TR-5006: High Throughput Oracle VLDB Implementation on Google Cloud NetApp Volumes with Data Guard

NetApp database solutions

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The solution provides an overview and details for configuring high throughput Oracle Very Large Database (VLDB) on Google Cloud NetApp Volumes (GCNV) with Oracle Data Guard in Google cloud.

Purpose

High throughput and mission-critical Oracle VLDB put a heavy demand on backend database storage. To meet service level agreement (SLA), the database storage must deliver the required capacity and high input/output operations per second (IOPS) while maintaining sub milliseconds latency performance. This is particularly challenging when deploying such a database workload in the public cloud with a shared storage resources environment. Not all storage platforms are created equal. GCNV is a premium storage service offered by Google that can support mission-critical Oracle Database deployments in Google cloud requiring sustained IOPS and low-latency performance characteristics. The architecture accommodates OLTP and OLAP workloads, with configurable service tiers supporting various performance profiles. GCNV delivers blazing-fast performance with sub milliseconds latency, achieving up to 4.5 GiBps per volume throughput with mixed read/write workloads.

Leveraging the fast snapshot backup (seconds) and clone (minutes) feature of GCNV, full-size copies of the production database can be cloned from Physical Standby on the fly to serve many other use cases such as DEV, UAT, etc. You can do away with an Active Data Guard license and inefficient and complex Snapshot Standby. The cost savings can be substantial. For a nominal Oracle Data Guard setup with 64 cores CPUs on both primary and standby Oracle servers, just the Active Data Guard licensing cost saving amounts to $1,472,000 based on the latest Oracle price list.

In this documentation, we demonstrate how to set up an Oracle VLDB with Data Guard configuration on GCNVS storage with multiple NFS volumes and Oracle ASM for storage load balancing. The standby database volumes can be quickly backed up via snapshot and cloned for read/write access. NetApp Solutions Engineering team provides an automation toolkit to create and refresh clones with streamlined lifecycle management.

This solution addresses the following use cases:

- Implementation of Oracle VLDB in a Data Guard setting on GCNV storage service across Google cloud regions.
- Snapshot backup and clone the physical standby database to serve use cases such as reporting, dev, test, etc. via automation.

Audience

This solution is intended for the following people:

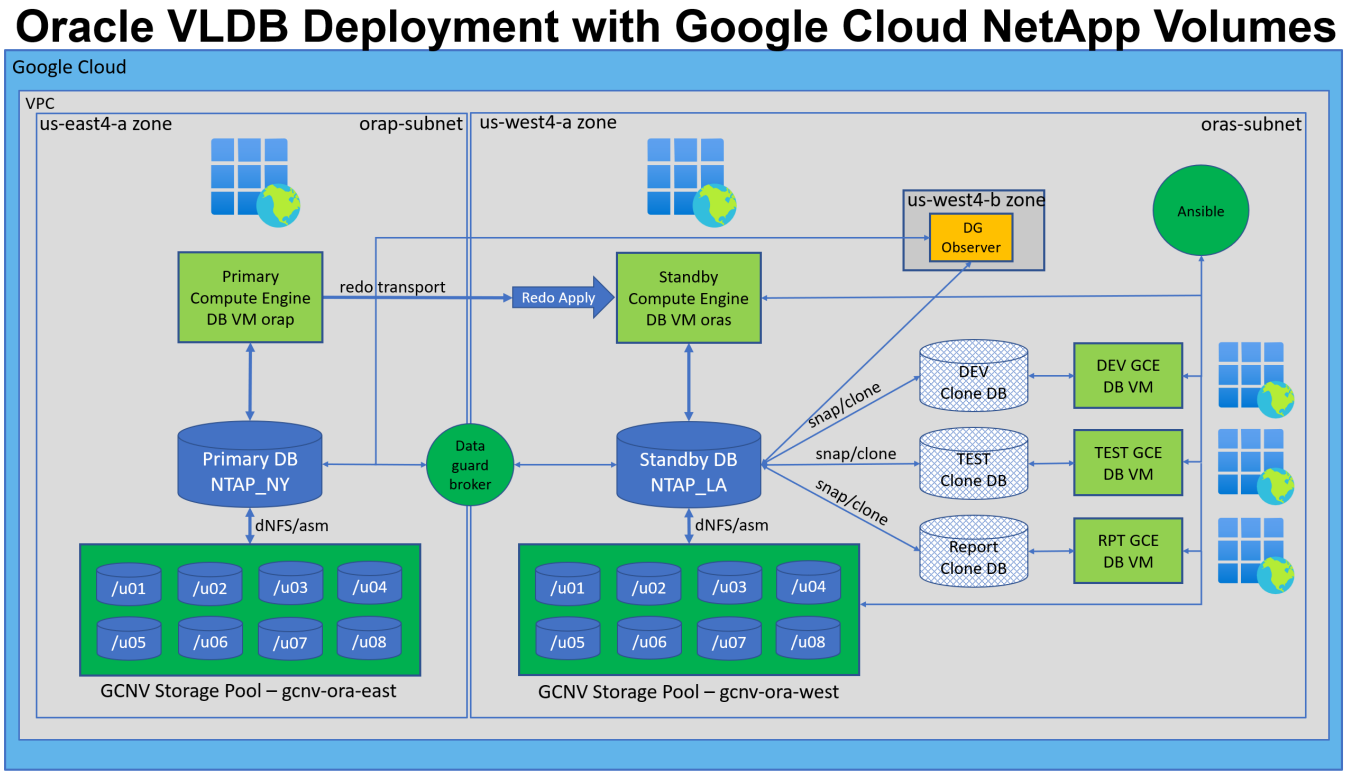
- A DBA who sets up Oracle VLDB with Data Guard in Google cloud for high availability, data protection, and disaster recovery.

- A database solution architect interested in Oracle VLDB with Data Guard configuration in the Google cloud.
- A storage administrator who manages GCNV storage that supports Oracle database.
- An application owner who likes to stand up Oracle VLDB with Data Guard in a Google cloud environment.

Solution test and validation environment

The testing and validation of this solution was performed in a Google cloud lab setting that might not match the actual user deployment environment. For more information, see the section Key factors for deployment consideration.

Architecture



Hardware and software components

Hardware		
Google Cloud NetApp Volumes	Current service offered by Google	Two Storage Pools, Premium Service Level, Auto QoS
Google Compute Engine VMs for DB Servers	N1 (4 vcpus, 15 GiB memory)	Four DB VMs, primary DB server, standby DB server, clone DB server, and Data Guard observer.
Software		
RedHat Linux	Red Hat Enterprise Linux 8.10 (Ootpa) - x86/64	RHEL Marketplace image, PAYG

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
dNFS OneOff Patch	p32931941_190000_Linux-x86-64.zip	Applied to both grid and database
Oracle OPatch	Version 12.2.0.1.36	Latest patch p6880880_190000_Linux-x86-64.zip
Ansible	Version core 2.16.2	python version - 3.10.13
NFS	Version 3.0	dNFS enabled for Oracle

Oracle VLDB Data Guard configuration with a simulated NY to LA DR setup

Database	DB_UNIQUE_NAME	Oracle Net Service Name
Primary	NTAP_NY	NTAP_NY.cvs-pm-host-1p.internal
Standby	NTAP_LA	NTAP_LA.cvs-pm-host-1p.internal

Key factors for deployment consideration

- **Google Cloud NetApp Volumes Configuration.** GCNV are allocated in the Google cloud as `Storage Pools`. In these tests and validations, we deployed an 2 TiB storage pool to host Oracle primary database at the East4 region and a 4 TiB storage pool to host standby database and DB clone at the West4 region. GCNV storage pool has four service levels: Flex, Standard, Premium, and Extreme. The IO capacity of ANF capacity pool is based on the size of the capacity pool and its service level. At a capacity pool creation, you set storage pool location, service level, availability zone, and capacity of storage pool. For Oracle Data Guard configuration, Zonal availability should be sufficient as the Data Guard provides the database failover protection due to a zone level failure.
- **Sizing the Database Volumes.** For production deployment, NetApp recommends taking a full assessment of your Oracle database throughput requirement from Oracle AWR report. Take into consideration the database size, the throughput requirements, and service level when designing GCNV volumes layout for VLDB database. It is recommended to use only `Premium` or `Extreme` service for Oracle database. The bandwidth is guaranteed at 64 MiB/s per TiB volume capacity up to maximum of 4.5 GiBps for `Premium` service and 128 MiB/s per TiB volume capacity up to 4.5 GiBps for `Extreme` service. Higher throughput will need larger volume sizing to meet the requirement.
- **Multiple Volumes and Load Balancing.** A single large volume can provide similar performance level as multiple volumes with same aggregate volume size as the QoS is strictly enforced based on the volume sizing and storage pool service level. It is recommended to implement multiple volumes (multiple NFS mount points) for Oracle VLDB to better utilize shared backend GCNV storage resource pool and to meet throughput requirement exceeding 4.5 GiBps. Implement Oracle ASM for IO load balancing on multiple NFS volumes.
- **Google Compute Engine VM Instance Consideration.** In these tests and validations, we used Compute Engine VM - N1 with 4 vCPUs and 15 GiB memory. You need to choose the Compute Engine DB VM instance appropriately for Oracle VLDB with high throughput requirement. Besides the number of vCPUs

and the amount of RAM, the VM network bandwidth (ingress and egress or NIC throughput limit) can become a bottleneck before database storage throughput is reached.

- **dNFS Configuration.** By using dNFS, an Oracle database running on a Google Compute Engine VM with GCNV storage can drive significantly more I/O than the native NFS client. Ensure that Oracle dNFS patch p32931941 is applied to address potential bugs.

Solution deployment

The following section demonstrates the configuration for Oracle VLDB on GCNV in an Oracle Data Guard setting between a primary Oracle DB in Google cloud of East region with GCNV storage to a physical standby Oracle DB in Google cloud of West region with GCNV storage.

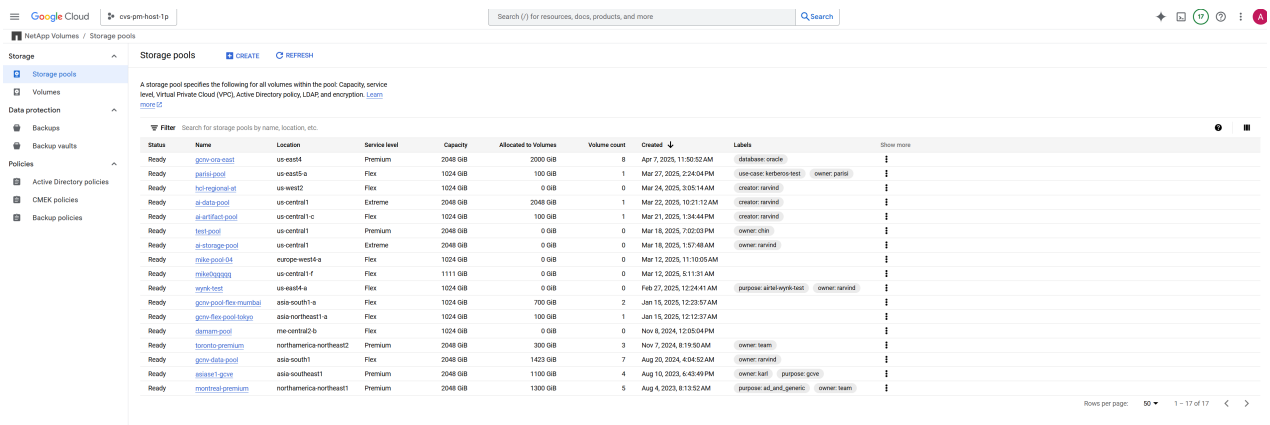
Prerequisites for deployment

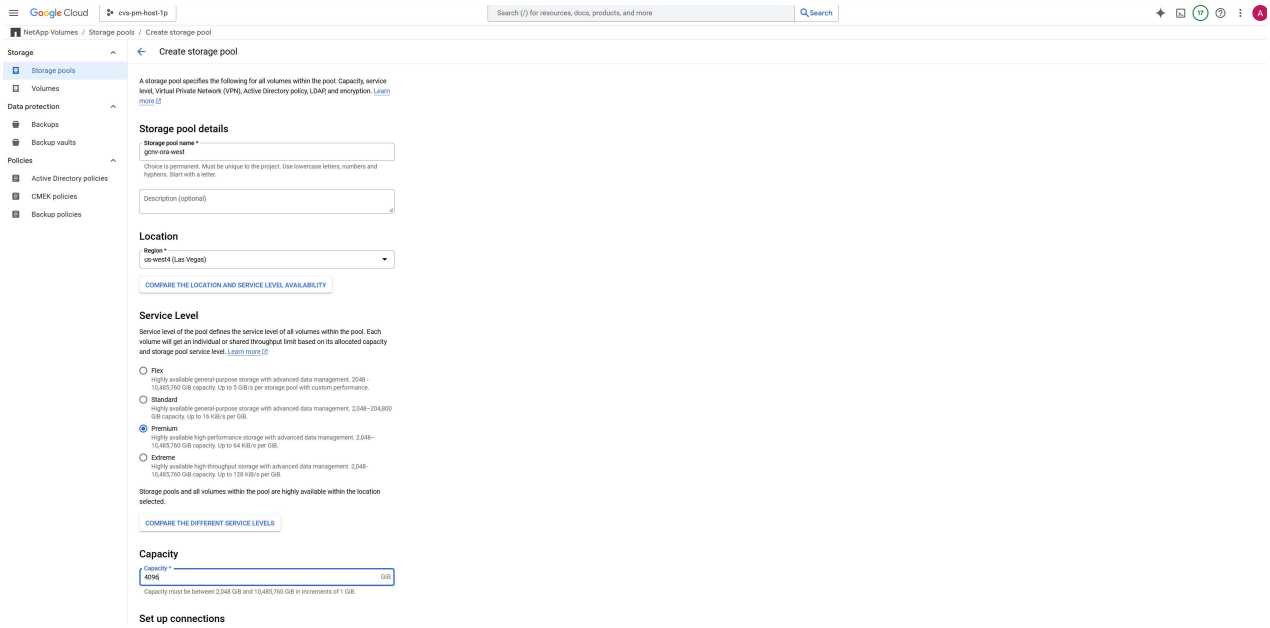
Deployment requires the following prerequisites.

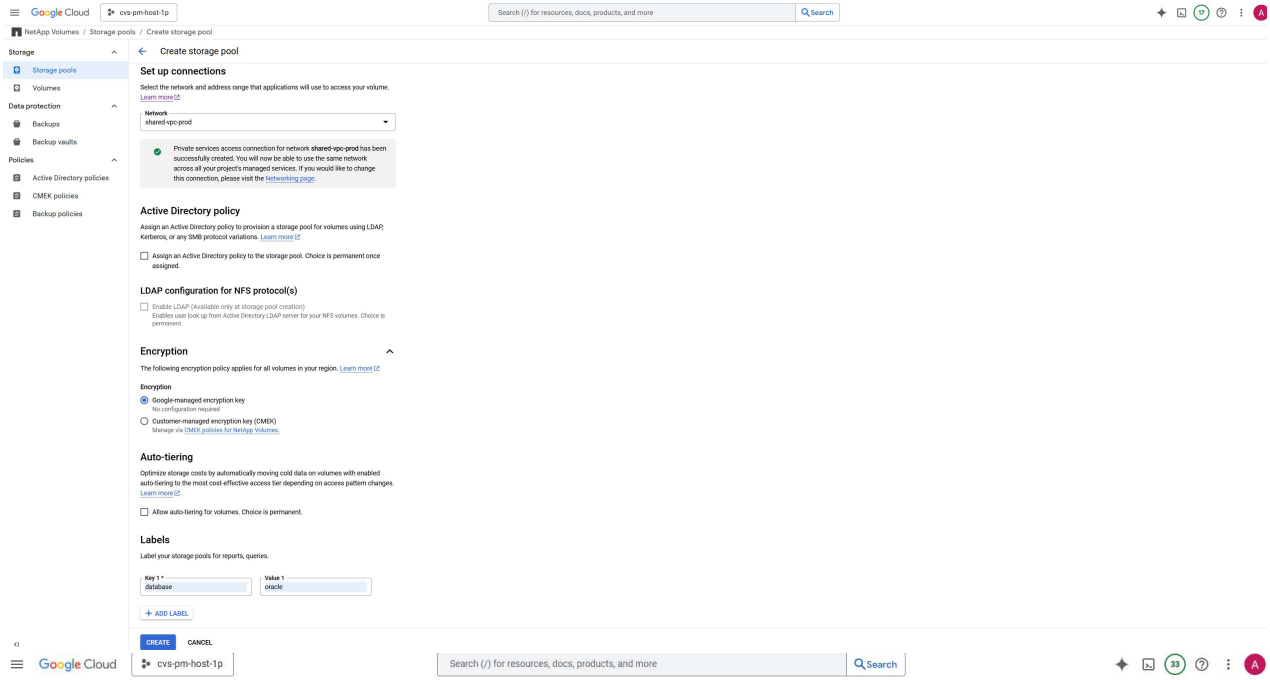
1. A Google cloud account has been set up and a project has been created within your Google account to deploy resources for setting up Oracle Data Guard.
2. Create a VPC and subnets that span the regions that are desired for Data Guard. For a resilient DR setup, consider to place the primary and standby DBs in different geographic locations that can tolerate major diaster in a local region.
3. From the Google cloud portal console, deploy four Google compute engine Linux VM instances, one as the primary Oracle DB server, one as the standby Oracle DB server, a clone target DB server, and an Oracle Data Guard observer. See the architecture diagram in the previous section for more details about the environment setup. Follow Google documentation Create a Linux VM instance in Compute Engine for detailed instructions.

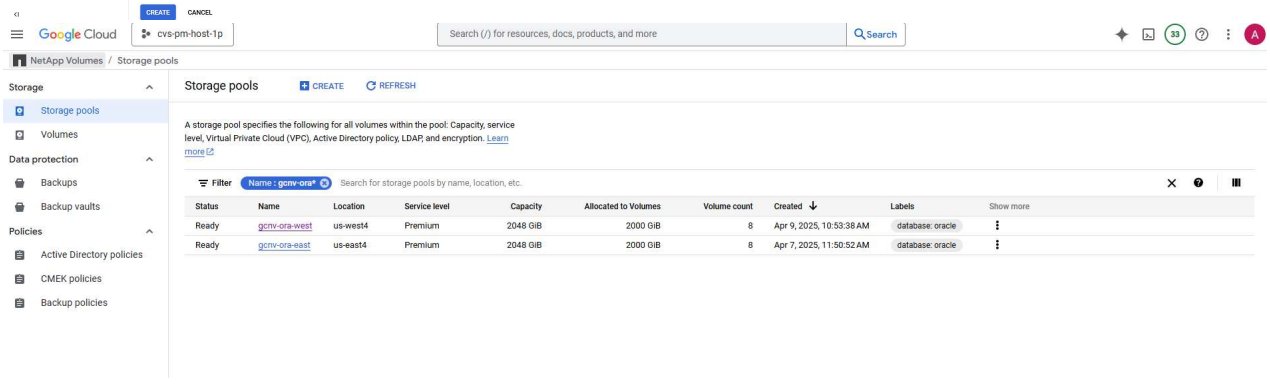
> Ensure that you have allocated at least 50G in the Azure VMs root volume in order to have sufficient space to stage Oracle installation files. Google compute engine VMs are locked down at instance level by default. To enable communication between VMs, a specific firewall rules should be created to open the TCP port traffic flow such as typical Oracle port 1521.

4. From the Google cloud portal console, deploy two GCNV storage pools to host Oracle database volumes. Referred to documentation Create a storage pool quickstart for step-by-step instructions. Following are some screen shots for quick reference.

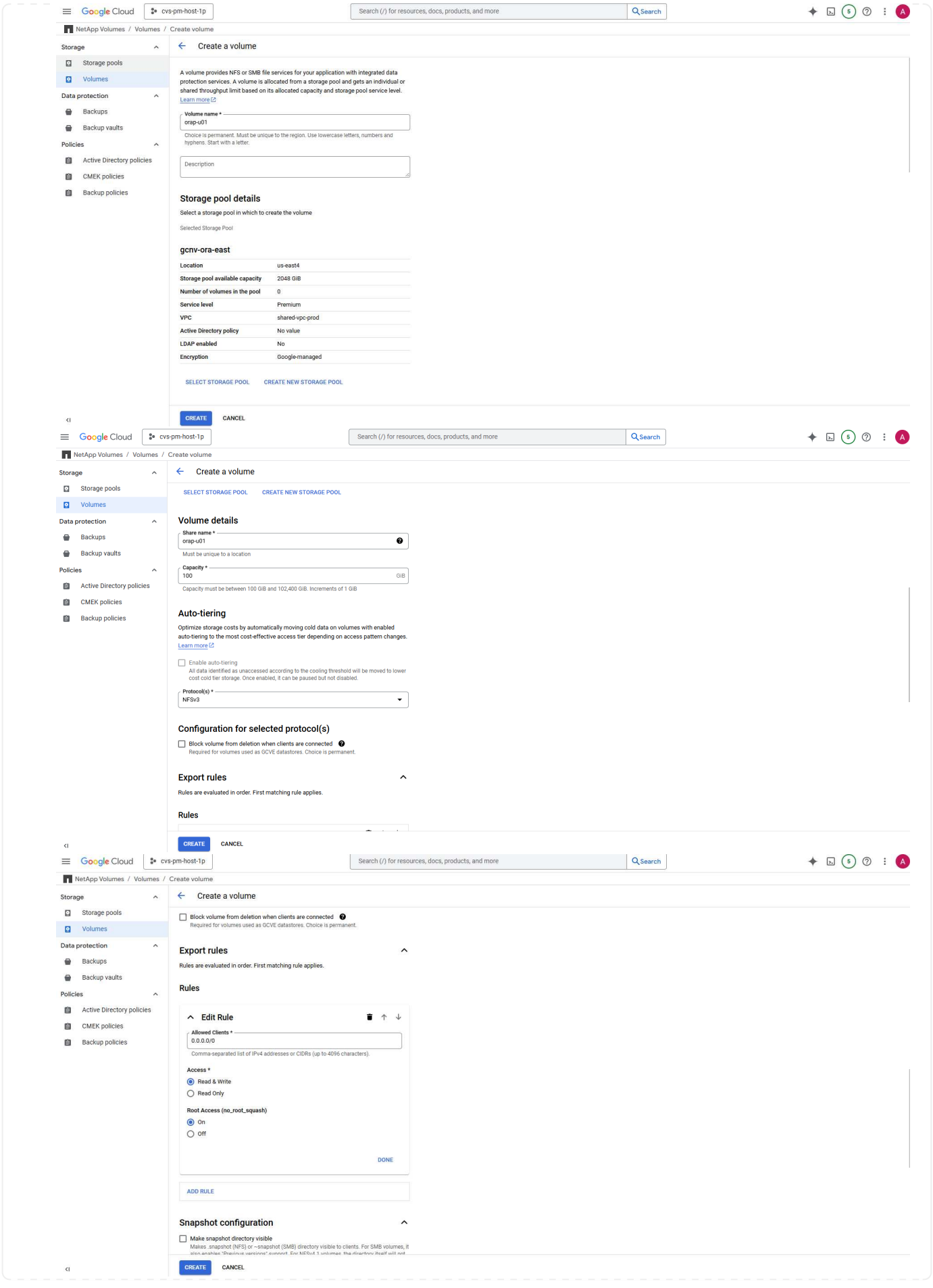


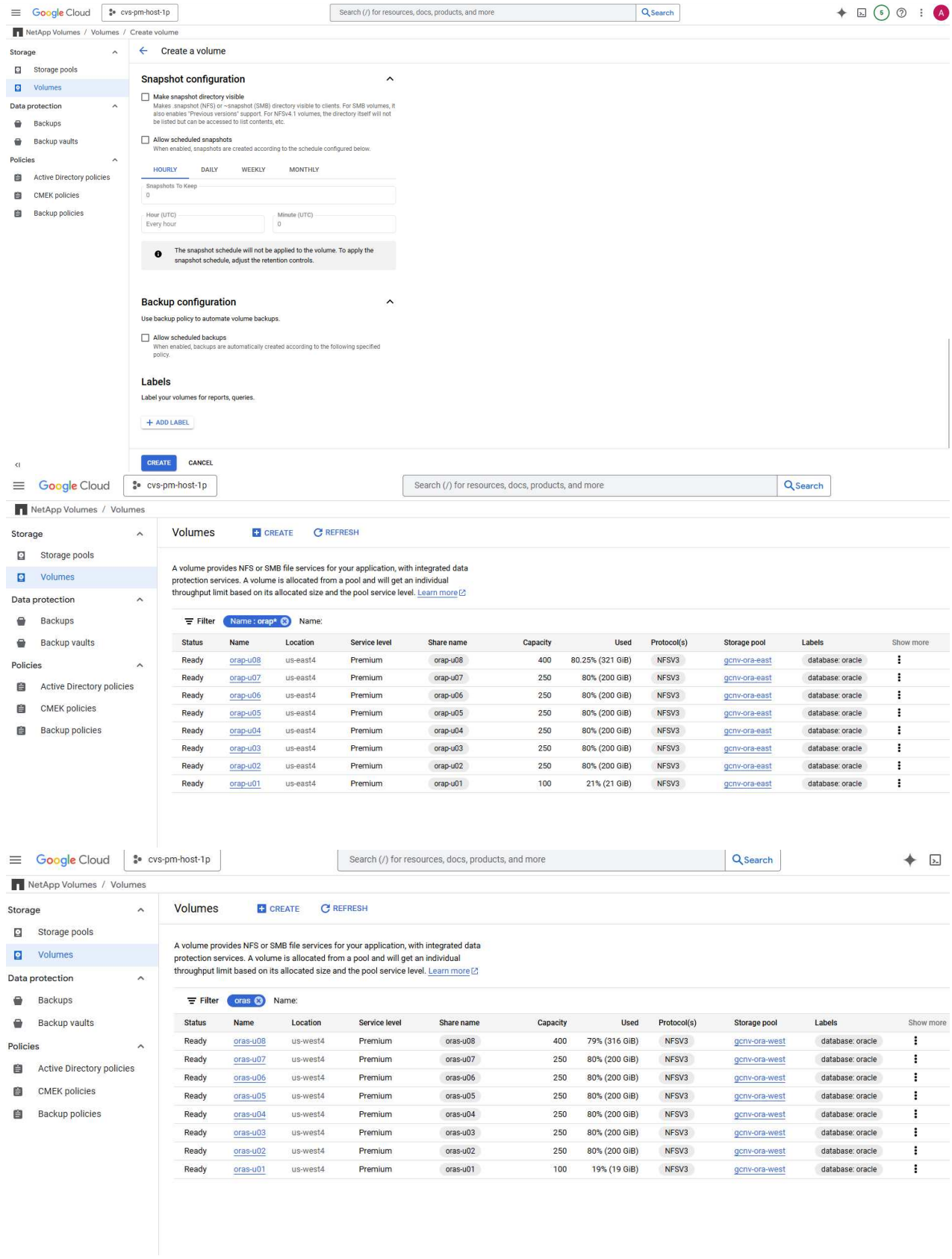






5. Create database volumes in storage pools. Referred to documentation Create a volume quickstart for step-by-step instructions. Following are some screen shots for quick reference.


Google Cloud
cvs-pm-host-1p
Search (/) for resources, docs, products, and more
Search
NetApp Volumes / Volumes / Create volume
Storage
Storage pools
Volumes
Data protection
Backups
Backup vaults
Policies
Active Directory policies
CMEK policies
Backup policies
Create a volume
A volume provides NFS or SMB file services for your application with integrated data protection services. A volume is allocated from a storage pool and gets an individual or shared throughput limit based on its allocated capacity and storage pool service level.
Learn more
Volume name *
orap-u01
Choice is permanent. Must be unique to the region. Use lowercase letters, numbers and hyphens. Start with a letter.
Description
Storage pool details
Select a storage pool in which to create the volume
Selected Storage Pool
gcnv-ora-east
Location us-east4
Storage pool available capacity 2048 GiB
Number of volumes in the pool 0
Service level Premium
VPC shared-vpc-prod
Active Directory policy No value
LDAP enabled No
Encryption Google-managed
SELECT STORAGE POOL
CREATE NEW STORAGE POOL
CREATE
CANCEL
Volume details
Share name *
orap-u01
Must be unique to a location
Capacity *
100
GiB
Capacity must be between 100 GiB and 102,400 GiB. Increments of 1 GiB
Auto-tiering
Optimize storage costs by automatically moving cold data on volumes with enabled auto-tiering to the most cost-effective access tier depending on access pattern changes.
Learn more
Enable auto-tiering
All data identified as unaccessed according to the cooling threshold will be moved to lower cost cold tier storage. Once enabled, it can be paused but not disabled.
Protocol(s) *
NFSv3
Configuration for selected protocol(s)
Block volume from deletion when clients are connected
Required for volumes used as GCVE datastores. Choice is permanent.
Export rules
Rules are evaluated in order. First matching rule applies.
Rules
Edit Rule
Allowed Clients *
0.0.0.0/0
Comma-separated list of IPv4 addresses or CIDRs (up to 4096 characters).
Access *
Read & Write
Read Only
Root Access (no_root_squash)
On
Off
DONE
ADD RULE
Snapshot configuration
Make snapshot directory visible
Makes .snapshot (NFS) or ~snapshot (SMB) directory visible to clients. For SMB volumes, it also enables "Previous versions" support. For NFSv4.1 volumes, the directory itself will not



6. The primary Oracle database should have been installed and configured in the primary Oracle DB server. On the other hand, in the standby Oracle DB server or the clone Oracle DB server, only Oracle software is installed and no Oracle databases are created. Ideally, the Oracle files directories layout should be exactly matching on all Oracle DB servers. Refer to TR-4974 for help on Oracle grid infrastructure and database installation and configuration with NFS/ASM. Although the solution is

validated on AWS FSx/EC2 environment, it can be equally applied to Google GCNV/Compute Engine environment.

- TR-4974: Oracle 19c in Standalone Restart on AWS FSx/EC2 with NFS/ASM

Primary Oracle VLDB configuration for Data Guard

In this demonstration, we have setup a primary Oracle database called NTAP on the primary DB server with eight NFS mount points: /u01 for the Oracle binary, /u02, /u03, /u04, /u05, /u06, /u07 for the Oracle data files, and load balanced with Oracle ASM disk group +DATA; /u08 for the Oracle active logs, archived log files, and load balanced with Oracle ASM disk group +LOGS. Oracle control files are placed on both +DATA and +LOGS disk groups for redundancy. This setup serves as a reference configuration. Your actual deployment should take into consideration of your specific needs and requirements in terms of the storage pool sizing, the service level, the number of database volumes and the sizing of each volume.

For detailed step by step procedures for setting up Oracle Data Guard on NFS with ASM, please referred to TR-5002 - Oracle Active Data Guard Cost Reduction with Azure NetApp Files. Although the procedures in TR-5002 were validated on Azure ANF environment, they are equally applicable to Google GCNV environment.

Following illustrates the details of a primary Oracle VLDB in a Data Guard configuration in Google GCNV environment.

1. The primary database NTAP in the primary compute engine DB server is deployed as a single instance database in a standalone Restart configuration on the GCNV storage with NFS protocol and ASM as database storage volume manager.

```
orap.us-east4-a.c.cvs-pm-host-1p.internal:
Zone: us-east-4a
size: n1-standard-4 (4 vCPUs, 15 GB Memory)
OS: Linux (redhat 8.10)
pub_ip: 35.212.124.14
pri_ip: 10.70.11.5

[oracle@orap ~]$ df -h
Filesystem                Size  Used Avail Use% Mounted on
devtmpfs                  7.2G     0  7.2G   0% /dev
tmpfs                     7.3G     0  7.3G   0% /dev/shm
tmpfs                     7.3G  8.5M  7.2G   1% /run
tmpfs                     7.3G     0  7.3G   0% /sys/fs/cgroup
/dev/sda2                  50G   40G   11G  80% /
/dev/sda1                 200M  5.9M  194M   3% /boot/efi
10.165.128.180:/orap-u05  250G  201G   50G  81% /u05
10.165.128.180:/orap-u08  400G  322G   79G  81% /u08
10.165.128.180:/orap-u04  250G  201G   50G  81% /u04
10.165.128.180:/orap-u07  250G  201G   50G  81% /u07
10.165.128.180:/orap-u02  250G  201G   50G  81% /u02
10.165.128.180:/orap-u06  250G  201G   50G  81% /u06
10.165.128.180:/orap-u01  100G   21G   80G  21% /u01
10.165.128.180:/orap-u03  250G  201G   50G  81% /u03


[oracle@orap ~]$ cat /etc/oratab
#
```

```
# This file is used by ORACLE utilities.  It is created by root.sh
# and updated by either Database Configuration Assistant while
creating
# a database or ASM Configuration Assistant while creating ASM
instance.

# A colon, ':', is used as the field terminator.  A new line
terminates
# the entry.  Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
#   $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.  The third field indicates
# to the dbstart utility that the database should , "Y", or should
not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
#
+ASM:/u01/app/oracle/product/19.0.0/grid:N
NTAP:/u01/app/oracle/product/19.0.0/NTAP:N
```

2. Login to primary DB server as the oracle user. Validate grid configuration.

```
$GRID_HOME/bin/crsctl stat res -t
```

```
[oracle@orap ~]$ $GRID_HOME/bin/crsctl stat res -t
--------------------------------------------------------------------------------
------------
Name           Target  State        Server                   State
details
--------------------------------------------------------------------------------
------------
Local Resources
--------------------------------------------------------------------------------
------------
ora.DATA.dg
               ONLINE  ONLINE       orap                     STABLE
ora.LISTENER.lsnr
               ONLINE  ONLINE       orap                     STABLE
ora.LOGS.dg
               ONLINE  ONLINE       orap                     STABLE
ora.asm
               ONLINE  ONLINE       orap
Started,STABLE
ora.ons
               OFFLINE OFFLINE      orap                     STABLE
--------------------------------------------------------------------------------
------------
Cluster Resources
--------------------------------------------------------------------------------
------------
ora.cssd
      1        ONLINE  ONLINE       orap                     STABLE
ora.diskmon
      1        OFFLINE OFFLINE                               STABLE
ora.evmd
      1        ONLINE  ONLINE       orap                     STABLE
ora.ntap.db
      1        ONLINE  ONLINE       orap
Open,HOME=/u01/app/o

racle/product/19.0.0

/NTAP,STABLE
--------------------------------------------------------------------------------
------------
[oracle@orap ~]$
```

3. ASM disk group configuration.

```
asmcmd
```

```
[oracle@orap ~]$ asmcmd
ASMCMD> 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  4194304
1228800  1219888                0         1219888              0
N  DATA/
MOUNTED  EXTERN  N         512             512   4096  4194304
327680   326556                0          326556              0
N  LOGS/
ASMCMD> lsdsk
Path
/u02/oradata/asm/orap_data_disk_01
/u02/oradata/asm/orap_data_disk_02
/u02/oradata/asm/orap_data_disk_03
/u02/oradata/asm/orap_data_disk_04
/u03/oradata/asm/orap_data_disk_05
/u03/oradata/asm/orap_data_disk_06
/u03/oradata/asm/orap_data_disk_07
/u03/oradata/asm/orap_data_disk_08
/u04/oradata/asm/orap_data_disk_09
/u04/oradata/asm/orap_data_disk_10
/u04/oradata/asm/orap_data_disk_11
/u04/oradata/asm/orap_data_disk_12
/u05/oradata/asm/orap_data_disk_13
/u05/oradata/asm/orap_data_disk_14
/u05/oradata/asm/orap_data_disk_15
/u05/oradata/asm/orap_data_disk_16
/u06/oradata/asm/orap_data_disk_17
/u06/oradata/asm/orap_data_disk_18
/u06/oradata/asm/orap_data_disk_19
/u06/oradata/asm/orap_data_disk_20
/u07/oradata/asm/orap_data_disk_21
/u07/oradata/asm/orap_data_disk_22
/u07/oradata/asm/orap_data_disk_23
/u07/oradata/asm/orap_data_disk_24
/u08/oralogs/asm/orap_logs_disk_01
/u08/oralogs/asm/orap_logs_disk_02
/u08/oralogs/asm/orap_logs_disk_03
/u08/oralogs/asm/orap_logs_disk_04
ASMCMD>
```

4. Parameters setting for Data Guard on primary DB.

```
SQL> show parameter name

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
cdb_cluster_name                     string
cell_offloadgroup_name               string
db_file_name_convert                 string
db_name                              string      ntap
db_unique_name                       string      ntap_ny
global_names                         boolean     FALSE
instance_name                        string      NTAP
lock_name_space                      string
log_file_name_convert                string
pdb_file_name_convert                string
processor_group_name                 string

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
service_names                        string      ntap_ny.cvs-pm-
host-1p.interna

SQL> sho parameter log_archive_dest

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
log_archive_dest                     string
log_archive_dest_1                   string
LOCATION=USE_DB_RECOVERY_FILE_
                                                 DEST
VALID_FOR=(ALL_LOGFILES,A
                                                 LL_ROLES)
DB_UNIQUE_NAME=NTAP_
                                                 NY
log_archive_dest_10                  string
log_archive_dest_11                  string
log_archive_dest_12                  string
log_archive_dest_13                  string
log_archive_dest_14                  string
log_archive_dest_15                  string

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
```

```
log_archive_dest_16                  string
log_archive_dest_17                  string
log_archive_dest_18                  string
log_archive_dest_19                  string
log_archive_dest_2                   string      SERVICE=NTAP_LA
ASYNC VALID_FO

R=(ONLINE_LOGFILES,PRIMARY_ROL
                                                 E)
DB_UNIQUE_NAME=NTAP_LA
log_archive_dest_20                  string
log_archive_dest_21                  string
log_archive_dest_22                  string
```

5. Primary DB configuration.

```
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;

NAME
------------------------------------------------------------------------
------------
+DATA/NTAP/DATAFILE/system.257.1198026005
+DATA/NTAP/DATAFILE/sysaux.258.1198026051
+DATA/NTAP/DATAFILE/undotbs1.259.1198026075
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/system.266.1198
027075
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/sysaux.267.1198
027075
+DATA/NTAP/DATAFILE/users.260.1198026077
```

```
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/undotbs1.268.11
98027075
+DATA/NTAP/32639B76C9BC91A8E063050B460A2116/DATAFILE/system.272.1198
028157
+DATA/NTAP/32639B76C9BC91A8E063050B460A2116/DATAFILE/sysaux.273.1198
028157
+DATA/NTAP/32639B76C9BC91A8E063050B460A2116/DATAFILE/undotbs1.271.11
98028157
+DATA/NTAP/32639B76C9BC91A8E063050B460A2116/DATAFILE/users.275.11980
28185

NAME
--------------------------------------------------------------------
------------
+DATA/NTAP/32639D40D02D925FE063050B460A60E3/DATAFILE/system.277.1198
028187
+DATA/NTAP/32639D40D02D925FE063050B460A60E3/DATAFILE/sysaux.278.1198
028187
+DATA/NTAP/32639D40D02D925FE063050B460A60E3/DATAFILE/undotbs1.276.11
98028187
+DATA/NTAP/32639D40D02D925FE063050B460A60E3/DATAFILE/users.280.11980
28209
+DATA/NTAP/32639E973AF79299E063050B460AFBAD/DATAFILE/system.282.1198
028209
+DATA/NTAP/32639E973AF79299E063050B460AFBAD/DATAFILE/sysaux.283.1198
028209
+DATA/NTAP/32639E973AF79299E063050B460AFBAD/DATAFILE/undotbs1.281.11
98028209
+DATA/NTAP/32639E973AF79299E063050B460AFBAD/DATAFILE/users.285.11980
28229

19 rows selected.


SQL> select member from v$logfile;

MEMBER
--------------------------------------------------------------------
------------
+DATA/NTAP/ONLINELOG/group_3.264.1198026139
+LOGS/NTAP/ONLINELOG/group_3.259.1198026147
+DATA/NTAP/ONLINELOG/group_2.263.1198026137
+LOGS/NTAP/ONLINELOG/group_2.258.1198026145
+DATA/NTAP/ONLINELOG/group_1.262.1198026137
+LOGS/NTAP/ONLINELOG/group_1.257.1198026145
+DATA/NTAP/ONLINELOG/group_4.286.1198511423
```

```
+LOGS/NTAP/ONLINELOG/group_4.265.1198511425
+DATA/NTAP/ONLINELOG/group_5.287.1198511445
+LOGS/NTAP/ONLINELOG/group_5.266.1198511447
+DATA/NTAP/ONLINELOG/group_6.288.1198511459

MEMBER
------------------------------------------------------------------------
------------
+LOGS/NTAP/ONLINELOG/group_6.267.1198511461
+DATA/NTAP/ONLINELOG/group_7.289.1198511477
+LOGS/NTAP/ONLINELOG/group_7.268.1198511479

14 rows selected.


SQL> select name from v$controlfile;

NAME
------------------------------------------------------------------------
------------
+DATA/NTAP/CONTROLFILE/current.261.1198026135
+LOGS/NTAP/CONTROLFILE/current.256.1198026135
```

6. Oracle listener configuration.

```
lsnrctl status listener
```

```
[oracle@orap admin]$ lsnrctl status

LSNRCTL for Linux: Version 19.0.0.0.0 - Production on 15-APR-2025
16:14:00

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

Connecting to (ADDRESS=(PROTOCOL=tcp)(HOST=)(PORT=1521))
STATUS of the LISTENER
------------------------
Alias                     LISTENER
Version                   TNSLSNR for Linux: Version 19.0.0.0.0 -
Production
Start Date                14-APR-2025 19:44:21
Uptime                    0 days 20 hr. 29 min. 38 sec
Trace Level               off
Security                  ON: Local OS Authentication
```

```
SNMP                        OFF
Listener Parameter File
/u01/app/oracle/product/19.0.0/grid/network/admin/listener.ora
Listener Log File
/u01/app/oracle/diag/tnslsnr/orap/listener/alert/log.xml
Listening Endpoints Summary...
  (DESCRIPTION=(ADDRESS=(PROTOCOL=tcp)(HOST=orap.us-east4-a.c.cvs-
pm-host-1p.internal)(PORT=1521)))
  (DESCRIPTION=(ADDRESS=(PROTOCOL=ipc)(KEY=EXTPROC1521)))
Services Summary...
Service "+ASM" has 1 instance(s).
  Instance "+ASM", status READY, has 1 handler(s) for this
service...
Service "+ASM_DATA" has 1 instance(s).
  Instance "+ASM", status READY, has 1 handler(s) for this
service...
Service "+ASM_LOGS" has 1 instance(s).
  Instance "+ASM", status READY, has 1 handler(s) for this
service...
Service "32639b76c9bc91a8e063050b460a2116.cvs-pm-host-1p.internal"
has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "32639d40d02d925fe063050b460a60e3.cvs-pm-host-1p.internal"
has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "32639e973af79299e063050b460afbad.cvs-pm-host-1p.internal"
has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "86b637b62fdf7a65e053f706e80a27ca.cvs-pm-host-1p.internal"
has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "NTAPXDB.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "NTAP_NY_DGMGRL.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status UNKNOWN, has 1 handler(s) for this
service...
Service "ntap.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "ntap_pdb1.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
```

```
service...
Service "ntap_pdb2.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
Service "ntap_pdb3.cvs-pm-host-1p.internal" has 1 instance(s).
  Instance "NTAP", status READY, has 1 handler(s) for this
service...
The command completed successfully
```

7. Flashback is enabled at primary database.

```
SQL> select name, database_role, flashback_on from v$database;

NAME      DATABASE_ROLE    FLASHBACK_ON
--------- ---------------- ------------------
NTAP      PRIMARY          YES
```

8. dNFS configuration on primary DB.

```
SQL> select svrname, dirname from v$dnfs_servers;

SVRNAME
------------------------------------------------------------------------
------------
DIRNAME
------------------------------------------------------------------------
------------
10.165.128.180
/orap-u04

10.165.128.180
/orap-u05

10.165.128.180
/orap-u07


SVRNAME
------------------------------------------------------------------------
------------
DIRNAME
------------------------------------------------------------------------
------------
10.165.128.180
/orap-u03
```

```
10.165.128.180
/orap-u06

10.165.128.180
/orap-u02


SVRNAME
------------------------------------------------------------------------
------------
DIRNAME
------------------------------------------------------------------------
------------
10.165.128.180
/orap-u08

10.165.128.180
/orap-u01


8 rows selected.
```

This completes the demonstration of a Data Guard setup for VLDB NTAP at the primary site on GCNV with NFS/ASM.

Standby Oracle VLDB configuration for Data Guard

Oracle Data Guard requires OS kernel configuration and Oracle software stacks including patch sets on standby DB server to match with primary DB server. For easy management and simplicity, the database storage configuration of the standby DB server ideally should match with the primary DB server as well, such as the database directory layout and sizes of NFS mount points.

Again, for detailed step by step procedures for setting up Oracle Data Guard standby on NFS with ASM, please refer to TR-5002 - Oracle Active Data Guard Cost Reduction with Azure NetApp Files and TR-4974 - Oracle 19c in Standalone Restart on AWS FSx/EC2 with NFS/ASM relevant sections. Following illustrates the detail of standby Oracle VLDB configuration on standby DB server in a Data Guard setting in Google GCNV environment.

1. The standby Oracle DB server configuration at standby site in the demo lab.

```
oras.us-west4-a.c.cvs-pm-host-1p.internal:
Zone: us-west4-a
size: n1-standard-4 (4 vCPUs, 15 GB Memory)
OS: Linux (redhat 8.10)
pub_ip: 35.219.129.195
pri_ip: 10.70.14.16

[oracle@oras ~]$ df -h
Filesystem                Size  Used Avail Use% Mounted on
devtmpfs                  7.2G     0  7.2G   0% /dev
tmpfs                     7.3G  1.1G  6.2G  16% /dev/shm
tmpfs                     7.3G  8.5M  7.2G   1% /run
tmpfs                     7.3G     0  7.3G   0% /sys/fs/cgroup
/dev/sda2                  50G   40G   11G  80% /
/dev/sda1                 200M  5.9M  194M   3% /boot/efi
10.165.128.197:/oras-u07  250G  201G   50G  81% /u07
10.165.128.197:/oras-u06  250G  201G   50G  81% /u06
10.165.128.197:/oras-u02  250G  201G   50G  81% /u02
10.165.128.196:/oras-u03  250G  201G   50G  81% /u03
10.165.128.196:/oras-u01  100G   20G   81G  20% /u01
10.165.128.197:/oras-u05  250G  201G   50G  81% /u05
10.165.128.197:/oras-u04  250G  201G   50G  81% /u04
10.165.128.197:/oras-u08  400G  317G   84G  80% /u08

[oracle@oras ~]$ cat /etc/oratab
#Backup file is
/u01/app/oracle/crsdata/oras/output/oratab.bak.oras.oracle line
added by Agent
#



# This file is used by ORACLE utilities.  It is created by root.sh
# and updated by either Database Configuration Assistant while
```

```
creating
# a database or ASM Configuration Assistant while creating ASM
instance.

# A colon, ':', is used as the field terminator.  A new line
terminates
# the entry.  Lines beginning with a pound sign, '#', are comments.
#
# Entries are of the form:
#   $ORACLE_SID:$ORACLE_HOME:<N|Y>:
#
# The first and second fields are the system identifier and home
# directory of the database respectively.  The third field indicates
# to the dbstart utility that the database should , "Y", or should
not,
# "N", be brought up at system boot time.
#
# Multiple entries with the same $ORACLE_SID are not allowed.
#
#
+ASM:/u01/app/oracle/product/19.0.0/grid:N
NTAP:/u01/app/oracle/product/19.0.0/NTAP:N              # line added
by Agent
```

2. Grid infrastructure configuration on standby DB server.

```
[oracle@oras ~]$ $GRID_HOME/bin/crsctl stat res -t
--------------------------------------------------------------------------------
------------
Name           Target  State        Server                   State
details
--------------------------------------------------------------------------------
------------
Local Resources
--------------------------------------------------------------------------------
------------
ora.DATA.dg
               ONLINE  ONLINE       oras                     STABLE
ora.LISTENER.lsnr
               ONLINE  ONLINE       oras                     STABLE
ora.LOGS.dg
               ONLINE  ONLINE       oras                     STABLE
ora.asm
               ONLINE  ONLINE       oras
Started,STABLE
ora.ons
               OFFLINE OFFLINE      oras                     STABLE
--------------------------------------------------------------------------------
------------
Cluster Resources
--------------------------------------------------------------------------------
------------
ora.cssd
      1        ONLINE  ONLINE       oras                     STABLE
ora.diskmon
      1        OFFLINE OFFLINE                               STABLE
ora.evmd
      1        ONLINE  ONLINE       oras                     STABLE
ora.ntap_la.db
      1        ONLINE  INTERMEDIATE oras
Dismounted,Mount Ini

tiated,HOME=/u01/app

/oracle/product/19.0

.0/NTAP,STABLE
--------------------------------------------------------------------------------
------------
```

3. ASM disk groups configuration on standby DB server.

```
[oracle@oras ~]$ asmcmd
ASMCMD> 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  4194304
1228800  1228420                0         1228420              0
N  DATA/
MOUNTED  EXTERN  N         512             512   4096  4194304
322336   322204                0          322204              0
N  LOGS/
ASMCMD> lsdsk
Path
/u02/oradata/asm/oras_data_disk_01
/u02/oradata/asm/oras_data_disk_02
/u02/oradata/asm/oras_data_disk_03
/u02/oradata/asm/oras_data_disk_04
/u03/oradata/asm/oras_data_disk_05
/u03/oradata/asm/oras_data_disk_06
/u03/oradata/asm/oras_data_disk_07
/u03/oradata/asm/oras_data_disk_08
/u04/oradata/asm/oras_data_disk_09
/u04/oradata/asm/oras_data_disk_10
/u04/oradata/asm/oras_data_disk_11
/u04/oradata/asm/oras_data_disk_12
/u05/oradata/asm/oras_data_disk_13
/u05/oradata/asm/oras_data_disk_14
/u05/oradata/asm/oras_data_disk_15
/u05/oradata/asm/oras_data_disk_16
/u06/oradata/asm/oras_data_disk_17
/u06/oradata/asm/oras_data_disk_18
/u06/oradata/asm/oras_data_disk_19
/u06/oradata/asm/oras_data_disk_20
/u07/oradata/asm/oras_data_disk_21
/u07/oradata/asm/oras_data_disk_22
/u07/oradata/asm/oras_data_disk_23
/u07/oradata/asm/oras_data_disk_24
/u08/oralogs/asm/oras_logs_disk_01
/u08/oralogs/asm/oras_logs_disk_02
/u08/oralogs/asm/oras_logs_disk_03
/u08/oralogs/asm/oras_logs_disk_04
ASMCMD>
```

4. Parameters setting for Data Guard on standby DB.

```
SQL> show parameter name

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
cdb_cluster_name                     string
cell_offloadgroup_name               string
db_file_name_convert                 string
db_name                              string      NTAP
db_unique_name                       string      NTAP_LA
global_names                         boolean     FALSE
instance_name                        string      NTAP
lock_name_space                      string
log_file_name_convert                string
pdb_file_name_convert                string
processor_group_name                 string

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
service_names                        string      NTAP_LA.cvs-pm-
host-1p.interna
                                                 l

SQL> show parameter log_archive_config

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
log_archive_config                   string
DG_CONFIG=(NTAP_NY,NTAP_LA)
SQL> show parameter fal_server

NAME                                 TYPE        VALUE
------------------------------------ -----------
------------------------------
fal_server                           string      NTAP_NY
```

5. Standby DB configuration.

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

NAME      OPEN_MODE            LOG_MODE
--------- -------------------- ------------
NTAP      MOUNTED              ARCHIVELOG
```

```
SQL> show pdbs

    CON_ID CON_NAME                       OPEN MODE  RESTRICTED
---------- ------------------------------ ---------- ----------
         2 PDB$SEED                       MOUNTED
         3 NTAP_PDB1                      MOUNTED
         4 NTAP_PDB2                      MOUNTED
         5 NTAP_PDB3                      MOUNTED

SQL> select name from v$datafile;

NAME
--------------------------------------------------------------------------------
------------
+DATA/NTAP_LA/DATAFILE/system.261.1198520347
+DATA/NTAP_LA/DATAFILE/sysaux.262.1198520373
+DATA/NTAP_LA/DATAFILE/undotbs1.263.1198520399
+DATA/NTAP_LA/32635CC1DCF58A60E063050B460AB746/DATAFILE/system.264.1
198520417
+DATA/NTAP_LA/32635CC1DCF58A60E063050B460AB746/DATAFILE/sysaux.265.1
198520435
+DATA/NTAP_LA/DATAFILE/users.266.1198520451
+DATA/NTAP_LA/32635CC1DCF58A60E063050B460AB746/DATAFILE/undotbs1.267
.1198520455
+DATA/NTAP_LA/32639B76C9BC91A8E063050B460A2116/DATAFILE/system.268.1
198520471
+DATA/NTAP_LA/32639B76C9BC91A8E063050B460A2116/DATAFILE/sysaux.269.1
198520489
+DATA/NTAP_LA/32639B76C9BC91A8E063050B460A2116/DATAFILE/undotbs1.270
.1198520505
+DATA/NTAP_LA/32639B76C9BC91A8E063050B460A2116/DATAFILE/users.271.11
98520513

NAME
--------------------------------------------------------------------------------
------------
+DATA/NTAP_LA/32639D40D02D925FE063050B460A60E3/DATAFILE/system.272.1
198520517
+DATA/NTAP_LA/32639D40D02D925FE063050B460A60E3/DATAFILE/sysaux.273.1
198520533
+DATA/NTAP_LA/32639D40D02D925FE063050B460A60E3/DATAFILE/undotbs1.274
.1198520551
+DATA/NTAP_LA/32639D40D02D925FE063050B460A60E3/DATAFILE/users.275.11
98520559
+DATA/NTAP_LA/32639E973AF79299E063050B460AFBAD/DATAFILE/system.276.1
```

```
198520563
+DATA/NTAP_LA/32639E973AF79299E063050B460AFBAD/DATAFILE/sysaux.277.1
198520579
+DATA/NTAP_LA/32639E973AF79299E063050B460AFBAD/DATAFILE/undotbs1.278
.1198520595
+DATA/NTAP_LA/32639E973AF79299E063050B460AFBAD/DATAFILE/users.279.11
98520605

19 rows selected.


SQL> select name from v$controlfile;

NAME
--------------------------------------------------------------------
------------
+DATA/NTAP_LA/CONTROLFILE/current.260.1198520303
+LOGS/NTAP_LA/CONTROLFILE/current.257.1198520305


SQL> select group#, type, member from v$logfile order by 2, 1;

    GROUP# TYPE    MEMBER
---------- -------
------------------------------------------------------------
         1 ONLINE  +DATA/NTAP_LA/ONLINELOG/group_1.280.1198520649
         1 ONLINE  +LOGS/NTAP_LA/ONLINELOG/group_1.259.1198520651
         2 ONLINE  +DATA/NTAP_LA/ONLINELOG/group_2.281.1198520659
         2 ONLINE  +LOGS/NTAP_LA/ONLINELOG/group_2.258.1198520661
         3 ONLINE  +DATA/NTAP_LA/ONLINELOG/group_3.282.1198520669
         3 ONLINE  +LOGS/NTAP_LA/ONLINELOG/group_3.260.1198520671
         4 STANDBY +DATA/NTAP_LA/ONLINELOG/group_4.283.1198520677
         4 STANDBY +LOGS/NTAP_LA/ONLINELOG/group_4.261.1198520679
         5 STANDBY +DATA/NTAP_LA/ONLINELOG/group_5.284.1198520687
         5 STANDBY +LOGS/NTAP_LA/ONLINELOG/group_5.262.1198520689
         6 STANDBY +DATA/NTAP_LA/ONLINELOG/group_6.285.1198520697

    GROUP# TYPE    MEMBER
---------- -------
------------------------------------------------------------
         6 STANDBY +LOGS/NTAP_LA/ONLINELOG/group_6.263.1198520699
         7 STANDBY +DATA/NTAP_LA/ONLINELOG/group_7.286.1198520707
         7 STANDBY +LOGS/NTAP_LA/ONLINELOG/group_7.264.1198520709

14 rows selected.
```

6. Validate the standby database recovery status. Notice the `recovery logmerger` in `APPLYING_LOG` action.

```
SQL> SELECT ROLE, THREAD#, SEQUENCE#, ACTION FROM
V$DATAGUARD_PROCESS;

ROLE                        THREAD#  SEQUENCE# ACTION
--------------------------- ---------- ---------- ------------
post role transition                 0          0 IDLE
recovery apply slave                 0          0 IDLE
recovery apply slave                 0          0 IDLE
recovery apply slave                 0          0 IDLE
recovery apply slave                 0          0 IDLE
recovery logmerger                   1         24 APPLYING_LOG
managed recovery                     0          0 IDLE
RFS ping                             1         24 IDLE
archive redo                         0          0 IDLE
archive redo                         0          0 IDLE
gap manager                          0          0 IDLE

ROLE                        THREAD#  SEQUENCE# ACTION
--------------------------- ---------- ---------- ------------
archive local                        0          0 IDLE
redo transport timer                 0          0 IDLE
archive redo                         0          0 IDLE
RFS async                            1         24 IDLE
redo transport monitor               0          0 IDLE
log writer                           0          0 IDLE

17 rows selected.
```

7. Flashback is enabled at standby database.

```
SQL> select name, database_role, flashback_on from v$database;

NAME      DATABASE_ROLE    FLASHBACK_ON
--------- ---------------- ------------------
NTAP      PHYSICAL STANDBY YES
```

8. dNFS configuration on standby DB.

```
SQL> select svrname, dirname from v$dnfs_servers;

SVRNAME
--------------------------------------------------------------------------------
---------
DIRNAME
--------------------------------------------------------------------------------
---------
10.165.128.197
/oras-u04

10.165.128.197
/oras-u05

10.165.128.197
/oras-u06

10.165.128.197
/oras-u07

10.165.128.197
/oras-u02

10.165.128.197
/oras-u08

10.165.128.196
/oras-u03

10.165.128.196
/oras-u01


8 rows selected.
```

This completes the demonstration of a Data Guard setup for VLDB NTAP with managed standby recovery enabled at standby site.

Setup Data Guard Broker and FSFO with an Observer

Setup Data Guard Broker

Oracle Data Guard broker is a distributed management framework that automates and centralizes the creation, maintenance, and monitoring of Oracle Data Guard configurations. Following section demonstrate how to setup Data Guard Broker to manage Data Guard environment.

1. Start data guard broker on both the primary and the standby databases with following command via sqlplus.

```
alter system set dg_broker_start=true scope=both;
```

2. From primary database, connect to Data Guard Borker as SYSDBA.

```
[oracle@orap ~]$ dgmgrl sys@NTAP_NY
DGMGRL for Linux: Release 19.0.0.0.0 - Production on Wed Dec 11
20:53:20 2024
Version 19.18.0.0.0

Copyright (c) 1982, 2019, Oracle and/or its affiliates.  All rights
reserved.

Welcome to DGMGRL, type "help" for information.
Password:
Connected to "NTAP_NY"
Connected as SYSDBA.
DGMGRL>
```

3. Create and enable Data Guard Broker configuration.

```
DGMGRL> create configuration dg_config as primary database is
NTAP_NY connect identifier is NTAP_NY;
Configuration "dg_config" created with primary database "ntap_ny"
DGMGRL> add database NTAP_LA as connect identifier is NTAP_LA;
Database "ntap_la" added
DGMGRL> enable configuration;
Enabled.
DGMGRL> show configuration;

Configuration - dg_config

  Protection Mode: MaxPerformance
  Members:
  ntap_ny - Primary database
    ntap_la - Physical standby database

Fast-Start Failover:  Disabled

Configuration Status:
SUCCESS   (status updated 3 seconds ago)
```

4. Validate the database status within the Data Guard Broker management framework.

```
DGMGRL> show database ntap_ny;

Database - ntap_ny

  Role:               PRIMARY
  Intended State:     TRANSPORT-ON
  Instance(s):
    NTAP

Database Status:
SUCCESS


DGMGRL> show database ntap_la;

Database - ntap_la

  Role:               PHYSICAL STANDBY
  Intended State:     APPLY-ON
  Transport Lag:      0 seconds (computed 0 seconds ago)
  Apply Lag:          0 seconds (computed 0 seconds ago)
  Average Apply Rate: 3.00 KByte/s
  Real Time Query:    OFF
  Instance(s):
    NTAP

Database Status:
SUCCESS

DGMGRL>
```

In the event of a failure, Data Guard Broker can be used to failover the primary database to the standby instantaniouly. If `Fast-Start Failover` is enabled, Data Guard Broker can failover the primary database to the standby when a failure is detected without an user intervention.

Configure FSFO with an Observer

Optionally, Fast Start Fail Over (FSFO) can be enabled for Data Guard Broker to failover the primary database to standby database in the event of a failure automatically. Following are the procedures to setup FSFO with an observer instance.

1. Create a lightweight Google compute engine instance to run Observer in a different zone than primary or standby DB server. In the test case, we used a N1 instance with 2 vCPU with 7.5G memory. Have same version of Oracle installed on the host.
2. Login in as oracle user and set oracle environment in the oracle user .bash_profile.

```
vi ~/.bash_profile
```

```
# .bash_profile

# Get the aliases and functions
if [ -f ~/.bashrc ]; then
        . ~/.bashrc
fi

# User specific environment and startup programs

export ORACLE_HOME=/u01/app/oracle/product/19.0.0/NTAP
export PATH=$ORACLE_HOME/bin:$PATH
```

3. Add primary and standby DB TNS name entries to tnsname.ora file.

```
vi $ORACLE_HOME/network/admin/tsnames.ora
```

```
NTAP_NY =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = orap.us-east4-a.c.cvs-pm-
host-1p.internal)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = NTAP_NY.cvs-pm-host-1p.internal)
      (UR=A)
    )
  )

NTAP_LA =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = oras.us-west4-a.c.cvs-pm-
host-1p.internal)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = NTAP_LA.cvs-pm-host-1p.internal)
      (UR=A)
    )
  )
```

4. Create and initialize wallet with a password.

```
mkdir -p /u01/app/oracle/admin/NTAP/wallet
```

```
mkstore -wrl /u01/app/oracle/admin/NTAP/wallet -create
```

```
[oracle@orao NTAP]$ mkdir -p /u01/app/oracle/admin/NTAP/wallet
[oracle@orao NTAP]$ mkstore -wrl /u01/app/oracle/admin/NTAP/wallet
-create
Oracle Secret Store Tool Release 19.0.0.0.0 - Production
Version 19.4.0.0.0
Copyright (c) 2004, 2022, Oracle and/or its affiliates. All rights
reserved.

Enter password:
Enter password again:
[oracle@orao NTAP]$
```

5. Enable passwordless authentication for user sys of both primary and standby database. Enter sys password first, then wallet password from previous step.

mkstore -wrl /u01/app/oracle/admin/NTAP/wallet -createCredential NTAP_NY sys

mkstore -wrl /u01/app/oracle/admin/NTAP/wallet -createCredential NTAP_LA sys

```
[oracle@orao NTAP]$ mkstore -wrl /u01/app/oracle/admin/NTAP/wallet
-createCredential NTAP_NY sys
Oracle Secret Store Tool Release 19.0.0.0.0 - Production
Version 19.4.0.0.0
Copyright (c) 2004, 2022, Oracle and/or its affiliates. All rights
reserved.

Your secret/Password is missing in the command line
Enter your secret/Password:
Re-enter your secret/Password:
Enter wallet password:
[oracle@orao NTAP]$ mkstore -wrl /u01/app/oracle/admin/NTAP/wallet
-createCredential NTAP_LA sys
Oracle Secret Store Tool Release 19.0.0.0.0 - Production
Version 19.4.0.0.0
Copyright (c) 2004, 2022, Oracle and/or its affiliates. All rights
reserved.

Your secret/Password is missing in the command line
Enter your secret/Password:
Re-enter your secret/Password:
Enter wallet password:
[oracle@orao NTAP]$
```

6. Update sqlnet.ora with wallet location.

```
vi $ORACLE_HOME/network/admin/sqlnet.ora
```

```
WALLET_LOCATION =
   (SOURCE =
      (METHOD = FILE)
      (METHOD_DATA = (DIRECTORY =
/u01/app/oracle/admin/NTAP/wallet))
)
SQLNET.WALLET_OVERRIDE = TRUE
```

7. Validate the crentials.

```
mkstore -wrl /u01/app/oracle/admin/NTAP/wallet -listCredential
```

```
sqlplus /@NTAP_LA as sysdba
```

```
sqlplus /@NTAP_NY as sysdba
```

```
[oracle@orao NTAP]$ mkstore -wrl /u01/app/oracle/admin/NTAP/wallet
-listCredential
Oracle Secret Store Tool Release 19.0.0.0.0 - Production
Version 19.4.0.0.0
Copyright (c) 2004, 2022, Oracle and/or its affiliates. All rights
reserved.

Enter wallet password:
List credential (index: connect_string username)
2: NTAP_LA sys
1: NTAP_NY sys
```

8. Configure and enable Fast-Start Failover.

```
mkdir /u01/app/oracle/admin/NTAP/fsfo
```

```
dgmgrl
```

```
Welcome to DGMGRL, type "help" for information.
DGMGRL> connect /@NTAP_NY
Connected to "ntap_ny"
Connected as SYSDBA.
DGMGRL> show configuration;

Configuration - dg_config

  Protection Mode: MaxAvailability
  Members:
  ntap_ny - Primary database
    ntap_la - Physical standby database

Fast-Start Failover:  Disabled

Configuration Status:
SUCCESS   (status updated 58 seconds ago)

DGMGRL> enable fast_start failover;
Enabled in Zero Data Loss Mode.
DGMGRL> show configuration;

Configuration - dg_config

  Protection Mode: MaxAvailability
  Members:
  ntap_ny - Primary database
    Warning: ORA-16819: fast-start failover observer not started

    ntap_la - (*) Physical standby database

Fast-Start Failover: Enabled in Zero Data Loss Mode

Configuration Status:
WARNING   (status updated 43 seconds ago)
```

9. Start and validate observer.

```
nohup dgmgrl /@NTAP_NY "start observer
file='/u01/app/oracle/admin/NTAP/fsfo/fsfo.dat'" >>
/u01/app/oracle/admin/NTAP/fsfo/dgmgrl.log &
```

```
[oracle@orao NTAP]$ nohup dgmgrl /@NTAP_NY "start observer
file='/u01/app/oracle/admin/NTAP/fsfo/fsfo.dat'" >>
```

```
/u01/app/oracle/admin/NTAP/fsfo/dgmgrl.log &
[1] 94957

[oracle@orao fsfo]$ dgmgrl
DGMGRL for Linux: Release 19.0.0.0.0 - Production on Wed Apr 16
21:12:09 2025
Version 19.18.0.0.0

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reserved.

Welcome to DGMGRL, type "help" for information.
DGMGRL> connect /@NTAP_NY
Connected to "ntap_ny"
Connected as SYSDBA.
DGMGRL> show configuration verbose;

Configuration - dg_config

  Protection Mode: MaxAvailability
  Members:
  ntap_ny - Primary database
    ntap_la - (*) Physical standby database

  (*) Fast-Start Failover target

  Properties:
    FastStartFailoverThreshold      = '30'
    OperationTimeout                = '30'
    TraceLevel                      = 'USER'
    FastStartFailoverLagLimit       = '30'
    CommunicationTimeout            = '180'
    ObserverReconnect               = '0'
    FastStartFailoverAutoReinstate  = 'TRUE'
    FastStartFailoverPmyShutdown    = 'TRUE'
    BystandersFollowRoleChange      = 'ALL'
    ObserverOverride                = 'FALSE'
    ExternalDestination1            = ''
    ExternalDestination2            = ''
    PrimaryLostWriteAction          = 'CONTINUE'
    ConfigurationWideServiceName    = 'ntap_CFG'

Fast-Start Failover: Enabled in Zero Data Loss Mode
  Lag Limit:          30 seconds (not in use)
  Threshold:          30 seconds
  Active Target:      ntap_la
```

```
  Potential Targets:  "ntap_la"
    ntap_la    valid
  Observer:           orao
  Shutdown Primary:   TRUE
  Auto-reinstate:     TRUE
  Observer Reconnect: (none)
  Observer Override:  FALSE

Configuration Status:
SUCCESS

DGMGRL>
```

To achieve zero data loss, Oracle Data Guard protection mode needs to be set to `MaxAvailability` or `MaxProtection` mode. The default protection mode of `MaxPerformance` can be changed from the Data Guard Broker interface by editing the Data Guard configuration and changing `LogXptMode` from ASYNC to SYNC. The Oracle archive log destination log mode needs to be changed accordingly. When real-time log application is enabled for Data Guard as required for `MaxAvailability`, avoid rebooting the database automatically because automatic database reboot may inaverdently open the standby database in `READ ONLY WITH APPLY` mode, which requires an Active Data Guard license. Instead, boot the database manually to ensure it remains in a `MOUNT` state with managed recovery in real time.

Clone standby database for other use cases via automation

Following automation toolkit is specifically designed to create or refresh clones of an Oracle Data Guard standby DB deployed to GCNV with NFS/ASM configuration for a complete clone lifecycle management.

```
https://bitbucket.ngage.netapp.com/projects/NS-
BB/repos/na_oracle_clone_gcnv/browse
```

The toolkit can only be accessed by NetApp internal user with bitbucket access at this moment. For interested external users, please request access from your account team or reach out to NetApp Solutions Engineering team. Refer to Automated Oracle Clone Lifecycle on GCNV with ASM for usage instructions.

Where to find additional information

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

- TR-5002: Oracle Active Data Guard Cost Reduction with Azure NetApp Files

TR-5002: Oracle Active Data Guard Cost Reduction with Azure NetApp Files

- TR-4974: Oracle 19c in Standalone Restart on AWS FSx/EC2 with NFS/ASM

  TR-4974: Oracle 19c in Standalone Restart on AWS FSx/EC2 with NFS/ASM

- NetApp's best-in-class file storage service, in Google Cloud

  https://cloud.google.com/netapp-volumes?hl=en

- Oracle Data Guard Concepts and Administration

  https://docs.oracle.com/en/database/oracle/oracle-database/19/sbydb/index.html#Oracle%C2%AE-Data-Guard

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