



TR-5006: 在Google Cloud NetApp Volumes上使用 Data Guard 实现高吞吐量 Oracle VLDB

NetApp database solutions

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TR-5006：在Google Cloud NetApp Volumes上使用 Data Guard 实现高吞吐量 Oracle VLDB

Allen Cao、Niyaz Mohamed，NetApp

该解决方案提供了在Google Cloud NetApp Volumes (GCNV) 上使用 Google 云中的 Oracle Data Guard 配置高吞吐量 Oracle 超大型数据库 (VLDB) 的概述和详细信息。

目的

高吞吐量和任务关键型 Oracle VLDB 对后端数据库存储提出了很高的要求。为了满足服务水平协议 (SLA)，数据库存储必须提供所需的容量和每秒高输入/输出操作数 (IOPS)，同时保持亚毫秒级延迟性能。在具有共享存储资源环境的公共云中部署此类数据库工作负载时，这一点尤其具有挑战性。并非所有存储平台都是平等的。GCNV 是 Google 提供的一项高级存储服务，可以支持 Google 云中需要持续 IOPS 和低延迟性能特征的关键任务 Oracle 数据库部署。该架构可适应 OLTP 和 OLAP 工作负载，并具有支持各种性能配置文件的可配置服务层。GCNV 提供超快的性能和亚毫秒级的延迟，在混合读/写工作负载下实现每卷高达 4.5 GiBps 的吞吐量。

利用 GCNV 的快速快照备份（秒）和克隆（分钟）功能，可以从物理备用数据库动态克隆生产数据库的全尺寸副本，以满足许多其他用例（如 DEV、UAT 等）的需求。您可以摆脱 Active Data Guard 许可证以及低效而复杂的快照备用数据库。可以节省大量成本。对于在主 Oracle 和备用 Oracle 服务器上均配备 64 个核心 CPU 的典型 Oracle Data Guard 设置，根据最新的 Oracle 价格表，仅 Active Data Guard 许可成本节省就高达 1,472,000 美元。

在本文档中，我们演示了如何在具有多个 NFS 卷和 Oracle ASM 的 GCNV 存储上设置具有 Data Guard 配置的 Oracle VLDB，以实现存储负载平衡。备用数据库卷可以通过快照快速备份并克隆以进行读/写访问。NetApp 解决方案工程团队提供了自动化工具包，以通过简化的生命周期管理来创建和刷新克隆。

此解决方案适用于以下用例：

- 在 Google 云区域的 GCNV 存储服务上的 Data Guard 设置中实现 Oracle VLDB。
- 快照备份并克隆物理备用数据库，以通过自动化服务于报告、开发、测试等用例。

受众

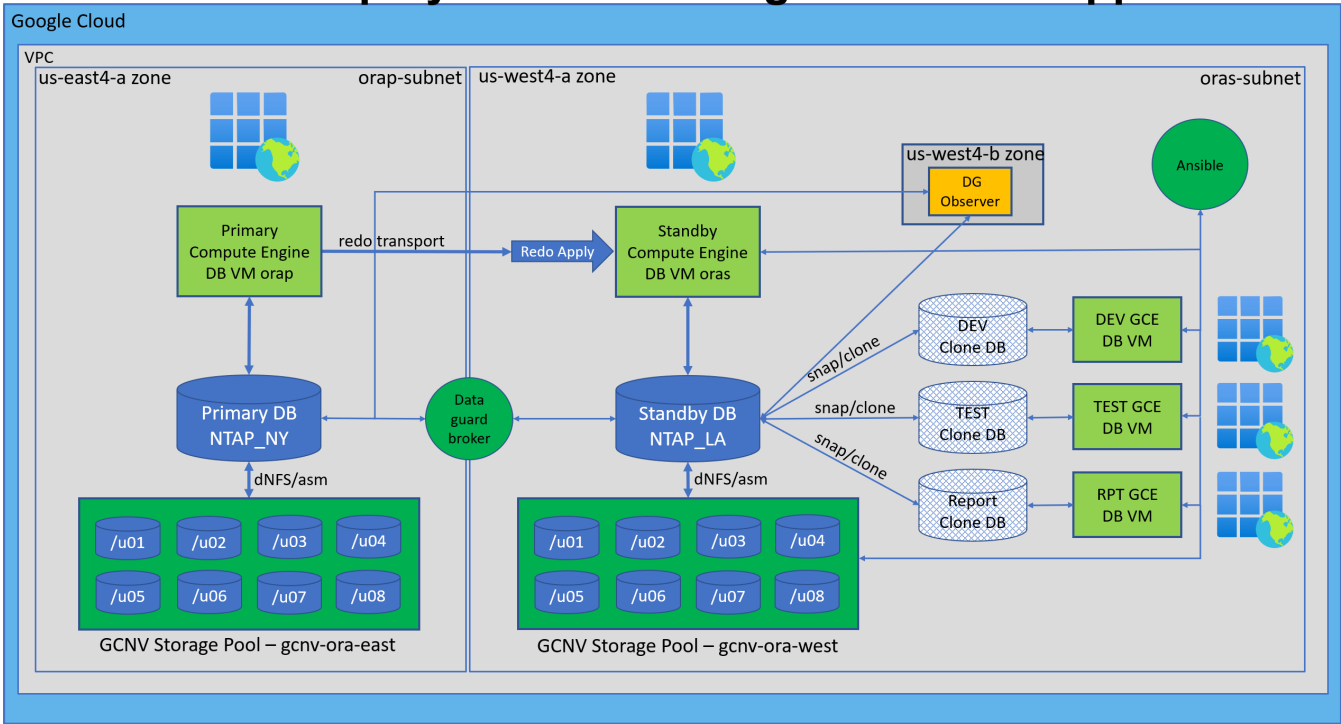
此解决方案适用于以下人群：

- 一位 DBA 在 Google 云中使用 Data Guard 设置 Oracle VLDB 以实现高可用性、数据保护和灾难恢复。
- 一位对 Google 云中带有 Data Guard 配置的 Oracle VLDB 感兴趣的数据库解决方案架构师。
- 管理支持 Oracle 数据库的 GCNV 存储的存储管理员。
- 喜欢在 Google 云环境中使用 Data Guard 建立 Oracle VLDB 的应用程序所有者。

解决方案测试和验证环境

该解决方案的测试和验证是在 Google 云实验室设置中进行的，可能与实际用户部署环境不匹配。有关更多信息，请参阅[部署考虑的关键因素](#)。

Oracle VLDB Deployment with Google Cloud NetApp Volumes



硬件和软件组件

硬件		
Google Cloud NetApp Volumes	Google 当前提供的服务	两个存储池、高级服务级别、自动 QoS
用于数据库服务器的 Google Compute Engine 虚拟机	N1 (4 个 vCPU, 15 GiB 内存)	四个 DB VM、主 DB 服务器、备用 DB 服务器、克隆 DB 服务器和 Data Guard 观察器。
软件		
红帽Linux	Red Hat Enterprise Linux 8.10 (Ootpa) - x86/64	RHEL 市场图像, PAYG
Oracle 网络基础设施	19.18 版	已应用RU补丁p34762026_190000_Linux-x86-64.zip
Oracle 数据库	19.18 版	已应用RU补丁p34765931_190000_Linux-x86-64.zip
dNFS一次性补丁	p32931941_190000_Linux-x86-64.zip	适用于网络和数据库
Oracle OPatch	版本 12.2.0.1.36	最新补丁p6880880_190000_Linux-x86-64.zip

Ansible	版本核心 2.16.2	python版本-3.10.13
NFS	3.0 版	为 Oracle 启用 dNFS

Oracle VLDB Data Guard 配置，模拟纽约到洛杉矶的灾难恢复设置

数据库	数据库唯一名称	Oracle 网络服务名称
主云	NTAP_NY	NTAP_NY.cvs-pm-主机-1p.内部
备用	NTAP_LA	NTAP_LA.cvs-pm-主机-1p.内部

部署考虑的关键因素

- * Google Cloud NetApp Volumes配置。* GCNV 在 Google 云中分配为 Storage Pools。在这些测试和验证中，我们部署了一个 2 TiB 存储池来托管 East4 区域的 Oracle 主数据库，并部署了一个 4 TiB 存储池来托管 West4 区域的备用数据库和数据库克隆。GCNV存储池有四个服务级别：Flex、Standard、Premium、Extreme。ANF容量池的IO容量取决于容量池的大小及其服务等级。在创建容量池时，您可以设置存储池位置、服务级别、可用区域和存储池容量。对于 Oracle Data Guard 配置，区域可用性应该足够，因为 Data Guard 会因区域级别故障而提供数据库故障转移保护。
- *调整数据库卷的大小。*对于生产部署，NetApp建议根据 Oracle AWR 报告对 Oracle 数据库吞吐量要求进行全面评估。在为 VLDB 数据库设计 GCNV 卷布局时，请考虑数据库大小、吞吐量要求和服务级别。建议仅使用 `Premium` 或者 `Extreme` Oracle 数据库服务。带宽保证为每 TiB 卷容量 64 MiB/s，最高可达 4.5 GiBps `Premium` 服务，每 TiB 卷容量 128 MiB/s，最高 4.5 GiBps `Extreme` 服务。更高的吞吐量将需要更大的体积尺寸来满足要求。
- *多个卷和负载平衡。*由于 QoS 是根据卷大小和存储池服务级别严格执行的，因此单个大卷可以提供与具有相同聚合卷大小的多个卷类似的性能级别。建议为 Oracle VLDB 实现多个卷（多个 NFS 挂载点），以更好地利用共享后端 GCNV 存储资源池，并满足超过 4.5 GiBps 的吞吐量要求。实现 Oracle ASM 以实现多个 NFS 卷上的 IO 负载平衡。
- *Google Compute Engine VM 实例考虑。*在这些测试和验证中，我们使用了具有 4 个 vCPU 和 15 GiB 内存的 Compute Engine VM - N1。您需要为具有高吞吐量要求的 Oracle VLDB 选择适当的 Compute Engine DB VM 实例。除了 vCPU 数量和 RAM 数量之外，在达到数据库存储吞吐量之前，VM 网络带宽（入口和出口或 NIC 吞吐量限制）也可能成为瓶颈。
- *dNFS 配置。通过使用 dNFS，在具有 GCNV 存储的 Google Compute Engine VM 上运行的 Oracle 数据库可以比本机 NFS 客户端驱动更多的 I/O。确保应用 Oracle dNFS 补丁 p32931941 来解决潜在的错误。

解决方案部署

以下部分演示了在 Oracle Data Guard 设置中 GCNV 上的 Oracle VLDB 的配置，该设置位于东部地区 Google 云中，使用 GCNV 存储的主 Oracle 数据库和西部地区 Google 云中，使用 GCNV 存储的物理备用 Oracle 数据库之间。

部署先决条件

部署需要以下先决条件。

1. 已设置 Google 云帐户，并在您的 Google 帐户内创建项目以部署设置 Oracle Data Guard 的资源。
2. 创建跨越 Data Guard 所需区域的 VPC 和子网。对于有弹性的 DR 设置，请考虑将主数据库和备用数据库放置在可以容忍本地区域发生重大灾难的不同地理位置。
3. 从 Google 云门户控制台部署四个 Google 计算引擎 Linux VM 实例，一个作为主 Oracle DB 服务器，一个作为备用 Oracle DB 服务器，一个克隆目标 DB 服务器和一个 Oracle Data Guard 观察器。有关环境设置的更多详细信息，请参阅上一节中的架构图。按照 Google 文档操作["在 Compute Engine 中创建 Linux 虚拟机实例"](#)以获得详细说明。



确保在 Azure VM 根卷中分配了至少 50G，以便有足够的空间来暂存 Oracle 安装文件。默认情况下，Google 计算引擎虚拟机在实例级别被锁定。为了实现虚拟机之间的通信，应该创建特定的防火墙规则来打开 TCP 端口流量，例如典型的 Oracle 端口 1521。

4. 从 Google 云门户控制台部署两个 GCNV 存储池来托管 Oracle 数据库卷。参考文档["创建存储池快速入门"](#)以获得分步说明。以下是一些屏幕截图，供快速参考。

The screenshot displays the Google Cloud Storage Pools console. The top section shows a list of storage pools with columns for Status, Name, Location, Service level, Capacity, Allocated to Volumes, Volume count, Created, and Labels. Below this, the 'Create storage pool' form is shown, including fields for Storage pool name, Description, Location, Service level, and Capacity.

Status	Name	Location	Service level	Capacity	Allocated to Volumes	Volume count	Created	Labels
Ready	gov-ora-east	us-east4	Premium	2048 GiB	2000 GiB	8	Apr 7, 2025, 11:50:52 AM	database: oracle
Ready	partis-pool	us-east5-a	Flex	1024 GiB	100 GiB	1	Mar 27, 2025, 2:24:04 PM	use-case: kubernetes-test owner: paris
Ready	hcd-regional-af	us-west2	Flex	1024 GiB	0 GiB	0	Mar 24, 2025, 3:05:14 AM	creator: ravid
Ready	ai-data-pool	us-central1	Extreme	2048 GiB	2048 GiB	1	Mar 22, 2025, 10:21:12 AM	creator: ravid
Ready	ai-artifact-pool	us-central1-c	Flex	1024 GiB	100 GiB	1	Mar 21, 2025, 1:34:44 PM	creator: ravid
Ready	test-pool	us-central1	Premium	2048 GiB	0 GiB	0	Mar 18, 2025, 7:02:09 PM	owner: dhan
Ready	ai-storage-pool	us-central1	Extreme	2048 GiB	0 GiB	0	Mar 18, 2025, 1:57:48 AM	owner: ravid
Ready	nike-pool-04	eu-west-4	Flex	1024 GiB	0 GiB	0	Mar 12, 2025, 11:10:05 AM	owner: ravid
Ready	nike02pool	us-central1-f	Flex	1111 GiB	0 GiB	0	Mar 12, 2025, 5:11:31 AM	
Ready	nyx-test	us-east4-a	Flex	1024 GiB	0 GiB	0	Feb 27, 2025, 12:24:41 AM	purpose: airtel-nyx6-test owner: ravid
Ready	gov-pool-flex-mumbai	asia-south1-a	Flex	1024 GiB	700 GiB	2	Jan 15, 2025, 12:23:57 AM	
Ready	gov-flex-pool-telaviv	asia-northeast1-a	Flex	1024 GiB	100 GiB	1	Jan 15, 2025, 12:12:57 AM	
Ready	demam-pool	me-central2-b	Flex	1024 GiB	0 GiB	0	Nov 8, 2024, 12:05:04 PM	
Ready	toronto-premium	northamerica-northeast2	Premium	2048 GiB	300 GiB	3	Nov 7, 2024, 8:19:30 AM	owner: team
Ready	gov-data-pool	asia-south1	Flex	2048 GiB	1423 GiB	7	Aug 20, 2024, 4:04:52 AM	owner: ravid
Ready	awsnet1-govnet	asia-southeast1	Premium	2048 GiB	1100 GiB	4	Aug 10, 2023, 6:40:49 PM	owner: kati purpose: govnet
Ready	montreal-premium	northamerica-northeast1	Premium	2048 GiB	1300 GiB	5	Aug 4, 2023, 8:13:52 AM	purpose: ml_awsnet_generic owner: team

Create storage pool

A storage pool specifies the following for all volumes within the pool: Capacity, service level, Virtual Private Network (VPN), Active Directory policy, LDAP and encryption. [Learn more](#)

Storage pool details

Storage pool name *
gov-ora-west

Description (optional)

Location
Region *
us-west4 (Las Vegas)

Service level
Service level of the pool defines the service level of all volumes within the pool. Each volume will get an individual or shared throughput limit based on its allocated capacity and storage pool service level. [Learn more](#)

☐ Flex
highly available general purpose storage with advanced data management, 2048-10,485,760 GiB capacity. Up to 5 GiB/s per storage pool with custom performance.

☐ Standard
highly available general purpose storage with advanced data management, 2,048-10,485,760 GiB capacity. Up to 16 KiB/s per GiB.

☒ Premium
highly available high-performance storage with advanced data management, 2,048-10,485,760 GiB capacity. Up to 64 KiB/s per GiB.

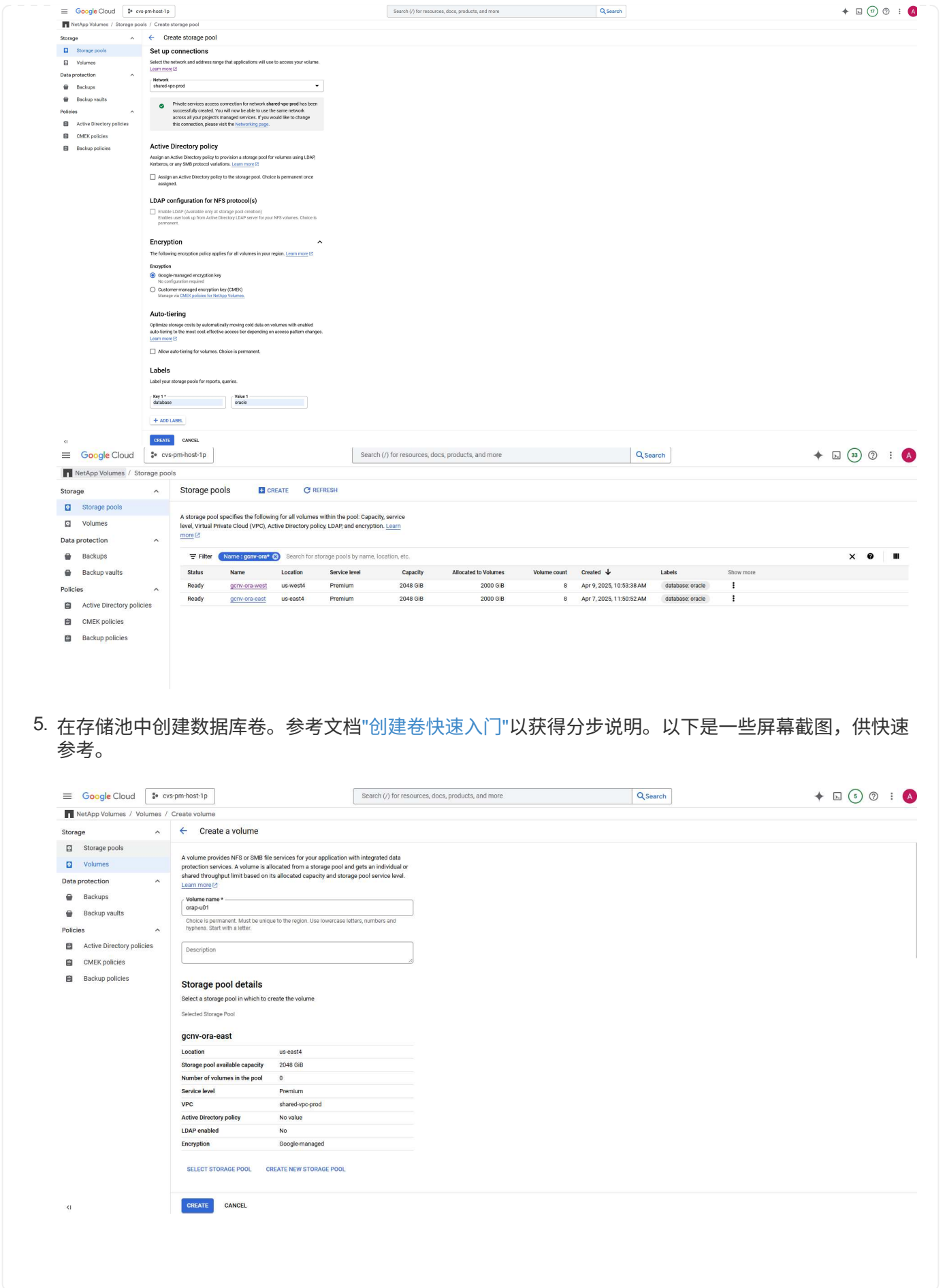
☐ Extreme
highly available high-throughput storage with advanced data management, 2,048-10,485,760 GiB capacity. Up to 128 KiB/s per GiB.

Storage pools and all volumes within the pool are highly available within the location selected.

Capacity
Capacity *
4096 GiB

Capacity must be between 2,048 GiB and 10,485,760 GiB in increments of 1 GiB.

Set up connections



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Create a volume

SELECT STORAGE POOL

CREATE NEW STORAGE POOL

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

CREATE

CANCEL

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Backup policies

Create a volume

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 be listed but can be accessed to list contents, etc.

Allow scheduled snapshots

When enabled, snapshots are created according to the schedule configured below.

HOURLY

DAILY

WEEKLY

MONTHLY

Snapshots To Keep

0

Hour (UTC)

Every hour

Minute (UTC)

0

The snapshot schedule will not be applied to the volume. To apply the snapshot schedule, adjust the retention controls.

Backup configuration

Use backup policy to automate volume backups.

Allow scheduled backups

When enabled, backups are automatically created according to the following specified policy.

Labels

Label your volumes for reports, queries.

ADD LABEL

CREATE

CANCEL

6

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Backup policies

Volumes

CREATE

REFRESH

A volume provides NFS or SMB file services for your application, with integrated data protection services. A volume is allocated from a pool and will get an individual throughput limit based on its allocated size and the pool service level. [Learn more](#)

Filter

Name: orap*

Name:

Status	Name	Location	Service level	Share name	Capacity	Used	Protocol(s)	Storage pool	Labels	Show more
Ready	orap-u08	us-east4	Premium	orap-u08	400	80.25% (321 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u07	us-east4	Premium	orap-u07	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u06	us-east4	Premium	orap-u06	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u05	us-east4	Premium	orap-u05	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u04	us-east4	Premium	orap-u04	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u03	us-east4	Premium	orap-u03	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u02	us-east4	Premium	orap-u02	250	80% (200 GiB)	NFSV3	gcnv-ora-east	database: oracle	
Ready	orap-u01	us-east4	Premium	orap-u01	100	21% (21 GiB)	NFSV3	gcnv-ora-east	database: oracle	

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Active Directory policies

CMEK policies

Backup policies

Volumes

CREATE

REFRESH

A volume provides NFS or SMB file services for your application, with integrated data protection services. A volume is allocated from a pool and will get an individual throughput limit based on its allocated size and the pool service level. [Learn more](#)

Filter

Name: oras*

Name:

Status	Name	Location	Service level	Share name	Capacity	Used	Protocol(s)	Storage pool	Labels	Show more
Ready	oras-u08	us-west4	Premium	oras-u08	400	79% (316 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u07	us-west4	Premium	oras-u07	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u06	us-west4	Premium	oras-u06	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u05	us-west4	Premium	oras-u05	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u04	us-west4	Premium	oras-u04	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u03	us-west4	Premium	oras-u03	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u02	us-west4	Premium	oras-u02	250	80% (200 GiB)	NFSV3	gcnv-ora-west	database: oracle	
Ready	oras-u01	us-west4	Premium	oras-u01	100	19% (19 GiB)	NFSV3	gcnv-ora-west	database: oracle	

6. 主 Oracle 数据库应该已经在主 Oracle DB 服务器中安装并配置。另一方面，在备用 Oracle DB 服务器或克隆 Oracle DB 服务器中，仅安装了 Oracle 软件，而没有创建 Oracle 数据库。理想情况下，Oracle 文件目录布局应该与所有 Oracle DB 服务器完全匹配。有关使用 NFS/ASM 安装和配置 Oracle 网络基础架构和数据库的帮助，请参阅 TR-4974。虽然该解决方案在 AWS FSx/EC2 环境上得到了验证，但它同样可以应用于 Google GCNV/Compute Engine 环境。

"TR-4974：在 AWS FSx/EC2 上使用 NFS/ASM 进行独立重启时 Oracle 19c"

Data Guard 的主要 Oracle VLDB 配置

7

在本演示中，我们在主 DB 服务器上设置了一个名为 NTAP 的主 Oracle 数据库，该数据库具有八个 NFS 挂载点：/u01 用于 Oracle 二进制文件，/u02、/u03、/u04、/u05、/u06、/u07 用于 Oracle 数据文件，并使用 Oracle ASM 磁盘组 +DATA 进行负载平衡；/u08 用于 Oracle 活动日志、归档日志文件，并使用 Oracle ASM 磁盘组 +LOGS 进行负载平衡。Oracle 控制文件放置在 +DATA 和 +LOGS 磁盘组上以实现冗余。此设置可作为参考配置。您的实际部署应该考虑到存储池大小、服务级别、数据库卷数量和每个卷的大小方面的特定需求和要求。

有关使用 ASM 在 NFS 上设置 Oracle Data Guard 的详细分步过程，请参阅 TR-5002 -"[使用 Azure NetApp Files 降低 Oracle Active Data Guard 成本](#)"。虽然 TR-5002 中的程序是在 Azure ANF 环境上验证的，但它们同样适用于 Google GCNV 环境。

下面说明了 Google GCNV 环境中 Data Guard 配置中主 Oracle VLDB 的详细信息。

1. 主计算引擎 DB 服务器中的主数据库 NTAP 作为单实例数据库在 GCNV 存储上的独立重启配置中部署，使用 NFS 协议和 ASM 作为数据库存储卷管理器。

```
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. 以 oracle 用户身份登录主数据库服务器。验证电网配置。

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

```

[oracle@orap ~]$ $GRID_HOME/bin/crsctl stat res -t
-----
-----
Name          Target  State          Server          State
details
-----
-----
Local Resources
-----
-----
ora.DATA.dg
          ONLINE  ONLINE        orap            STABLE
ora.LISTENER.lsnr
          ONLINE  ONLINE        orap            STABLE
ora.LOGS.dg
          ONLINE  ONLINE        orap            STABLE
ora.asm
          ONLINE  ONLINE        orap
Started, STABLE
ora.ons
          OFFLINE OFFLINE        orap            STABLE
-----
-----
Cluster Resources
-----
-----
ora.cssd
    1      ONLINE  ONLINE        orap            STABLE
ora.diskmon
    1      OFFLINE OFFLINE
ora.evmd
    1      ONLINE  ONLINE        orap            STABLE
ora.ntap.db
    1      ONLINE  ONLINE        orap
Open, HOME=/u01/app/o
racle/product/19.0.0
/NTAP, STABLE
-----
-----
[oracle@orap ~]$

```

3. ASM 磁盘组配置。

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> lsdisk
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. 主数据库上 Data Guard 的参数设置。

```
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-lp.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. 主数据库配置。

```
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.266.1198027075
+DATA/NTAP/86B637B62FE07A65E053F706E80A27CA/DATAFILE/sysaux.267.1198027075

```

+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 监听器配置。

```
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. 主数据库已启用闪回。

```

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

```

NAME	DATABASE_ROLE	FLASHBACK_ON
NTAP	PRIMARY	YES

8. 主数据库上的 dNFS 配置。

```

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.
```

这样就完成了在 GCNV 主站点上使用 NFS/ASM 为 VLDB NTAP 设置 Data Guard 的演示。

针对 **Data Guard** 的备用 **Oracle VLDB** 配置

Oracle Data Guard 需要操作系统内核配置和 Oracle 软件堆栈（包括备用数据库服务器上的补丁集）以与主数据库服务器匹配。为了便于管理和简单起见，备用数据库服务器的数据库存储配置理想情况下也应该与主数据库服务器匹配，例如数据库目录布局和 NFS 挂载点的大小。

再次强调，有关使用 ASM 在 NFS 上设置 Oracle Data Guard 备用服务器的详细分步过程，请参阅["TR-5002 - 使用 Azure NetApp Files 降低 Oracle Active Data Guard 成本"](#)和["TR-4974 - 使用 NFS/ASM 在 AWS FSx/EC2 上独立重启 Oracle 19c"](#)相关章节。下面说明了 Google GCNV 环境中 Data Guard 设置中备用数据库服务器上备用 Oracle VLDB 配置的详细信息。

1. 演示实验室中备用站点的备用 Oracle DB 服务器配置。

```
oras.us-west4-a.c.cvs-pm-host-1p.internal:
Zone: us-west4-a
size: nl-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. 备用数据库服务器上的网络基础设施配置。

```

[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. 备用数据库服务器上的 ASM 磁盘组配置。

```

[oracle@oras ~]$ asmcmd
ASMCMDB> 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/
ASMCMDB> lsdk
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
ASMCMDB>

```

4. 备用数据库上的 Data Guard 参数设置。

```
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-lp.interna		1

```
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. 备用数据库配置。

```
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. 验证备用数据库恢复状态。注意 `recovery logmerger` 在 `APPLYING\_LOG` 行动。

```
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. 备用数据库已启用闪回。

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

NAME	DATABASE_ROLE	FLASHBACK_ON
NTAP	PHYSICAL STANDBY	YES

8. 备用数据库上的 dNFS 配置。

```
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.
```

这样就完成了 VLDB NTAP 的 Data Guard 设置演示，并在备用站点启用了托管备用恢复。

使用观察者设置 Data Guard Broker 和 FSFO

设置 Data Guard Broker

Oracle Data Guard 代理是一个分布式管理框架，可自动并集中执行 Oracle Data Guard 配置的创建、维护和监控。以下部分演示如何设置 Data Guard Broker 来管理 Data Guard 环境。

1. 通过 sqlplus 使用以下命令在主数据库和备用数据库上启动数据保护代理。

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

2. 从主数据库，以 SYSDBA 身份连接到 Data Guard Broker。

```
[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. 创建并启用 Data Guard Broker 配置。

```
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. 在 Data Guard Broker 管理框架内验证数据库状态。

```
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>
```

如果发生故障，可以使用 Data Guard Broker 立即将主数据库故障转移到备用数据库。如果 `Fast-Start Failover` 启用后，当检测到故障时，Data Guard Broker 可以将主数据库故障转移到备用数据库，而无需用户干预。

使用观察者配置 **FSFO**

或者，可以为 Data Guard Broker 启用快速启动故障转移 (FSFO)，以便在发生故障时自动将主数据库故障转移到备用数据库。以下是使用观察者实例设置 FSFO 的步骤。

1. 创建一个轻量级的 Google 计算引擎实例，以在与主数据库服务器或备用数据库服务器不同的区域运行 Observer。在测试用例中，我们使用了具有 2 个 vCPU、7.5G 内存的 N1 实例。在主机上安装相同版本的 Oracle。
2. 以 oracle 用户身份登录并在 oracle 用户 .bash_profile 中设置 oracle 环境。

```
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. 将主数据库和备用数据库 TNS 名称条目添加到 tnsname.ora 文件。

```
vi $ORACLE_HOME/network/admin/tnsnames.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. 创建并使用密码初始化钱包。

```
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. 为主数据库和备数据库的用户 sys 启用无密码认证。首先输入系统密码，然后输入上一步的钱包密码。

```
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. 使用钱包位置更新 sqlnet.ora。

```
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. 验证凭证。

```
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. 配置并启用快速启动故障转移。

```
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. 启动并验证观察者。

```
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

Copyright (c) 1982, 2019, Oracle and/or its affiliates. All rights
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'
  FastStartFailoverAutoReinstat  = '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>



为了实现零数据丢失，需要将 Oracle Data Guard 保护模式设置为 MaxAvailability`或者`MaxProtection`模式。默认保护模式`MaxPerformance`可以通过编辑 Data Guard 配置并更改来从 Data Guard Broker 界面进行更改`LogXptMode`从异步到同步。Oracle 归档日志目标日志模式需要相应更改。当根据需要为 Data Guard 启用实时日志应用程序时`MaxAvailability`，避免自动重启数据库，因为自动重启数据库可能会无意中打开备用数据库`READ ONLY WITH APPLY`模式，该模式需要 Active Data Guard 许可证。相反，手动启动数据库以确保它保持`MOUNT`实时管理恢复的状态。

通过自动化克隆其他用例的备用数据库

以下自动化工具包专门用于创建或刷新部署到 GCNV 的 Oracle Data Guard 备用数据库的克隆，并使用 NFS/ASM 配置实现完整的克隆生命周期管理。

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



目前，只有具有 bitbucket 访问权限的 NetApp 内部用户才能访问该工具包。对于感兴趣的外部用户，请向您的客户团队请求访问权限或联系 NetApp 解决方案工程团队。参考["使用 ASM 在 GCNV 上实现 Oracle 克隆生命周期自动化"](#)了解使用说明。

在哪里可以找到更多信息

要了解有关本文档中描述的信息的更多信息，请查看以下文档和/或网站：

- TR-5002：使用 Azure NetApp Files 降低 Oracle Active Data Guard 成本
["TR-5002：使用 Azure NetApp Files 降低 Oracle Active Data Guard 成本"](#)
- TR-4974：在 AWS FSx/EC2 上使用 NFS/ASM 进行独立重启时 Oracle 19c

"TR-4974: 在 AWS FSx/EC2 上使用 NFS/ASM 进行独立重启时 Oracle 19c"

- NetApp 在 Google Cloud 上提供一流的文件存储服务

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

- Oracle Data Guard 概念和管理

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

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