

**NetApp Solution Deployment Guidelines**

**Thomson Reuters – Log Backups**

**Synopsis:** This document details the NetApp clustered Data ONTAP solution used for backups of log files from Oracle, SQL Server, and MySQL databases.

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**Document Version:** V11

**Date:** November 2015

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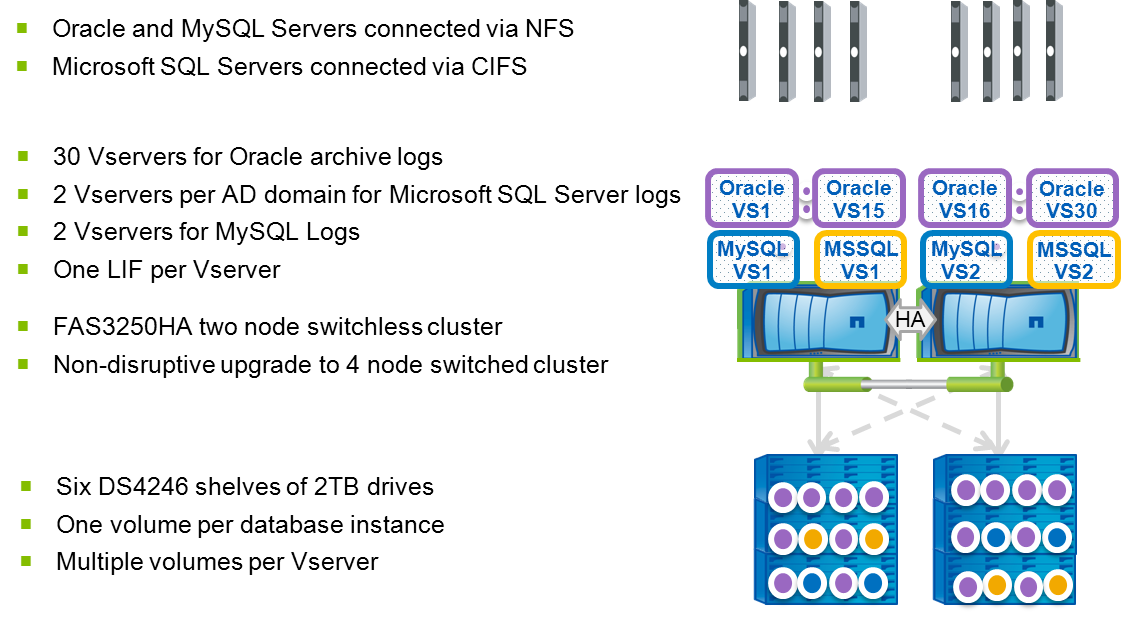
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# Introduction

## Management Summary

This document details the NetApp clustered Data ONTAP solution used for backups of log files from Oracle, SQL Server, and MySQL instances. 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 solution.



## 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 and Windows operating systems, NFS and CIFS protocols, and database systems at a high level.

## Change History

|  |  |  |  |
| --- | --- | --- | --- |
| **Ver** | **Date** | **Author** | **Key Changes** |
| 1 | September 2013 | Michael Arndt | Initial Version. |
| 2 | October 2013 | Michael Arndt | Added a note that the log backup nodes should be kept separate from other clusters, in section 2.3. |
| 3 | October 2013 | Michael Arndt | Added DNS configuration example. |
| 4 | November 2013 | Michael Arndt | Added volume naming format examples, pruning script example, and name-mapping examples. |
| 5 | November 2013 | Michael Arndt | One SQL log Vserver per domain, 7 Mode SQL log backup |
| 6 | December 2013 | Michael Arndt | Create log backup volumes as the same size of the aggregate. |
| 7 | January 2014 | Michael Arndt | Set the log backup volume size to 70,000GB. |
| 8 | February 2014 | Michael Arndt | Naming convention changes. |
| 9 | February 2014 | Michael Arndt | More naming convention changes, and included 30 day retention option. |
| 10 | April 2014 | Michael Arndt | 8.2P5 is minimum version, Oracle Vserver change to 30. |
| 11 | November 2015 | Ken Zola | Updated language setting for Vservers and volumes. |

## Distribution List

|  |  |
| --- | --- |
| **Name** | **Role** |
| Brett Truhler | Customer |
| Stewart Bird | Customer |
| Mitchell Vallone | Reviewer |
| Ken Zola | 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. |

# NetApp Storage System Configuration

## Cluster configuration

The log backup solution will initially consist of a single HA pair of FAS3250 or FAS8040 storage nodes, configured in a two node switchless cluster. Each node will have 3 DS4246 shelves of 2TB drives attached to it for storage. If the cluster needs to grow at some point in the future, a non-disruptive reconfiguration from the two node switchless cluster to a four node switched cluster can be performed. Each storage node in a cluster will be licensed only for NFS and CIFS protocols. No other software licensing will be required for the log backup environment.

## Configuration limitations

The following clustered ONTAP limitations were taken into account during the planning of the Vserver, network, and volume layout. These limitations apply to FAS3250 and FAS8040 storage systems running clustered ONTAP 8.2.x with CIFS and NFS protocol licenses:

* 128 Logical Interfaces (LIFs) per storage node
* 125 Vservers per storage node
* 1000 Volumes per storage node
* 240TB (FAS3250) & 324TB (FAS8040) maximum aggregate size
* 70TB (FAS3250) & 100TB (FAS8040) maximum volume size

While this is not an exhaustive list of all possible limits, these are some of the more important limits to keep in mind for the log backup environment.

## Controller layout and ONTAP version

The log backup solution will use a FAS3250 or FAS8040 HA pair, configured in a two node switchless cluster. In the event that the solution must grow beyond two nodes in a given TR datacenter module, it can be non-disruptively upgraded to a four node switched cluster, using NetApp CN1610 cluster switches. The minimum version of ONTAP for the initial two node configuration will be cDOT 8.2P5. The minimum version of ONTAP for a switched cluster using NetApp CN1610 cluster switches will be cDOT 8.2.1. Since the log backup solution is a dedicated environment, it is not recommended that these systems be configured as part of a cluster with any other nodes such as shared high tier, shared low tier, shared backup systems, etc.

## Physical network configuration

Physical network connectivity will typically be configured as a LACP interface group with a VLAN tag. In most Thomson Reuters environments, we expect to use the same VLAN tagged interface for all LIFs across the Vservers. In the event that different networks must be connected, using different VLANs, the routing group functionality of cDOT will allow each LIF to use a unique default gateway. Note that failover groups must also be configured to ensure proper LIF failover during HA events.

## Aggregate settings

Each node in the cluster will be configured with a dedicated root aggregate, per clustered Data ONTAP best practices. Each node in the cluster will also have a single aggregate used for data storage. We will configure the data aggregates with the free space reallocation option enabled, which will result in the aggregate doing low priority background data organization on a continuous basis in order to keep large amounts of contiguous free space available, and give us better long term write performance.

## Vserver layout

The Vserver layout described below will cover one HA pair of log backup storage nodes. If another HA pair of log backup storage nodes are added to a cluster in the future, this same layout would be repeated on those nodes.

The Vserver layout per HA pair of storage nodes can be summarized as follows. In this configuration, each Vserver will have a single LIF for data access. The same LIF will be used for Vserver management, if required.

* 30 Vservers for Oracle archive log backups (15 per storage node)
* 2 Vservers for MySQL log backups (1 per storage node)
* At least 2 Vservers for SQL Server log backups (1 per storage node for each AD domain)

The following describes the main drivers for this Vserver layout:

* If at all possible, we want to keep the I/O for all clients on a direct path between LIFs and volumes. This means that if we must move a volume from one node to another in order to balance workloads or capacity, we should move the LIF and all other volumes in that Vserver to the same node.
* This design allows for non-disruptive data mobility of Oracle workloads. With 10 Oracle archive log Vservers per node, we will have the flexibility to move approximately 10% of the Oracle workload or capacity from one node to another, while still keeping the I/O on a direct path. If we must move a single Oracle client from one node to another, and we wish to leave other Oracle clients attached to the same Vserver, the migrating Oracle client would need to have it’s NFS mountpoint changed to point at a new LIF and new volume on a different Vserver. This could be done by temporarily switching the Oracle server to use it’s alternate archive log destination. In this situation, the old archive logs for that Oracle client would have to age out on the original volume, as this solution is not licensed for the SnapMirror software that would be required to migrate the old volume to a new Vserver.
* Since we expect far less I/O from SQL Server backups and MySQL backups than from Oracle backups, we only configure one Vserver per node for each Active Directory domain that requires SQL Server log backups. For MySQL, we anticipate needing only a single Vserver per node. In the SQL Server environment, log backup shares are not accessed on a continuous basis, so we could easily change the share that the SQL Server is pointing to if we wanted to move a SQL Server client to a new node. Since MySQL traffic is expected to be very small, we will not plan to handle non-disruptive data mobility of MySQL log backups at this time.
* It would be possible to configure multiple LIFs in a single Vserver in order to distribute workload for different volumes across different LIFs. While this is technically possible, it would be administratively more difficult to keep track of which LIFs are being used to access each volume if we wanted to move a workload to a different node in the cluster. Grouping volumes to a single LIF in a Vserver and configuring multiple Vservers simplifies this mapping of volumes to LIFs.

## Volume layout, configuration, and naming convention

The volume layout will simply be one volume per database server, or one volume per set of database servers in an Oracle RAC or SQL Server on Microsoft Cluster environment. Volumes will be distributed across all the Vservers in a given cluster, for the given type of database. Volumes will be configured with the following properties:

* No snapshots will be taken, and no SnapVault backups will be performed.
* No snapshot reserve space will be used.
* The volume guarantee will be set to “none”, in order to enable thin provisioning.
* All volumes will be created with a size of 70,000GB, and space management will be done at the aggregate level.

Qtrees will not be used in this configuration. Volumes will be mounted at the root of the Vserver namespace, and the NFS and CIFS exports and shares will be configured directly at the volume level. Since NFS clients must traverse the namespace starting at the root, export policy rules must be added for each client to the default export policy that is assigned to the root volume. In addition, unique export policies and rules are created for each volume that is junctioned into the namespace, in order to ensure that clients can only access their own data volume.

The volume naming convention will be *<cb#>\_<app>\_<ret#>\_n0<inst#>oraarch1\_nosnap* for Oracle log files, where *<ret#>* is the number of days that logs are retained (with a value of 7, 14, 30, or 45) and <inst#> is typically a value of 1, but can be incremented for additional instances.

The volume naming convention will be *<cb#>\_<app>\_<ret#>\_n0<inst#>mysqlarch\_nosnap* for MySQL log files, where *<ret#>* is the number of days that logs are retained (with a value of 7, 14, 30, or 45) and <inst#> is typically a value of 1, but can be incremented for additional instances.

The volume naming convention will be *<cb#>\_<app>\_<ret#>\_sqlarch<inst#>\_nosnap* for SQL Server log files, where *<ret#>* is the number of days that logs are retained (with a value of 7, 14, 30, or 45) and <inst#> is typically a value of 1, but can be incremented for additional instances.

## Storage efficiency configuration

We will configure post-process compression on each volume. In addition, we will use the volume efficiency policy functionality for scheduling, as it provides the following functionality:

* The ability to schedule post-process job start times at the policy level, and assign the same policy to multiple volumes.
* The ability to configure the efficiency qos-policy at a setting of “background”, which lowers the priority of post process compression and deduplication work so that it does not impact the performance of ongoing protocol work. Note that the volume efficiency qos-policy setting discussed here is not related to the workload tracking QoS configuration discussed later in this document.

## QoS configuration

We will configure QoS policy groups, one for each volume, and assign them at the volume level. The QoS policy groups will not have any limits set on throughput, but rather will be used to track workloads and performance on a per volume basis.

## Storage provisioning

As of the writing of this document, the expectation is that NetApp OnCommand Workflow Automater (WFA) will be used for provisioning of Vservers and Volumes in the log backup environment. There will be a workflow for creating a NFS or CIFS Vserver, as well as a workflow for creating a Volume to be used by a single instance of a database client and accessed via NFS or CIFS. The Volume provisioning workflow will also create the appropriate share access, as well as storage efficiency configuration for the Volume.

# Log file management

## ****Log file retention and pruning****

**Log files will be kept online on the log backup environment for a period of time based on the retention setting as denoted in the volume name. A simple script will be run on a nightly basis from the NetApp OnCommand Unified Manager (DFM) servers in each module in order to remove log files older than two weeks. The *Pruning Script Example* section of this document shows a simple version of a script that would be run from cron on a DFM server to prune the log files.**

**In order for this script to prune logs from SQL Server logs, as wells as Oracle and MySQL logs, all log backups volumes must be exported to the DFM server for the module that will manage the log backup storage system. In addition, name-mapping must be configured on the SQL Server log backup Vservers in order to map the root account from unix to a local administrator account on the Vserver. This name-mapping will allow the root account on the DFM server that is doing the log pruning to have full privileges to the NTFS security style volume.**

## ****Oracle archive logs****

**Oracle servers in the environment will be configured with a primary and alternate archive log destination. The primary archive log destination will be the cDOT based log backup environment as described in this document, and will hold all archive logs on a regular basis. A secondary, and much smaller, archive log destination will be configured on a standard NetApp low tier shared storage system as a method of redundancy. This location will initially be a 7 Mode NetApp storage system, but may switch to another cDOT NetApp low tier storage system over time.**

## ****SQL Server logs****

In the SQL Server environment, log backups are managed by SQL Agent jobs created by the SQL DBA. SQL Server full backups are performed by NetApp SnapManager for SQL (SMSQL), but SMSQL does not perform any log management. All SQL Server log backups and restores are performed by the SQL Server DBA, using the CIFS share provided for each SQL Server by the log backup solution described in this document. **A secondary, and much smaller, SQL Server log destination will be configured on a standard NetApp low tier shared storage system as a method of redundancy. This location will initially be a 7 Mode NetApp storage system, but may switch to another cDOT NetApp low tier storage system over time.**

## MySQL logs

MySQL logs will be copied to the log backup environment via a simple NFS mountpoint on the MySQL server.

# Clustered ONTAP provisioning CLI examples

While WFA is meant to be used for all storage provisioning in the log backup 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.

## ****Physical network configuration****

### Create a VLAN tagged interface group

network port ifgrp create -node <node> -ifgrp a0a -mode multimode\_lacp -distr\_func ip

network port ifgrp add-port -node <node> -ifgrp a0a -port <port>

network port ifgrp add-port -node <node> -ifgrp a0a -port <port>

network port vlan create -node <node> -port a0a -vlan-id <vlan>

network port ifgrp show

network port vlan show

network port show

### Configure jumbo frames and disable flowcontrol

network port modify -node <node> -port a0a -mtu 9000

network port modify -node <node> -port <port> -flowcontrol-admin none

network port modify -node <node> -port <port> -flowcontrol-admin none

network port show

network port show –instance

### Configure failover groups

network interface failover-groups create -failover-group <groupname> -node <node1> -port a0a-<vlan>

network interface failover-groups create -failover-group <groupname> -node <node2> -port a0a-<vlan>

network interface failover-groups show

network interface show –failover

## ****Aggregate creation****

### Create aggregate with free space reallocation enabled

storage aggregate create -aggregate aggr1\_<node> -nodes <node> -diskcount <diskcount> -raidtype raid\_dp -maxraidsize <raidsize>

storage aggregate modify -aggregate aggr1\_<node> -free-space-realloc on

storage disk show

storage aggregate show

storage aggregate show -instance

## ****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 en\_US

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

## ****DNS configuration****

### Setup DNS on a Vserver

vserver services dns create -vserver <vsname> -domains <domainname> -name-servers <comma\_separate\_name\_server\_list>

vserver services dns show

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

### Enable NFSv3

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

vserver nfs show

### Enable CIFS

cifs create -cifs-server <vsname> -domain <ad\_domain> -ou CN=Computers -status-admin up -vserver <vsname>

cifs show

cifs options show

### Configure name mapping

vserver name-mapping create -vserver <vsname> -direction unix-win -position 1 -pattern root -replacement <vsname>[\\administrator](file://administrator)

vserver name-mapping show

diag secd name-mapping show -node <node> -vserver <vserver> -direction unix-win -name root

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

### Create volume and share for NFS access

vserver export-policy create -vserver <vsname> -policyname <policyname>

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

volume create -vserver <vsname> -volume <volname>\_nosnap -aggregate <aggrname> -size <size> -policy <policyname> -snapshot-policy none -junction-path /<volname> -security-style unix –space-guarantee none –percent-snapshot-space 0 –language en\_US

volume show

vserver export-policy rule show

### Create volume and share for CIFS access

volume create -vserver <vsname> -volume <volname>\_nosnap -aggregate <aggrname> -size <size> -snapshot-policy none -junction-path /<volname> -security-style ntfs –space-guarantee none –percent-snapshot-space 0 –language en\_US

cifs share create -vserver <vsname> -share-name <volname> -path /<volname>

cifs share access-control create -share <volname> -user-or-group <usergroup> -permission Full\_Control

volume show

cifs share show

cifs share access-control show

## ****QoS configuration****

### Create and assign QoS policy group for workload tracking

qos policy-group create -policy-group <volname> -vserver <vsname>

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

qos policy-group show

volume show -instance

## ****Storage Efficiency configuration****

### Create job schedule and efficiency policy

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

volume efficiency policy create -vserver <vsname> -policy <policyname> -schedule <schedule> -qos-policy background

job schedule cron show

volume efficiency policy show

### Enable compression on a volume and assign efficiency policy

volume efficiency modify -vserver <vsname> -volume <volname> -compression true -inline-compression false

volume efficiency modify -vserver <vsname> -volume <volname> -policy <policyname>

volume efficiency show –instance

df –h -S

# Pruning Script Example

The following shell script shows a simple example of how to perform the pruning of log backups from a DFM server. The following assumptions are made by the script:

1. The LOGBASEDIR variable is the base directory on the DFM server where all log backup volumes get mounted.
2. The log backup volumes are mounted in subdirectories of the LOGBASEDIR directory, with the subdirectory name matching the volume name.
3. The script is run nightly from cron, as the root user.

#!/bin/bash

LOGBASEDIR="logbasedir"

find $LOGBASEDIR -path '\*\_7\_\*' -type f -mtime +7 -exec rm {} \;

find $LOGBASEDIR -path '\*\_14\_\*' -type f -mtime +14 -exec rm {} \;

find $LOGBASEDIR -path '\*\_30\_\*' -type f -mtime +14 -exec rm {} \;

find $LOGBASEDIR -path '\*\_45\_\*' -type f -mtime +45 -exec rm {} \;