

**NetApp Solution Deployment Guidelines**

**Thomson Reuters – Oracle on NetApp cDOT**

**Synopsis:** This document details the NetApp clustered Data ONTAP solution used for storage in Oracle environments at Thomson Reuters.

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**Document Version:** V1

**Date:** November 2013

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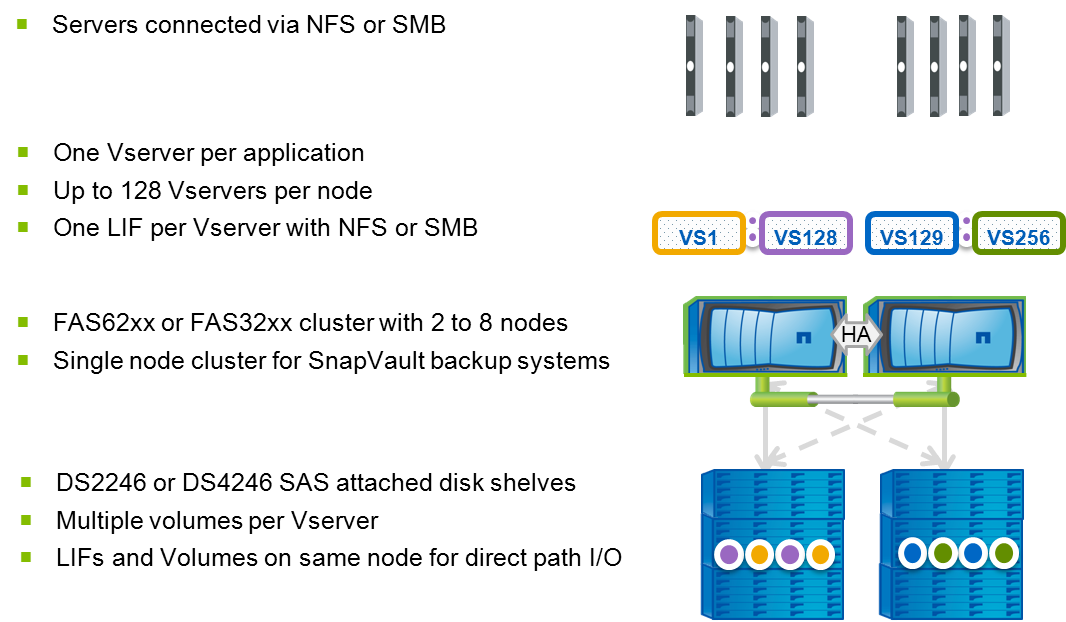
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# Introduction

## Management Summary

This document details the NetApp clustered Data ONTAP (cDOT) solution used for Oracle environments at Thomson Reuters. The storage system configuration of Vservers, Networking, Volumes, and Storage Efficiency will be covered in detail. The following drawing gives a high level overview of the cDOT shared storage environment solution at Thomson Reuters.



## Assumptions

It is assumed the person(s) reading this document are conversant with NetApp hardware and software. They will also be conversant with the Linux operating systems, NFS protocol, and database systems at a high level.

## Change History

|  |  |  |  |
| --- | --- | --- | --- |
| **Ver** | **Date** | **Author** | **Key Changes** |
| 1 | November 2013 | Michael Arndt | Initial Version |

## 

## Distribution List

|  |  |
| --- | --- |
| **Name** | **Role** |
| Brett Truhler | Customer |
| Stewart Bird | Customer |
| Dan Dressel | Customer |
| Boris Belous | Customer |
| Mitchell Vallone | Reviewer |
| Michael Arndt | Reviewer |
| Ian Daniel | Reviewer |

## Glossary

|  |  |
| --- | --- |
| **Term** | **Definition** |
| cDOT | clustered Data ONTAP |
| Vserver | A logical storage virtual server, also known as a Storage Virtual Machine (SVM), which contains LIFs, Volumes, and configuration information such as access control details. |
| LIF | Logical Interface – a cDOT logical network interface with an IP address, assigned to a single Vserver. |
| QoS | Quality of Service – introduced in cDOT 8.2 to provide workload monitoring and throughput rate limiting as desired. |
| WFA | OnCommand Workflow Automater – An automation framework application from NetApp, used for storage provisioning. |

## What is new in cDOT for Oracle environments at TR

While many concepts and configuration tasks remain identical in the NetApp cDOT storage environment for Oracle, as compared to the NetApp 7 Mode environment, a few things are different. The following gives a list of the most visible changes that the reader should be aware of:

* The path that is mounted from the NFS client changes in cDOT. While the NFS mountpoints for all 7 Mode systems start with */vol/*, this is no longer the case with cDOT. As such, it will be easy to determine if a NetApp system is running 7 Mode or cDOT by simply looking at the path to the volume being mounted. For example, this would be a path to a 7 Mode volume in a NFS mountpoint:

*<vFiler>:/vol/<volname>/<qtreename>*

In cDOT, the path would instead look like this:

*<Vserver>:/<volname>/<qtreename>*

* Performing restores of single files in cDOT will be significantly faster than in 7 Mode, as the system uses a cloning technology that will complete the restore process in seconds, regardless of the file size. The SnapRestore licensing on a cDOT storage system allows for the use of this cloning technology during restore scenarios. A FlexClone license is therefore only required when making clones for the purposes of having additional copies of an object available, or for making a read/write copy of a snapshot.
* The method for creating snapshots on primary storage in the Oracle hot backup script changes, as compared to the process used by the Oracle hot backup scripts for 7 Mode. Section 6 provides example code for creating snapshots, removing old snapshots, and calculating SnapVault lag time on a cDOT system.
* Restores from the SnapVault secondary will be more easily performed, as cDOT uses a better integrated volume SnapVault process as compared to the process used by TR for 7 Mode.

# NetApp Storage System Configuration

## General configuration

The typical configuration for Oracle databases using NetApp storage within TR is to allocate 1 Vserver with 1 LIF per Oracle database. When configuring Vservers for use with Oracle databases, the following configuration options and limitations should be taken into consideration:

* The Oracle database servers must be able to access the Vserver via NFSv3 and SSH.
* While the Oracle database servers and the Vserver LIF do not need to reside on the same network subnet, the path should include a minimal number of network hops.
* Each Vserver will be configured with a local account, named *oracle*, used for communication via SSH between the Oracle server and the Vserver. The account should be created with a role that has access to the *volume snapshot* and *set* command directories.

## Volume and Qtree layout

Each Oracle deployment will typically have 3 flexvols configured on a NetApp primary storage system, as show in the following table. The following table gives a high level description of the volumes and qtrees used in a typical LION configuration for TR.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Storage Volume** | **Storage Qtree** | **Description** | **Snap Reserve** | **SnapVault?** |
| <bu>\_<app>\_n01ora1\_nosnap | n01oracluster1 | RAC OCR/Vote | 0% | No |
| n01oradata1 | Control, Temp, Online and Standby Redo logs |
| n01oraflash1 | Flashback Recovery area if in use |
| n01oraadmin1 | Admin area, does not require backup – ADR |
| n01oraggs | GoldenGate software and configuration if used |
| <bu>\_<app>\_s01ora1\_snap | s01oradata1 | Data and control files | 20% | Yes |
| <bu>\_<app>\_s01oraadm1\_snap | s01oraadmin1 | Admin area, requires backup – spfile | 20% | Yes |

When provisioning volumes and qtrees for an Oracle configuration, the following should be noted:

* Sizing requirements will be provided by DBA team, based on their requirements and their standard sizing templates for LION configurations.
* The qtrees in the nosnap volume will have quotas configured, with the tree quota limit as determined by the sizing input given by the DBA team.
* The qtrees in the snap volumes will not have quotas configured, since there is only a single qtree in the volume. We will still create the qtree just to maintain a consistent layout as compared to the 7 mode implementation.

The follow configuration settings apply for each *\_snap* volume, in order to implement snap autodelete:

* Set the *space-mgmt-try-first* volume setting to *snap\_delete*
* Enable *volume snapshot autodelete*

## Snap Reserve sizing and monitoring

For volumes on which snapshots will be taken, the Snap Reserve configuration listed in section 2.2 is 20%. A 20% snap reserve has shown to be adequate for most applications, without wasting space. This can be increased in the event that an application is consistently over-utilizing their Snap Reserve area and having too many snapshots autodeleted. Snap autodelete is used to keep the Snap Reserve area from overflowing into the active filesystem portion of the volume.

## Snapshot backup configuration on primary storage

Snapshot creation for the s01ora1\_snap volume on primary storage will be driven completely by scripts running on the Oracle server. These scripts will use SSH to run a *volume snapshot create* command while the database is in hot backup mode. In order to support the creation of snapshots that can be vaulted, the *snapmirror-label* argument must also be used when creating snapshots. By convention at TR, we will set the *snapmirror-label* to a value of *snapvault*, and all such snapshots will be vaulted to the secondary system.

The s01oraadm1\_snap for each database volume does not get snapshots taken as part of the backup process, and instead will have snapshots created on primary storage as part of a schedule associated with a volume snapshot policy. Again, these snapshots will use a *snapmirror-label* of *snapvault* to allow them to be transferred to the SnapVault secondary system.

Examples of the snapshot and snapvault configuration are given in the *Clustered ONTAP provisioning CLI examples* section of this document. An example of a script that uses cDOT commands for snapshot creation, rotation, and snapvault lag time calculation is given in the *Oracle hot backup script example* section.

## SnapVault backup configuration on secondary storage

The SnapVault relationship for volumes with Oracle databases on them will be initialized in the same way that all SnapVault relationships are configured within a cDOT system. By convention within the TR environment, they will be configured to vault all snapshots with a snapmirror-label of *snapvault*.

Note that the timing of the SnapVault replication updates is configured on the SnapVault secondary, and therefore snapshot creation via Oracle backup scripts should be configured to take place on primary storage prior to the replication update start time configured on the SnapVault secondary.

## QoS configuration

In the TR shared storage environment, QoS policies with specific rate limits will be configured on all volumes. One QoS policy group will be configured per Vserver, and the policy group will be named the same as the Vserver name. The QoS policy group for each Vserver will be applied to each of the volumes owned by that Vserver.

For dedicated storage environments at TR, QoS policies should still be configured in the same manner as the shared environment, with the one difference being that the policy group can be set without a throughput limit. This is done in order to utilize the QoS latency statistics.

# Oracle server configurations related to NetApp storage

## Database file layout

Each Oracle database will use a number of NFS mountpoints to store their data. The following table gives a high level description of the standard NFS mountpoint layout and how it maps to the volume layout on the NetApp storage system. A more detailed document on the sizing and configuration for these mountpoints is available from the TR DBA team.

|  |  |  |  |
| --- | --- | --- | --- |
| **Mount Description** | **Mountpoint** | **Storage Volume** | **Storage Qtree** |
| RAC OCR/Vote | /n01/oracluster1 | <bu>\_<app>\_n01ora1\_nosnap | n01oracluster1 |
| Control, Temp, Online and Standby Redo logs | /n01/oradata1 | n01oradata1 |
| Flashback Recovery area if in use | /n01/oraflash1 | n01oraflash1 |
| Admin area, does not require backup – ADR | /n01/oraadmin1 | n01oraadmin1 |
| GoldenGate software and configuration if used | /n01/oraggs | n01oraggs |
| Data and control files | /s01/oradata1 | <bu>\_<app>\_s01ora1\_snap | s01oradata1 |
| Admin area, requires backup – spfile | /s01/oraadmin1 | <bu>\_<app>\_s01oraadm1\_snap | s01oraadmin1 |

In the event that additional volumes are required when using multiple instances of Oracle on the same Oracle database servers, a second set of mountpoints with a slightly modified naming convention (n02 and s02 instead of n01 and s01) is configured as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Mount Description** | **Mountpoint** | **Storage Volume** | **Storage Qtree** |
| Control, Temp, Online and Standby Redo logs | /n02/oradata1 | <bu>\_<app>\_n02ora1\_nosnap | n02oradata1 |
| Flashback Recovery area if in use | /n02/oraflash1 | n02oraflash1 |
| Admin area, does not required backup – ADR | /n02/oraadmin1 | n02oraadmin1 |
| Data and control files | /s02/oradata1 | <bu>\_<app>\_s02ora1\_snap | s02oradata1 |
| Admin area, requires backup – spfile | /s02/oraadmin1 | <bu>\_<app>\_s02oraadm1\_snap | s02oraadmin1 |

## Oracle archive log storage

The database file layout guidelines given above do not address the location of Oracle archive logs. Oracle archive logs will be written to a NFS mountpoint served by a different Vserver that resides on a dedicated cDOT log backup storage system. The dedicated cDOT log backup storage system will have one volume per Oracle instance with no qtrees being used, and it will be configured with post-process compression. In the event that this primary log backup storage is unavailable due to a planned or unplanned outage, Oracle switches to writing the archive logs to a 7 Mode NetApp NFS mountpoint. The 7 Mode NetApp storage is configured as a single thin provisioned volume per datacenter module named infra\_nosnap, with each instance of Oracle having it’s own qtree for archive log storage. The following table describes the NFS mountpoints used by the Oracle server for achive log storage:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Mount Description** | **Mountpoint** | **Storage System** | **Storage Volume** | **Storage Qtree** |
| Primary archive area | /n01/oraarch1 | NetApp cDOT | <bu>\_<app>\_oralogs\_nosnap |  |
| Alternate archive area | /n01/oraarch2 | NetApp 7 Mode | infra\_nosnap | <bu>\_<app>\_n01oraarch2 |

## NFS mount options

NetApp and Oracle have well defined and jointly supported NFS mount options for Oracle single instance and Oracle RAC environments. The following Best Practices for Oracle Databases on NetApp Storage document on the NetApp support site (login required) documents these best practices:

<http://www.netapp.com/us/media/tr-3633.pdf>

Note that for Oracle RAC configurations, the “actimeo=0” NFS mount option is listed as being required for all Oracle mountpoints. While this is the published best practice by both NetApp and Oracle, we have seen within the TR environment that a large amount of NFS GETATTR and LOOKUP traffic is occasionally generated within the ADR location (/n01/oraadmin1). After extensive testing, and the relocation of the spfile to the /s01/oraadmin1 mountpoint, TR has determined that the actimeo=0 NFS mount option can be removed from the /n01/oraadmin1 mountpoint. This configuration is only in place for LIONv2 configurations.

This has shown a dramatic reduction in NFS operations on that mountpoint in some instances, and therefore this reduces the load significantly on shared storage systems hosting multiple Oracle databases. Any configuration not following the exact LIONv2 standard for the Oracle file layout should adhere to the recommendations in the KB article and use actime=0 on all mountpoints.

## Linux kernel TCP tuning on the Oracle server

A number of TCP tunings are used in the Linux kernel of the Oracle server, in order to ensure the best possible performance. The following is a subset of the settings used in /etc/sysctl.conf on the Oracle server, as they are defined for the LIONv2 standard. The TR DBA and Platform management teams can provide the full list of settings based on a specific implementation, and whenever possible the TR standard and tested configurations should be used. This section is included in this document only to remind the reader that these types of Linux kernel settings are important in order to ensure the best possible performance when running Oracle over NFS.

# 10GigE Standard Network Tunables for TR

net.core.rmem\_default = 16777216

net.core.rmem\_max = 16777216

net.core.wmem\_default = 16777216

net.core.wmem\_max = 16777216

net.ipv4.tcp\_wmem = 16777216 16777216 16777216

net.ipv4.tcp\_rmem = 16777216 16777216 16777216

net.core.netdev\_max\_backlog = 300000

# Increase NFS over TCP parallelism

sunrpc.tcp\_slot\_table\_entries = 128

## Oracle init.ora parameters

The Oracle init.ora configuration file contains a number of parameters in it, and these should be configured per the current TR standards for a given implementation. One parameter in particular is important to have properly configured when running Oracle over NFS, which we will call out in this document, is the filesystemio \_options setting. For any recent version of Linux (RHEL 5 and above, SLES 11 and above) this should be configured as “setall” in order to enable both Direct IO and Async IO. Older versions of Linux that don’t support Async IO with NFS should have this option configured simply as “directio”.

# Oracle backup and recovery

The Oracle backup and recovery procedures documented here are focused on the use of NetApp snapshots for Oracle datafile backup and recovery.

## Oracle backup

Backups are initiated by a shell script, scheduled in cron, from the Oracle server. This shell script, amongst other tasks, will put the Oracle tablespaces in hot backup mode and then run a *volume snapshot create* command via SSH on the Vserver hosting it’s *s01ora1\_snap* volume. This requires SSH publickey authentication to be properly configured between the Oracle server and the Vserver hosting it’s volumes. Each DBA group within TR manages it’s own shell script for doing Oracle backups, but the method by which the snapshots are taken is identical in all scripts.

## Oracle restore scenarios

### Restoring a single datafile from primary snapshot backups

There are two methods by which restores of single files can be performed from snapshots on primary storage. The first option is to use a simple *cp* command from the Oracle server to copy data from a snapshot directory back to the active filesystem. To see the snapshots available on primary storage, *cd* into the directory where the restore is required. Then use *cd .snapshot* and *ls –lu* to see the snapshots that are available. Once the snapshot path to the file to be restored has been identified, it can be copied back to the fully qualified path to the active filesystem. For example:

*cp /s01/oradata1/.snapshot/<dir>/<snapshot\_name>/<filename> /s01/oradata1/<dir>/<filename>*

The second option is to use the single file snap restore capabilities on the NetApp storage system to perform the restore. You can use the *volume snapshot show* command to determine which snapshot you want to use for the restore, or you can use the *ls –lu* command as described above to view the available snapshots. The single file snap restore and snapshot related commands can be run on the NetApp storage controller via a SSH connection from the Oracle server, and multiple files can be restored in parallel by issuing multiple commands via SSH. For example:

*ssh <Vserver> volume snapshot show –volume <volume\_name>*

*ssh <Vserver> volume snapshot restore-file –volume <volume\_name> –snapshot <snapshot\_name> -path </vol/volname/path/to/filename>*

The use of the single file snap restore command will be significantly faster than a simple client based “cp” command to restore files from snapshots, since single file snap restores within cDOT are actually performed by cloning the file from a snapshot. This allows for single file snap restores in cDOT to complete within seconds, regardless of the size of the file being restored.

### Restoring all datafiles in a volume from primary snapshot backups

In some use cases, it is necessary to restore all files in a given volume back to a previous point in time. When this is required, NetApp storage controllers have the ability to perform a volume snap restore operation. While this is similar in concept to the single file snaprestore, it has some very important differences:

• Using a volume snap restore can result in snapshot backups being removed from the volume. If a volume snap restore is used to restore to a snapshot that is older than the most recently created snapshot, then all of the snapshots that are newer than the snapshot being used for the restore will be removed. This is because a volume snap restore reverts the entire volume, including snapshots of the volume, back to the state as it existed when the snapshot being used for the restore was created.

An example of performing a volume snap restore is provided here:

*ssh <Vserver> “set advanced; volume snapshot restore –volume <volume\_name> –snapshot <snapshot\_name>“*

After a volume snap restore operation, the storage support team should be notified, as the SnapVault backup relationship to secondary storage may need to be re-initialized.

### Restore from Secondary snapshot backups

In the event that the snapshot backups required for the restore are no longer available on primary storage, the restore must be performed from secondary storage. Again, there are two ways in which this restore can be accomplished.

The first option is that the SnapVault secondary volume can be exported to the Oracle server, and it can be mounted via NFS on the server where the restore is required. This will require that the Oracle DBA make a request to the storage support team for the NFS export of the SnapVault secondary volume to be configured. The Oracle DBA can then use a simple copy operation, similar to what was described in section 4.2.1, to copy data from a snapshot on secondary storage back to the active filesystem on primary storage. The advantage to using this method is that the Oracle DBA has all the secondary snapshots at their disposal for use in the restore process. This can be useful if the DBA is not sure which version of a given file will be required, as they can quickly change to using a different snapshot for their restore process.

The second option is that the Oracle DBA can request that a SnapVault restore be performed to revert the entire contents of the primary storage volume(s) to a point in time from a previous backup. If a SnapVault restore is used to restore to a snapshot that is older than the most recently created snapshot, then all of the snapshots that are newer than the snapshot being used for the restore will be removed. This is because the SnapVault restore reverts the entire volume, including snapshots of the volume, back to the state as it existed when the snapshot being used for the restore was created.

An example of performing a volume snap restore is provided here:

*snapmirror restore -destination-path <Primary\_Vserver>:<Primary\_Volume> -source-path <Secondary\_Vserver>:<Secondary\_Volume> -source-snapshot <snapshot\_name>*

### Partial tablespace restores from snapshot backups

In some cases, only a small portion of a tablespace needs to be restored from a snapshot backup copy. Examples of this use case would be having a single table, or a single row in a table, that needs to be restored. In these cases, a snapshot of the SnapVault secondary volume can be cloned on the secondary controller. This clone is essentially a writable copy of a snapshot, but it only requires storage for blocks that are changed, and therefore it can be created very quickly (typically 10 seconds or less) regardless of the dataset size. This clone can then be exported via NFS to an Oracle restore server that would be used to bring up a version of the database that is used for restore purposes. While this method is not widely used within TR, the concept is documented here so that it can be considered for future restore scenarios.

# Clustered ONTAP provisioning CLI examples

While WFA is meant to be used for storage provisioning in the Oracle environment, it may be useful to know the exact commands that would be used in the event that provisioning needed to be done manually for any reason.

## ****Vserver and LIF creation****

### Create Vserver

vserver create -vserver <vsname> -rootvolume <vsname>\_root-aggregate <aggrname> -ns-switch file -nm-switch file -rootvolume-security-style unix -language C.UTF-8

vserver show

### Create LIF with default route and failover group

network interface create -vserver <vsname> -lif <vsname>\_lif1 -role data -data-protocol nfs,cifs -home-node <node> -home-port <port> -address <ip> -netmask <netmask> -status-admin up -firewall-policy mgmt -failover-group <group>

network routing-groups route create -vserver <vsname> -routing-group d<network>/<mask> -destination 0.0.0.0/0 -gateway <gateway>

vserver show

network interface show

network interface show -failover

network routing-groups route show

## ****Oracle account setup****

### Oracle role, user, and SSH publickey configuration

security login role create -role oracle -cmddirname "volume snapshot" -access all -vserver <vsname>

security login role create -role oracle -cmddirname "set" -access all -vserver <vsname>

security login create -username oracle -application ssh -authmethod publickey -role oracle -vserver <vsname>

security login publickey create -username oracle -vserver <vsname> -publickey "ssh-dss pub\_key\_string"

## ****NFS and CIFS configuration****

### Enable NFSv3

vserver nfs create -vserver <vsname> -access true -v3 enabled

vserver nfs show

## ****Primary job schedule and snapshot policy configuration****

### Create job schedule and snapshot policy

job schedule cron create -name <schedule> -minute <min> -hour <hour>

volume snapshot policy create -vserver <vsname> -policy oraadm\_daily -enabled true -schedule1 <schedule> -count1 7 -snapmirror-label1 snapvault -prefix1 oraadm\_daily

job schedule show

volume snapshot policy show

## ****Volume creation****

### Create primary volumes and share for NFS access

vserver export-policy rule create -vserver <vsname> -policyname default -clientmatch <nfsclient1> -rorule sys -rwrule sys -superuser sys

vserver export-policy rule create -vserver <vsname> -policyname default -clientmatch <nfsclient2> -rorule sys -rwrule sys -superuser sys

volume create -vserver <vsname> -volume <ora1\_volname> -aggregate <aggrname> -size <size> -policy default -snapshot-policy none -junction-path /<ora1\_volname> -security-style unix –space-guarantee none –percent-snapshot-space 20 –language C.UTF-8

volume create -vserver <vsname> -volume <oraadm\_volname> -aggregate <aggrname> -size <size> -policy default -snapshot-policy oraadm\_daily -junction-path /<oraadm\_volname> -security-style unix –space-guarantee none –percent-snapshot-space 20 –language C.UTF-8

volume create -vserver <vsname> -volume <nosnap\_volname> -aggregate <aggrname> -size <size> -policy default -snapshot-policy none -junction-path /<nosnap\_volname> -security-style unix –space-guarantee none –percent-snapshot-space 0 –language C.UTF-8

volume show

vserver export-policy rule show

### Setup snap autodelete on volumes

volume modify -vserver <vsname> -volume <ora1\_volname> -space-mgmt-try-first snap\_delete

volume modify -vserver <vsname> -volume <oraadm\_volname> -space-mgmt-try-first snap\_delete

volume snapshot autodelete modify -vserver <vsname> -volume <ora1\_volname> -enabled true

volume snapshot autodelete modify -vserver <vsname> -volume <oraadm\_volname> -enabled true

volume show -vserver <vsname> -fields space-mgmt-try-first

volume snapshot autodelete show -vserver <vsname>

### Create primary qtrees with quotas

volume quota on -vserver <vsname> -volume <nosnap\_volname>

volume qtree create -vserver <vsname> -volume <nosnap\_volname> -qtree <qtname> -security-style unix

volume quota policy rule create -vserver <vsname> -policy-name default -volume <nosnap\_volname> -type tree -target <qtname> -disk-limit <XXXg>

### Create secondary volumes for SnapVault as type “DP”

volume create -vserver <vsname> -volume <ora1\_volname> -aggregate <aggrname> -size <size> -security-style unix –space-guarantee none –percent-snapshot-space 0 –language C.UTF-8 –type DP

volume create -vserver <vsname> -volume <oraadm\_volname> -aggregate <aggrname> -size <size> -security-style unix –space-guarantee none –percent-snapshot-space 0 –language C.UTF-8 –type DP

volume show

## ****QoS policy group creation****

### Create QoS policy group and apply it at the volume level

qos policy-group create -policy-group <vsname> -vserver <vsname> -max-throughput <qosmax>MB/s

volume modify -vserver <vsname> -volume <volname> -qos-policy-group <vsname>

qos policy group show

volume show –vserver <vsname> -fields qos-policy-group

## ****Cluster and Vserver peering****

### Create the cluster and vserver peering required for SnapVault from the destination system

cluster peer create -peer-addrs <remote\_ICL\_IP1,remote\_ICL\_IP2> -username admin

vserver peer create -vserver <secondary\_vsname> -peer-cluster <source\_clustername> -peer-vserver <source\_vsname> -applications snapmirror

cluster peer show

vserver peer show

### Accept the vserver peering on the source system

vserver peer accept -vserver <source\_vsname> -peer-vserver <secondary\_vsname>

vserver peer show

## ****SnapVault configuration****

### Setup SnapMirror policy on destination system

job schedule cron create -name <schedule> -minute <min> -hour <hour>

snapmirror policy create -vserver <vsname> -policy <policy>

snapmirror policy add-rule -vserver <vsname> -policy <policy> -snapmirror-label snapvault -keep <num\_snapshots\_to\_keep>

job schedule show

snapmirror policy show

### Initialize SnapVault relationship

snapmirror create -source-path <source\_vsname:source\_vol> -destination-path <dest\_vsname:dest\_vol> -type XDP -schedule <schedule> -policy <policy>

snapmirror initialize -destination-path <dest\_vsname:dest\_vol>

snapmirror show

# Oracle hot backup script example

The following shell script shows an example of how to perform the following tasks on a cDOT system from an Oracle hot backup script:

1. Create a new snapshot with the proper snapmirror-label.
2. Remove the oldest snapshots when more than 7 snapshots exist.
3. Calculate the lag time since the most recent SnapVault update.

#!/bin/bash

DATADIRBASE="ora"

DATETIME=`date +%Y%m%d\_%H%M`

snapname="oracle\_hotbackup\_${DATETIME}"

for fullvolpath in `grep $DATADIRBASE /proc/mounts | grep -v nosnap | awk '{print $1}'` ; do

# Create a new snapshot.

volpath=`echo $fullvolpath | awk 'BEGIN {FS=":"} {print $2}'`

nasdevice=`echo $fullvolpath | awk 'BEGIN {FS=":"} {print $1}'`

volsnap=`echo $volpath | awk 'BEGIN {FS="/"} {print $2}'`

echo "Creating snapshot $snapname on volume $volsnap of nasdevice $nasdevice"

ssh oracle@${nasdevice} volume snapshot create -volume $volsnap -snapshot $snapname -snapmirror-label snapvault

# Find out if we have more than 7 snapshots on the primary.

snapcount=`ssh oracle@${nasdevice} volume snapshot show -volume $volsnap -snapmirror-label snapvault -fields snapmirror-label | grep snapvault | wc -l`

echo "$snapcount snapshots found"

if [ $snapcount -gt 7 ] ; then

removecount=`expr $snapcount - 7`

echo "Removing $removecount snapshots"

# The snapshots are listed from oldest to newest, so we remove the first $removecount snapshots in excess of 7.

for snapshot in `ssh oracle@${nasdevice} volume snapshot show -volume $volsnap -snapmirror-label snapvault -fields snapmirror-label | grep snapvault | head -n $removecount | awk '{print $3}'` ; do

echo "Removing snapshot $snapshot"

ssh oracle@${nasdevice} volume snapshot delete -volume $volsnap -snapshot $snapshot

done

fi

done

# Find the lag time.

last\_vault\_date=`ssh oracle@${nasdevice} "set diag; volume snapshot show -volume $volsnap -fields tags,create-time" | grep snapvault | grep snapmirrorDP | awk 'BEGIN {FS="\""} {print $2}'`

if [ "$last\_vault\_date" != "" ] ; then

echo "Last vault date: $last\_vault\_date"

last\_vault\_epoch=`date -d "$last\_vault\_date" +%s`

current\_epoch=`date +%s`

date\_diff=`expr $current\_epoch - $last\_vault\_epoch`

hours\_diff=`expr $date\_diff / 3600`

if [ "$hours\_diff" -gt 24 ] ; then

echo "Error in vault updates!"

echo "Lag hours is $hours\_diff."

echo "Last snapshot vaulted create-time is $last\_vault."

else

echo "Vault relationship is up to date. Lag hours is $hours\_diff."

fi

else

echo "Error finding last vault date."

fi