTAP/1FBF0AAA1D13CB5AE06315B43D0AB734/DATAFILE/sysaux.275.1177
083797
+DATA/NTAP/1FBF0AAA1D13CB5AE06315B43D0AB734/DATAFILE/system.274.1177
083797
+DATA/NTAP/1FBF0AAA1D13CB5AE06315B43D0AB734/DATAFILE/undo_2.277.1177
083853
+DATA/NTAP/1FBF0AAA1D13CB5AE06315B43D0AB734/DATAFILE/undotbs1.273.11
77083797
+DATA/NTAP/1FBF0AAA1D13CB5AE06315B43D0AB734/DATAFILE/users.278.11770
83901
+DATA/NTAP/1FBF142E7DB2D090E06315B43D0A6894/DATAFILE/sysaux.281.1177
083903

```
+DATA/NTAP/1FBF142E7DB2D090E06315B43D0A6894/DATAFILE/system.280.1177
083903
+DATA/NTAP/1FBF142E7DB2D090E06315B43D0A6894/DATAFILE/undo_2.283.1177
084061
+DATA/NTAP/1FBF142E7DB2D090E06315B43D0A6894/DATAFILE/undotbs1.279.11
77083903
+DATA/NTAP/1FBF142E7DB2D090E06315B43D0A6894/DATAFILE/users.284.11770
84103
+DATA/NTAP/1FBF203C3A46D7BAE06315B43D0AE055/DATAFILE/sysaux.287.1177
084105
```

NAME

```
-----
-----
+DATA/NTAP/1FBF203C3A46D7BAE06315B43D0AE055/DATAFILE/system.286.1177
084105
+DATA/NTAP/1FBF203C3A46D7BAE06315B43D0AE055/DATAFILE/undo_2.289.1177
084123
+DATA/NTAP/1FBF203C3A46D7BAE06315B43D0AE055/DATAFILE/undotbs1.285.11
77084105
+DATA/NTAP/1FBF203C3A46D7BAE06315B43D0AE055/DATAFILE/users.290.11770
84125
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/sysaux.266.1177
081837
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/system.265.1177
081837
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/undotbs1.267.11
77081837
+DATA/NTAP/CONTROLFILE/current.261.1177080403
+DATA/NTAP/DATAFILE/sysaux.258.1177080245
+DATA/NTAP/DATAFILE/system.257.1177080129
+DATA/NTAP/DATAFILE/undotbs1.259.1177080311
```

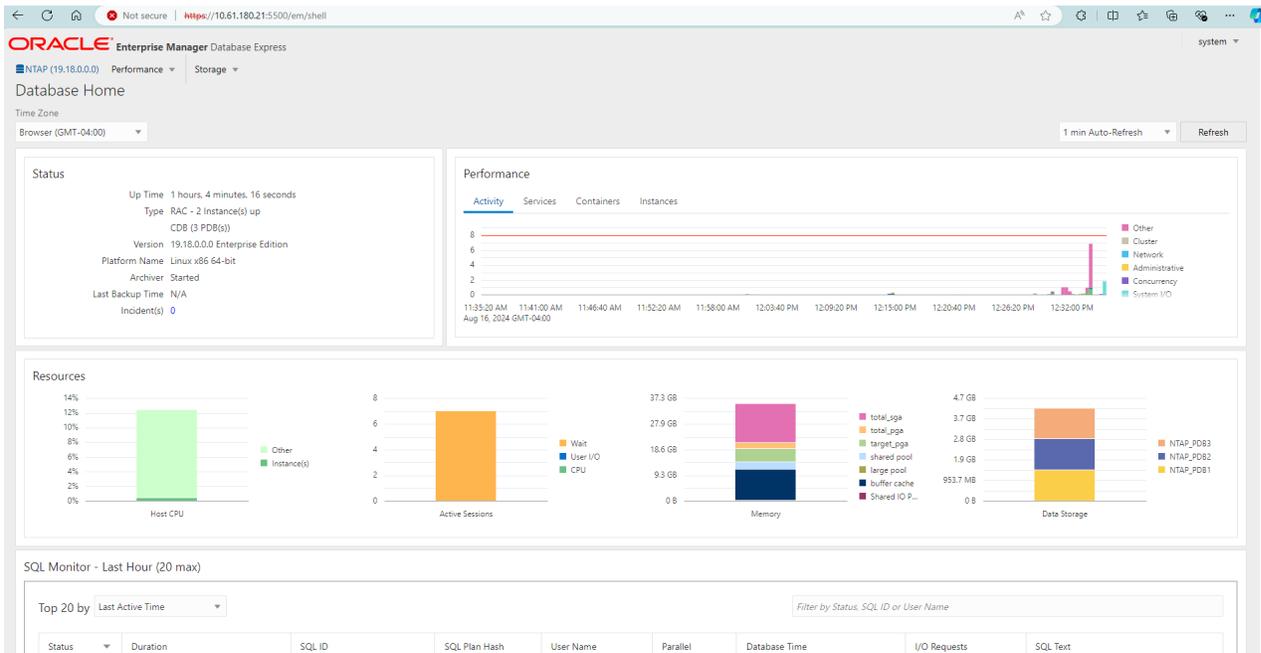
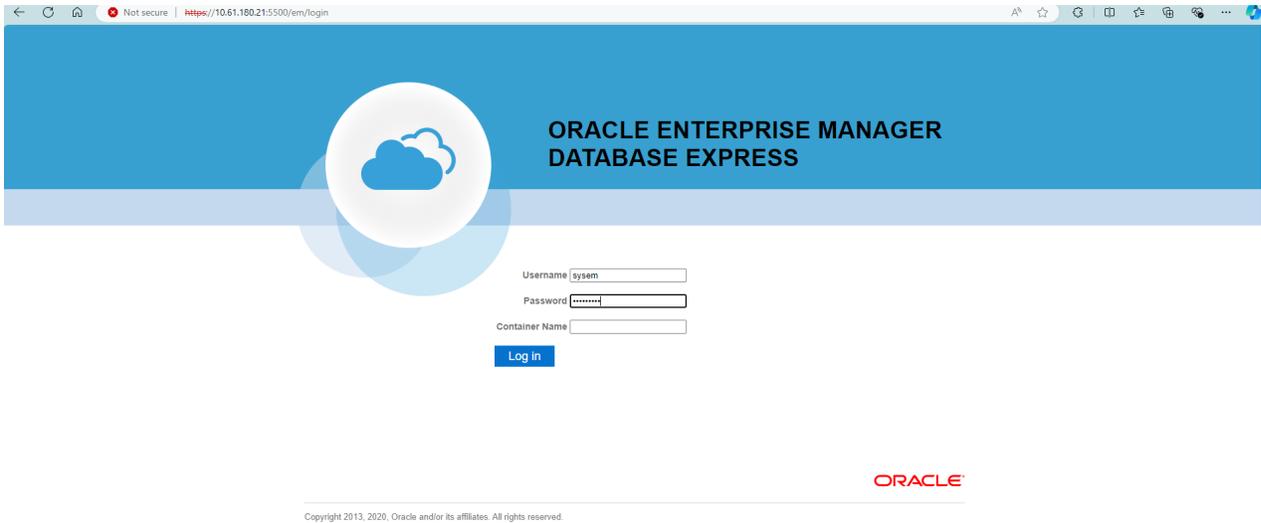
NAME

```
-----
-----
+DATA/NTAP/DATAFILE/undotbs2.269.1177082203
+DATA/NTAP/DATAFILE/users.260.1177080311
+DATA/NTAP/ONLINELOG/group_1.262.1177080427
+DATA/NTAP/ONLINELOG/group_2.263.1177080427
+DATA/NTAP/ONLINELOG/group_3.270.1177083297
+DATA/NTAP/ONLINELOG/group_4.271.1177083313
+RECO/NTAP/CONTROLFILE/current.256.1177080403
+RECO/NTAP/ONLINELOG/group_1.257.1177080427
+RECO/NTAP/ONLINELOG/group_2.258.1177080427
+RECO/NTAP/ONLINELOG/group_3.259.1177083313
```

```
+RECO/NTAP/ONLINELOG/group_4.260.1177083315
```

33 rows selected.

7. Or login to EM express to to validate RAC database after successful playbook execution.

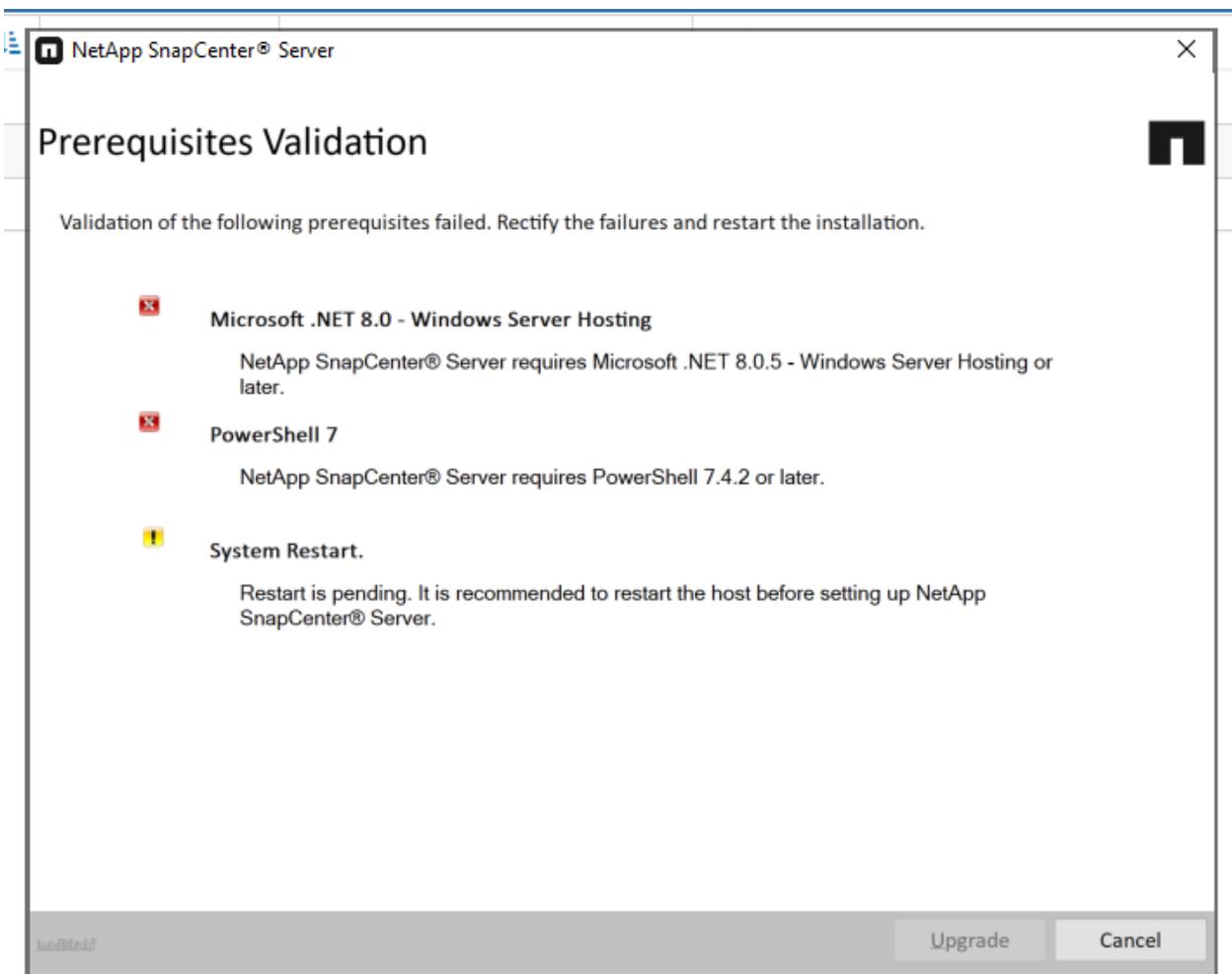


Oracle RAC database backup and recovery in VCF with SnapCenter

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 RAC database backup and recovery 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.

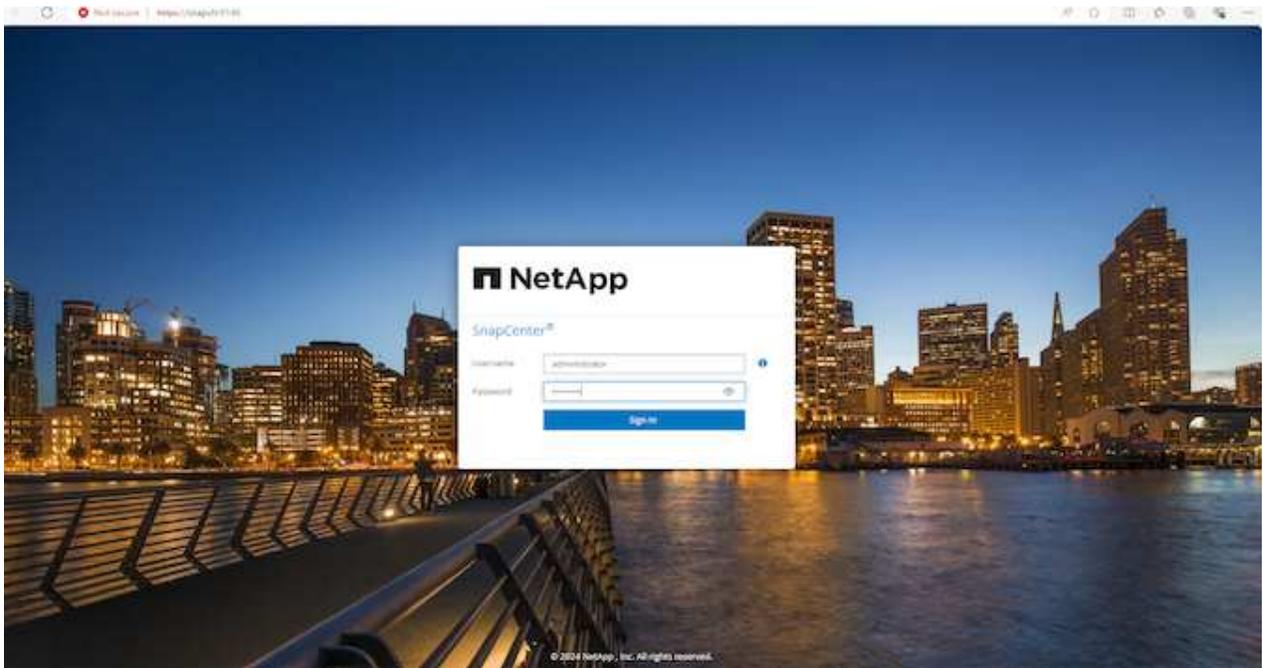


3. As administrator, install latest java JDK from [Get Java for desktop applications](#).

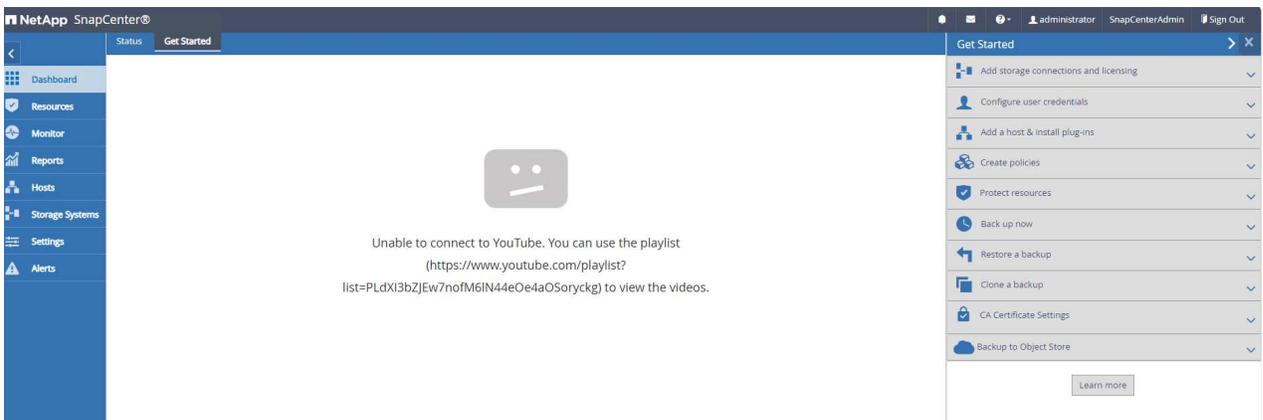


If Windows server is deployed in a domain environment, add a domain user to SnapCenter server local administrators group and run SnapCenter installation with the domain user.

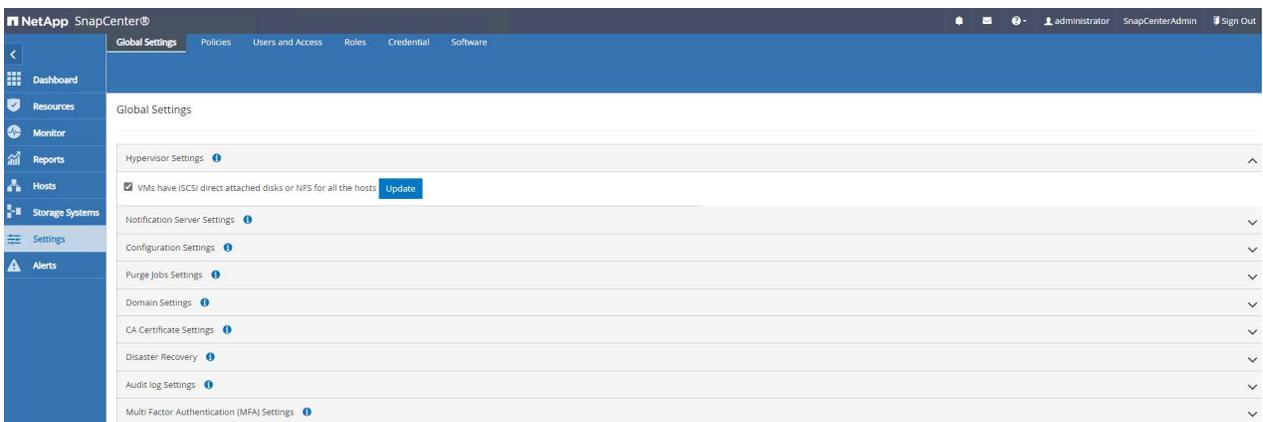
4. Login to SnapCenter UI via HTTPS port 8846 as installation user to configure SnapCenter for Oracle.



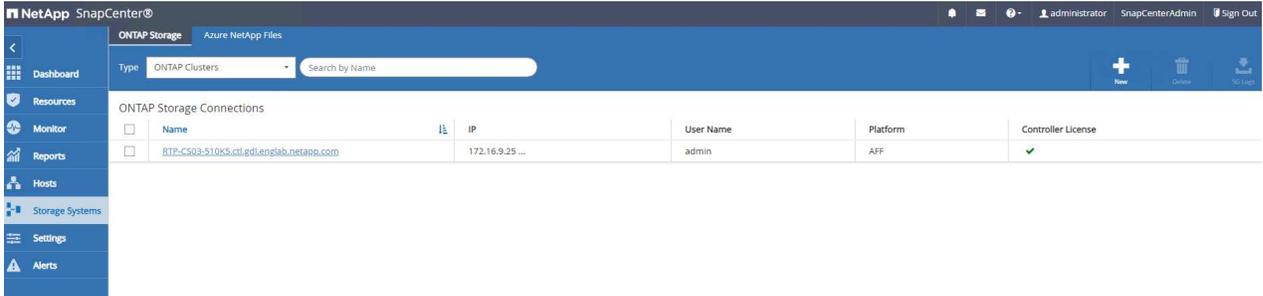
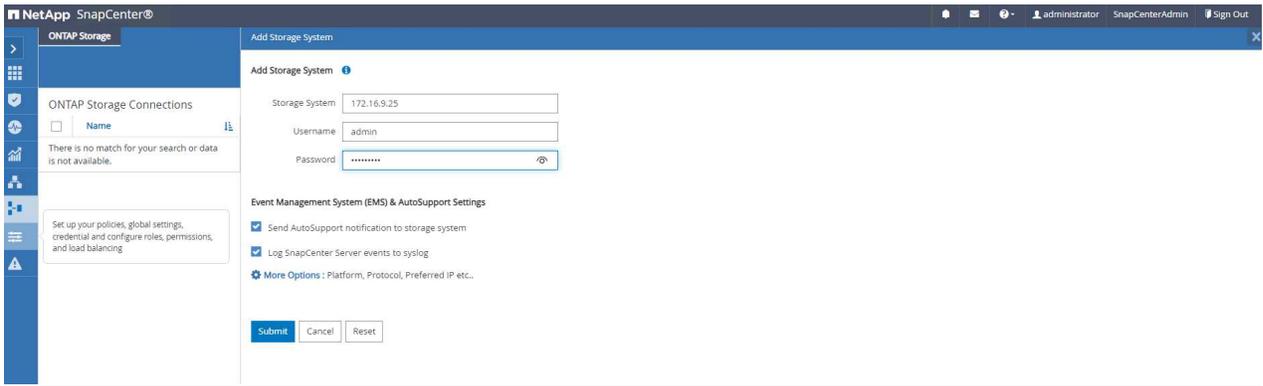
5. Review Get Started menu to get up to speed on SnapCenter if you are a new user.



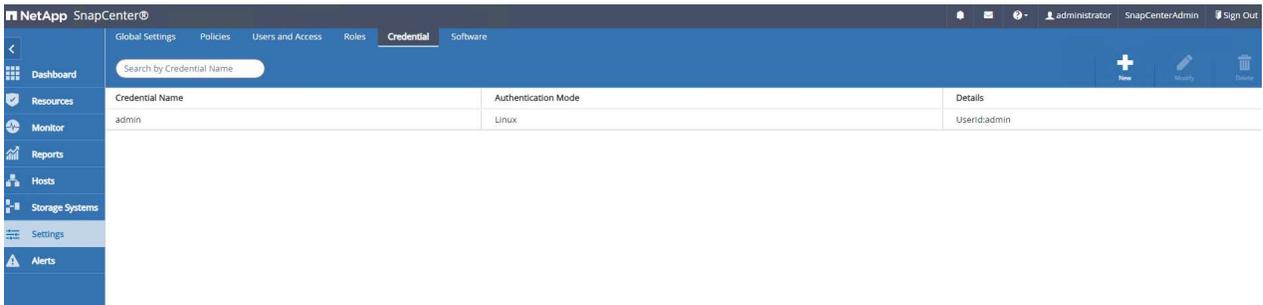
6. Update Hypervisor Settings in global settings.



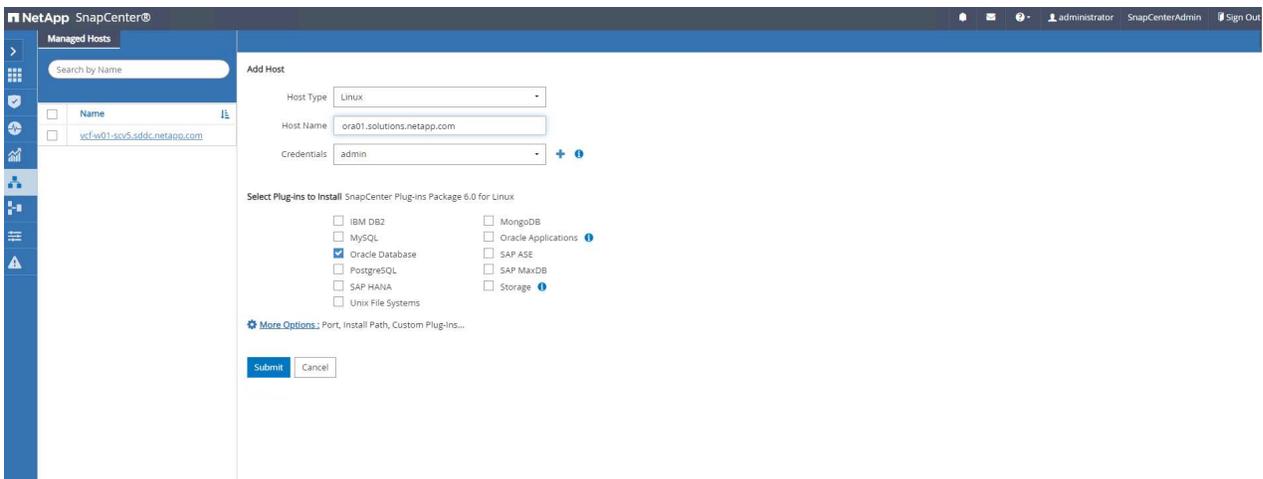
7. Add ONTAP storage cluster to Storage Systems with cluster management IP and authenticated via cluster admin user ID.



8. Add Oracle RAC database VMs 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. vSphere plugin VM management user ID is defined when the plugin VM is deployed in vCenter.



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



Confirm Fingerprint

Authenticity of the host cannot be determined ⓘ

Host name	Fingerprint	Valid
ora01.solutions.netapp.com	ssh-ed25519 256 FA:ED:C8:FC:C3:A3:95:6B:C8:BF:0A:C4:69:E6:FF:6A	

Confirm and Submit

Close

Confirm Fingerprint

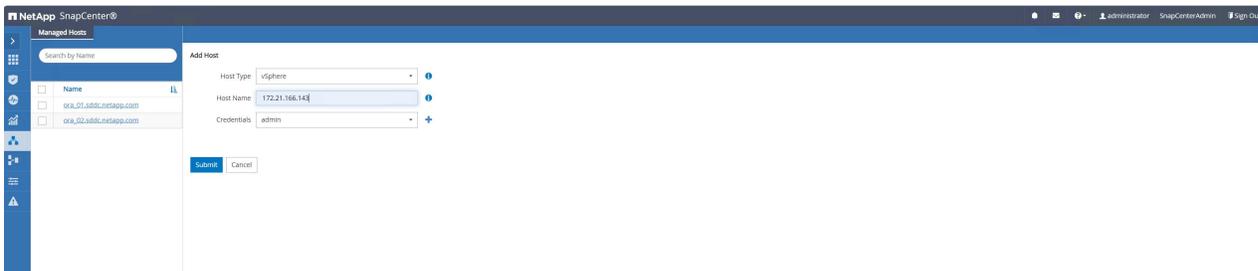
Authenticity of the host cannot be determined ⓘ

Host name	Fingerprint	Valid
ora01.solutions.netapp.com	ssh-ed25519 256 FA:ED:C8:FC:C3:A3:95:6B:C8:BF:0A:C4:69:E6:FF:6A	✓
ora02.solutions.netapp.com	ssh-ed25519 256 FA:ED:C8:FC:C3:A3:95:6B:C8:BF:0A:C4:69:E6:FF:6A	

Confirm Others and Submit

Close

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



Name	Type	System	Plugin	Version	Overall Status
ora01.solutions.netapp.com	Linux	RAC Node	Oracle Database, UNIX	6.0	Running
ora02.solutions.netapp.com	Linux	RAC Node	Oracle Database, UNIX	6.0	Running
vxf001.solutions.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.

The screenshot shows the NetApp SnapCenter interface. The top navigation bar includes 'Global Settings', 'Policies', 'Users and Access', 'Roles', 'Credential', and 'Software'. The left sidebar contains 'Dashboard', 'Resources', 'Monitor', 'Reports', 'Hosts', 'Storage Systems', 'Settings', and 'Alerts'. The main content area is titled 'Oracle Database' and features a search bar and action buttons (New, Modify, Copy, Details, Delete). Below is a table with the following data:

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

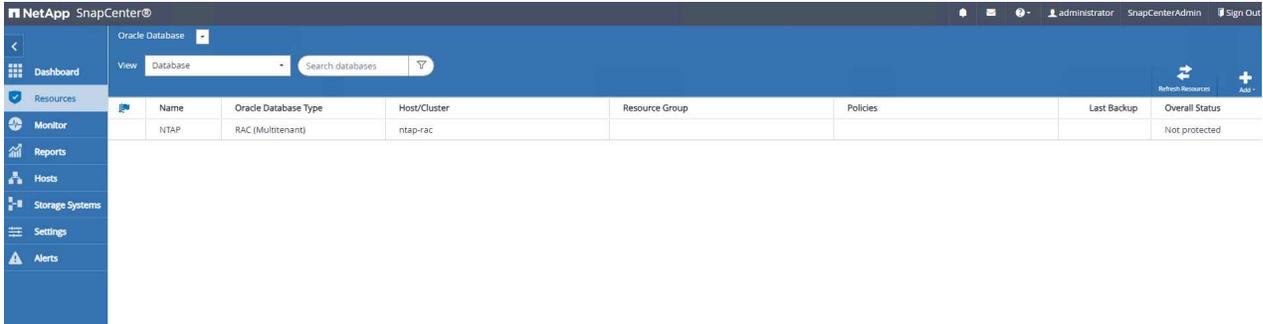


Ensure that the SnapCenter server name can be resolved to the IP address from the DB VM and vSphere plugin VM. Equally, the DB VM name and vSphere plugin VM name can be resolved to the IP address from the SnapCenter server.

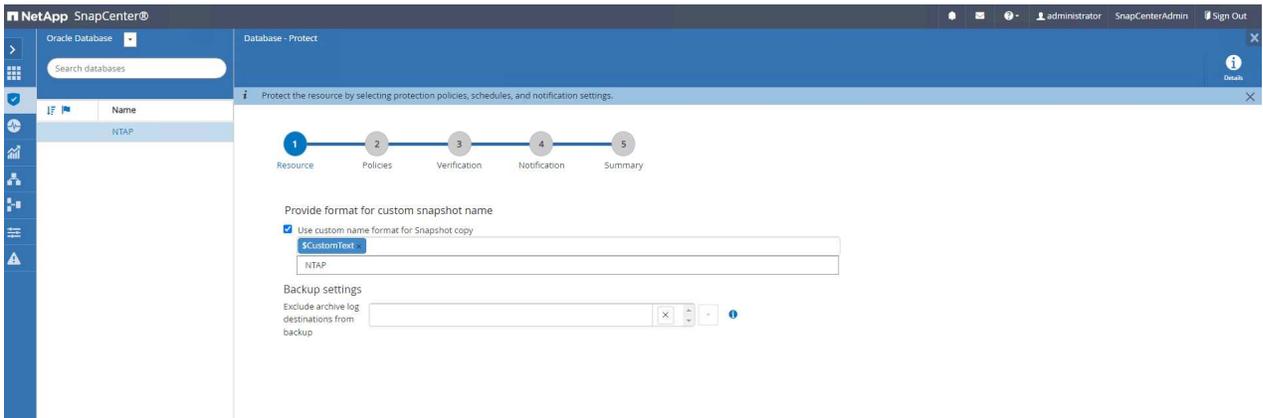
Database backup

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.

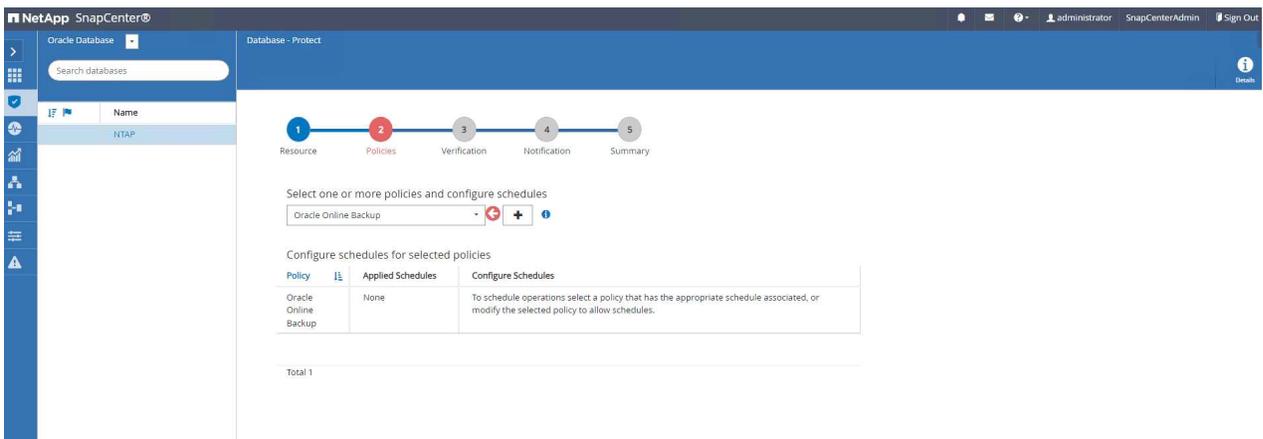
1. From the Resources tab, any databases on the VM are auto-discovered after the VM is added to SnapCenter. Initially, the database status shows as Not protected.



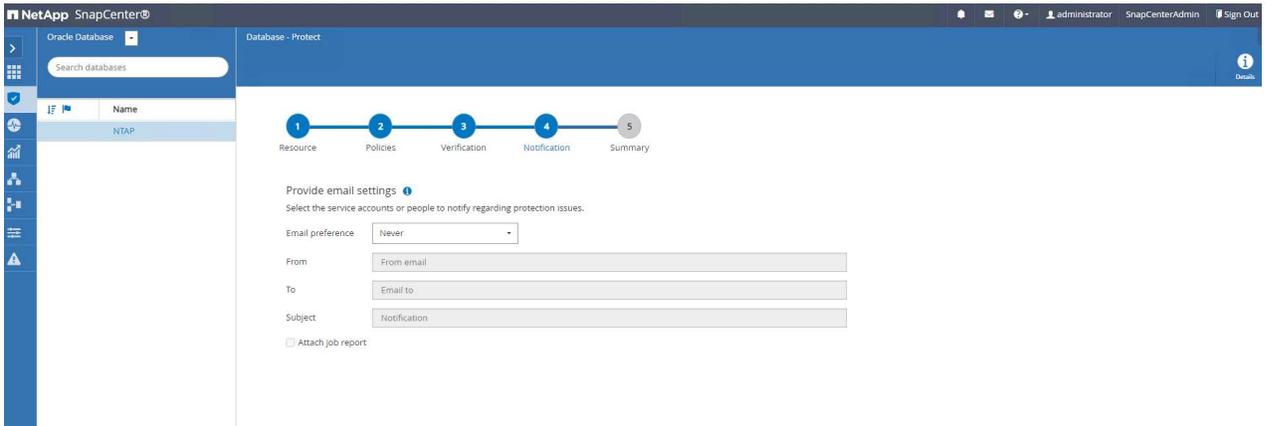
2. Click on database to start a workflow to enable protection for the database.



3. Apply backup policy, setup scheduling if needed.



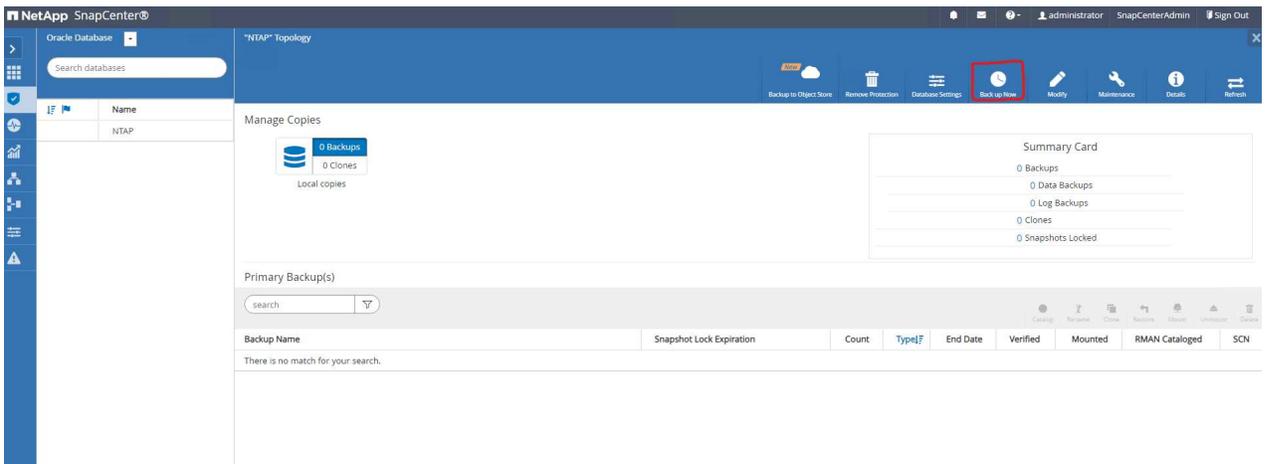
4. Setup backup job notification if required.



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

NTAP

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 'ntap-rac_NTAP' with policy 'Oracle Online Backup'

- ✓ ▾ Backup of Resource Group 'ntap-rac_NTAP' with policy 'Oracle Online Backup'
- ✓ ▶ Identifying preferred host
- ✓ ▾ ora01.solutions.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: ora01.solutions.netapp.com Start Time: 08/16/2024 6:10:10 PM End Time: 08/16/2024 6:14:33 PM

View Logs

Cancel Job

Close

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

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 RAC database 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@ora01 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Mon Aug 19 10:31:12
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> show pdbs

          CON_ID CON_NAME                                OPEN MODE  RESTRICTED
-----
          2 PDB$SEED                                READ ONLY  NO
          3 NTAP_PDB1                                READ WRITE NO
          4 NTAP_PDB2                                READ WRITE NO
          5 NTAP_PDB3                                READ WRITE NO

SQL> alter session set container=ntap_pdb1;

Session altered.

SQL> create table test (id integer, dt timestamp, event
varchar(100));

Table created.

SQL> insert into test values (1, sysdate, 'validate SnapCenter rac
database restore on VMware vVols storage');

1 row created.

SQL> commit;
```

Commit complete.

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

```
          ID
```

```
-----  
DT
```

```
-----  
EVENT
```

```
-----  
          1  
19-AUG-24 10.36.04.000000 AM
```

```
validate SnapCenter rac database restore on VMware vVols storage
```

```
SQL>
```

2. From SnapCenter Resources tab, open the database NTAP1 backup topology page. Highlight the snapshot data backup set created 3 days ago. Click on Restore to launch restore-recover workflow.

The screenshot shows the NetApp SnapCenter interface for the NTAP1 database. The 'Primary Backup(s)' table is displayed with the following data:

Backup Name	Snapshot Lock Expiration	Count	Type	End Date	Verified	Mounted	RMAN Cataloged	SCN
NTAP_08-16-2024_18.10.10.0274_1		1	Log	08/16/2024 6:14:25 PM	Not Applicable	False	Not Cataloged	3165738
NTAP_08-16-2024_18.10.10.0274_0		1	Data	08/16/2024 6:13:39 PM	Unverified	False	Not Cataloged	3164834

The 'Restore' button is highlighted in red in the table's action column.

3. Choose restore scope.

Restore NTAP



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Select RAC Node

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.

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 NTAP



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

Arguments

Script timeout

Previous

Next

6. Specify any optional after-script to run.

Restore NTAP



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 NTAP



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 NTAP



1 Restore Scope

2 Recovery Scope

3 PreOps

4 PostOps

5 Notification

6 Summary

Summary

Restore node	ora01.solutions.netapp.com
Backup name	NTAP_08-16-2024_18.10.10.0274_0
Backup date	08/16/2024 6:13:39 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 , Force in place restore mode
Prescript full path	None
Prescript arguments	
Postscript full path	None
Postscript arguments	
Send email	No

Previous

Finish

9. From RAC DB VM ora01, validate that a successful restore/recovery of database rolled forward to its most recent state and recovered the test table created 3 days later.

```
[root@ora01 ~]# su - oracle
[oracle@ora01 ~]$ sqlplus / as sysdba

SQL*Plus: Release 19.0.0.0.0 - Production on Mon Aug 19 11:51:15
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 from v$database;
```

```
NAME      OPEN_MODE
-----
```

```
NTAP      READ WRITE
```

```
SQL> sho pdba
```

```
CON_ID  CON_NAME                                OPEN MODE  RESTRICTED
-----
```

2	PDB\$SEED	READ ONLY	NO
3	NTAP_PDB1	READ WRITE	NO
4	NTAP_PDB2	READ WRITE	NO
5	NTAP_PDB3	READ WRITE	NO

```
SQL> alter session set container=ntap_pdb1;
```

```
Session altered.
```

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

```
      ID
-----
DT
-----
EVENT
-----
      1
19-AUG-24 10.36.04.000000 AM
validate SnapCenter rac database restore on VMware vVols storage
```

```
SQL> select current_timestamp from dual;
```

```
CURRENT_TIMESTAMP
-----
19-AUG-24 11.55.20.079686 AM -04:00
```

```
SQL> exit
```

```
Disconnected from Oracle Database 19c Enterprise Edition Release
19.0.0.0.0 - Production
Version 19.18.0.0.0
```

This completes the demonstration of SnapCenter backup, restore, and recovery of Oracle RAC database in VCF with vVols.

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](#)
- [ONTAP tools for VMware vSphere documentation](#)

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