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STORAGETEK

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Protecting Oracle Database Appliance – Tape Backup with EMC NetWorker

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Introduction

The Oracle Database Appliance is an engineered system consisting of hardware, software, and storage that saves customers time and money by simplifying deployment, maintenance, and support of high availability database solutions. The Oracle Database Appliance provides double or triple mirrored redundancy using Automatic Storage Management software. The Database Appliance is comprised of two nodes, each having its own dedicated power, memory, CPU, RAID control, etc. to allow for maximum redundancy. It allows for single instance, Real Application Clusters (RAC) One Node or full Oracle RAC configurations. Additionally, the Database Appliance supports virtualization using Oracle Virtual Machine (OVM). With the high level of redundancy, the chances of a physical failure are remote but still possible (ex. natural disaster or fire). There is also the possibility of logical corruption such as inadvertently deleted records or errors in programming. Due to the possibility of a disaster and/or logical corruption, it is still necessary to backup up the database to provide an extra layer of data protection, along with offsite storage capabilities. Oracle StorageTek (STK) Tape Libraries and Oracle StorageTek Tape Drives offer cost effective solutions for meeting Recovery Point Objectives (RPO) and Recovery Time Objectives (RTO) for the Oracle Database Appliance. The information in this document details how to setup EMC NetWorker to backup the Oracle Database Appliance using Oracle StorageTek tape products. The information in this document is intended to detail basic configuration of NetWorker on the Oracle Database Appliance to allow for RMAN backups directly to tape. A restore example, private network example, and performance tuning example are also included to assist with providing additional knowledge on using NetWorker with the Oracle Database Appliance, and to assist with optimizing your backup environment.

Hardware and Software

Below is a summary of the hardware and software utilized for Oracle Database Appliance tape tests.

Note: The table below only lists the combinations of hardware/software that were tested. There are newer generations of hardware/software available. Based on the hardware used for testing it is not expected that performance will differ appreciably (especially in a two to four tape drive configuration) as resources on the hardware used for testing were not anywhere close to being consumed. Newer generations of hardware should perform at the same level or better. The most likely limiting factor to performance is the network connection which is limited at 10Gb unless port bonding is implemented followed by the Host Bus Adapter card which if 16Gb Fibre, can transfer 32Gb/s of data or if 12Gb SAS, can transfer 24Gb/s of data.

TABLE1.TEST ENVIRONMENT

HARDWARE/SOFTWARE	VERSION	PURPOSE
Oracle Database Appliance	X3-2, Appliance Manager 12.1.2.1.0	Database Appliance
Oracle Linux	6.5 Backup Server for Oracle Database 5.10 Oracle Database Appliance X3-2	OS on Database and Backup Servers
Oracle Linux Kernel	Oracle Linux 5.10 Kernel = 2.6.39-400.214.3.el5uek (X3-2)	Kernel on Database Servers
NetWorker	8.2.0.1	Backup Software
Oracle Server X4-2L used for testing, but recommend Oracle Server X5-2	Base Hardware	EMC NetWorker Server/Storage Node
Oracle StorageTek SL150	Latest Firmware	Tape Library for Backup
LTO-6 Half Height Tape Drives (2)	Latest Firmware	Tape Drives for Backup
12Gb SAS PCIe HBA	Latest Firmware	Tape Connectivity to Storage Node

NetWorker Server/Storage Node

To manage the backup and recovery operations on the Oracle Database Appliance, a 1u single processor machine has plenty of resources as the NetWorker Server/Storage Node. Refer to the NetWorker Documentation link in the Appendix for additional information.

Oracle StorageTek Library and Tape Drives

Oracle StorageTek SL150 with two LTO-5 or LTO-6 tape drives. Also compatible are the Oracle StorageTek SL500 or SL24/48 with two LTO tape drives (LTO-6 not supported in SL24/48).

OS

The EMC NetWorker Server/Storage Node has Oracle Linux installed.

Backup Software

NetWorker Server/Storage Node software with associated licensing.

Connectivity

This section explains the different interfaces that will be utilized in this environment.

Ethernet

The NetWorker Server/Storage Node requires a Gb or 10Gb connection to the Oracle Database Appliance depending on which interface will be used for backup.

Serial Attached SCSI (SAS)

A single SAS HBA card in the NetWorker Server/Storage Node is used to attach each tape drive directly to the NetWorker Server/Storage Node.

Diagram of Configuration

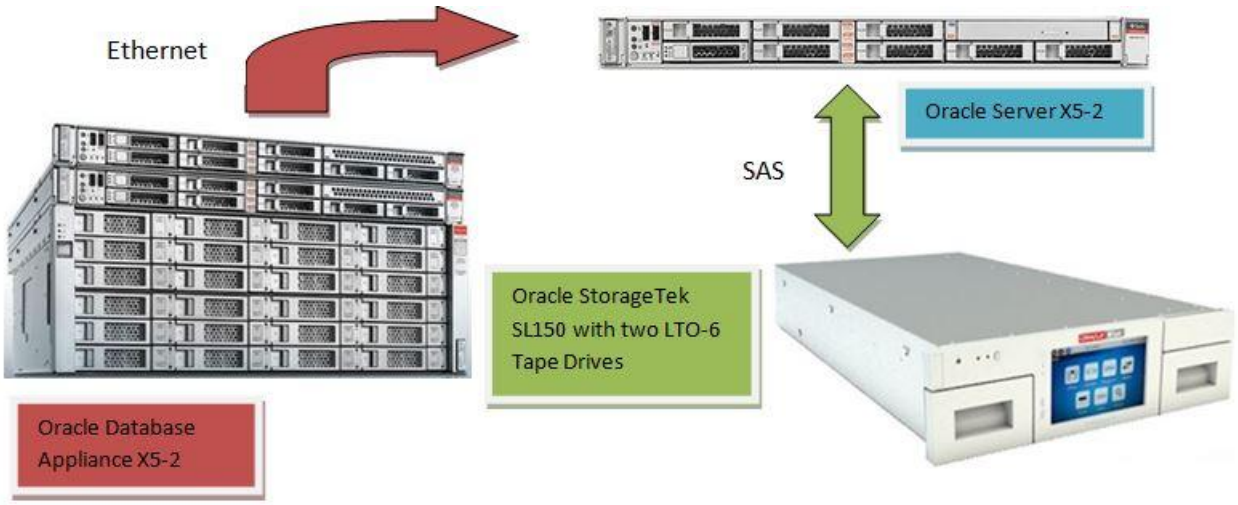

Figure 1: Physical components and connections for Oracle Database Appliance tape solution.

Date Synchronization

Ensure you are using Network Time Protocol (NTP) or have all the dates/times between all servers involved in this configuration in sync.

Oracle StorageTek Tape Configuration

The Oracle StorageTek (STK) SL150 is a modular library system with high capacity and high reliability which can be attached to a host via fiber channel or SAS. This configuration will utilize a SAS connection. The SL150 is a bridged library which means robot control commands are channeled through one of the tape drives (no separate connection for the robot). If this is a new library, follow the instructions in the SL150 documentation to setup the library. Following the initial setup of the SL150; connect the tape drives to the NetWorker Server/Storage Node. To connect the SL150 to the Oracle Server X5-2 NetWorker Server/Storage Node use SAS cables to hook each tape drive to the SAS ports on the X5-2 SAS HBA card. See figures 2 &3 below:

Physical Attachments

Figure 2: Rear of Oracle StorageTek SL150 tape library with two LTO SAS attached drives.

Figure 3: Rear of Sun Server X5-2 with multi-pronged SAS cable connected to SAS HBA card.

Library Monitoring

After initial library configuration, the Oracle StorageTek Library Browser User Interface (BUI) can be used to monitor, re-configure and operate the SL150 library. SL150 BUI is pictured in figure 4:

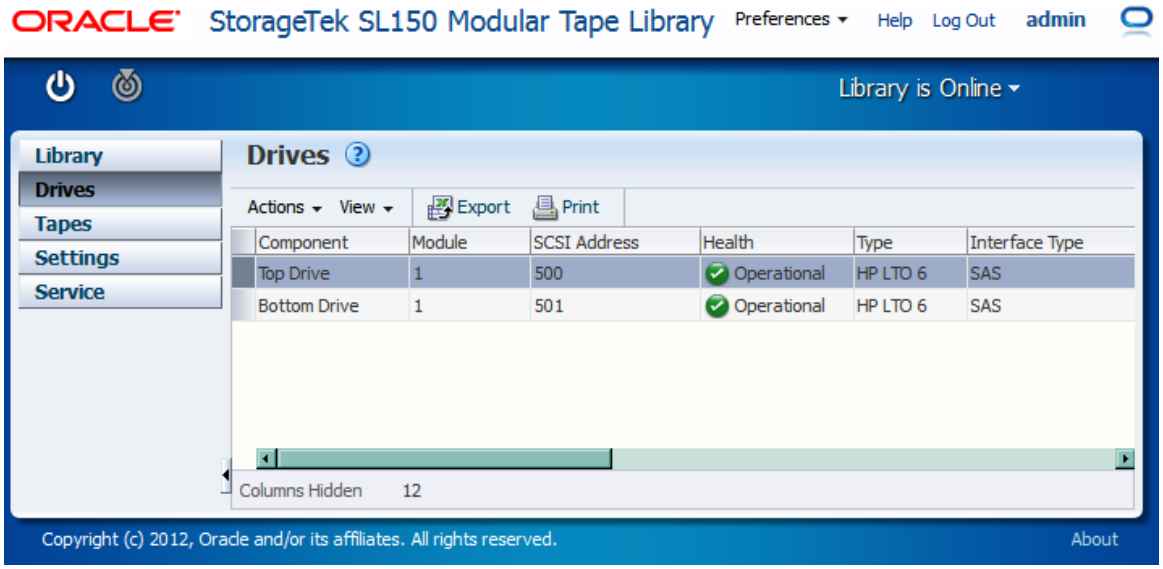

Figure 4: Oracle StorageTek SL150 Modular Tape Library BUI.

Library Drive OS Verification

Use the sg utility to verify you can see the Oracle StorageTek tape library and LTO-6 tape drives on the NetWorker Server/Storage Node (sg_map requires sg3 utilities to be installed in Linux. See MOS note 1461798.1 for details on installing RPM's to the Oracle Database Appliance):

```
[root@xman2 ~]# sg_map -i -x
/dev/sg0  0 0 0 0  1  /dev/nst0  HP       Ultrium 6-SCSI    32DS
/dev/sg1  0 0 1 0  1  /dev/nst1  HP       Ultrium 6-SCSI    32DS
/dev/sg2  0 0 1 1  8  STK       SL150          0225
/dev/sg3  5 0 22 0  13  ORACLE    CONCORD14        0d03
/dev/sg4  5 2 0 0  0  /dev/sda  LSI  MR9261-8i  2.13
/dev/sg5  12 0 0 0  0  /dev/sdb  ORACLE    SSM              PMAP
```

From the above output the Oracle StorageTek tape library (STK SL150) and two HP LTO-6 (Ultrium 6) drives are present.

NetWorker Configuration

EMC NetWorker configuration for tape backup with the Oracle Database Appliance is comprised of several tasks including setup at the OS level, installation of the EMC NetWorker software, tape library configuration, tape drive configuration, group setup, schedule setup, media setup, and database server setup.

Modify /etc/hosts files

Modification of the /etc/hosts files on the NetWorker Server/Storage Node and database nodes depends on which network interface will be used for backup, and the DNS setup in the environment. If the primary network is used for backup, and all hosts are in DNS, no changes to /etc/hosts files are required. If DNS, or another naming service, is not available, then the NetWorker Server/Storage Node needs to be added to /etc/hosts on each database node and each database node needs to be added to /etc/hosts on the NetWorker Server/Storage Node. The example and screen shots in this paper detail setup of a backup using the primary public Ethernet interface. If you plan to use one of the additional interfaces available on the Oracle Database Appliance for backups over a private network, please see the Private Network Configuration section near the end of this document for details on that configuration.

Install NetWorker

Install NetWorker on the NetWorker Server/Storage Node and database servers.

NetWorker Prerequisites

1) Disable SeLinux on the NetWorker Server/Storage Node – SeLinux must be disabled in order for the NetWorker console to function properly.
a) Modify the /etc/sysconfig/selinux file and set SELINUX=disabled.

2) Install required RPM's – NetWorker requires that openmotif and libXp be installed prior to installing NetWorker.
a) Check to see if the prerequisite RPM's exist on each system.
i. rpm –qa | grep openmotif
ii. rpm –qa | grep libXp

b) If the packages are not on a system install them (install them on the NetWorker Server/Storage Node and all database servers). Refer to MOS note 1461798.1 for adding packages to the Oracle Database Appliance.
i. rpm –ivh openmotif-2.3.1-2.el5.x86_64.rpm (version will vary depending on OS level).
ii. rpm –ivh libXp-1.0.0-8.1.el5_x86_64.rpm (version will vary depending on OS level).

Note: Prerequisites can vary from one version to another. Check Legato Networker documentation to determine if you have all the proper prerequisites for the version you are installing.

Install NetWorker Packages

1) The following packages will be installed on each of the servers in the configuration, and must be installed in the specified order to meet prerequisites.
a) NetWorker Server/Storage Node (RPM names vary by NetWorker version):
i. rpm –ivh lgtoclnt-8.0.1.1-1.x86_64.rpm
ii. rpm –ivh lgtoman-8.0.1.1-1.x86_64.rpm
iii. rpm –ivh lgtonode-8.0.1.1-1.x86_64.rpm
iv. rpm –ivh lgtoserv-8.0.1.1-1.x86_64.rpm
v. rpm –ivh lgtonmc-8.0.1.1-1.i686.rpm (Following installation of lgtonmc, execute the /opt/lgtonmc/bin/nmc_config script and configure the console per your needs.)
b) NetWorker Clients – database servers (RPM names vary by NetWorker version):
i. rpm –ivh lgtoclnt-8.0.1.1-1.x86_64.rpm

2) Start the NetWorker processes on each server in the configuration:
a) NetWorker Server/Storage Node:
i. /etc/init.d/networker start
ii. /etc/init.d/gst start
b) NetWorker Clients – database servers:
i. /etc/init.d/networker start

3) Install the NetWorker Module for Database Applications(NMDA) on each of the database servers (NetWorker processes must be started prior to installing the module):
a) rpm –ivh lgtonmda-1.2-1.x86_64.rpm
b) Link the RMAN library:
i. Switch user to oracle – su – oracle
ii. Change directory to $ORACLE_HOME/lib – cd $ORACLE_HOME/lib
iii. Link libobk.so to the NetWorker library – ln –s /usr/lib/libnsrora.so libobk.so

4) Launch the NetWorker Web Console:
a) The console is accessible from http://xman2:9000 (assuming default port of 9000 was selected during GST configuration).

b) The console requires Java (varies by version of NetWorker) to run properly. Java is executed from the host accessing the console, not on the host where NetWorker is installed.

Configure NetWorker Devices

1) From the NetWorker GUI, navigate to the Devices on the top level icon bar, highlight the name of the NetWorker Server (xman2), right click and choose Scan for Devices. Select to scan all servers in the configuration (xman2). The library will be automatically discovered by NetWorker, provided the OS is able to access it. (See figure 5):

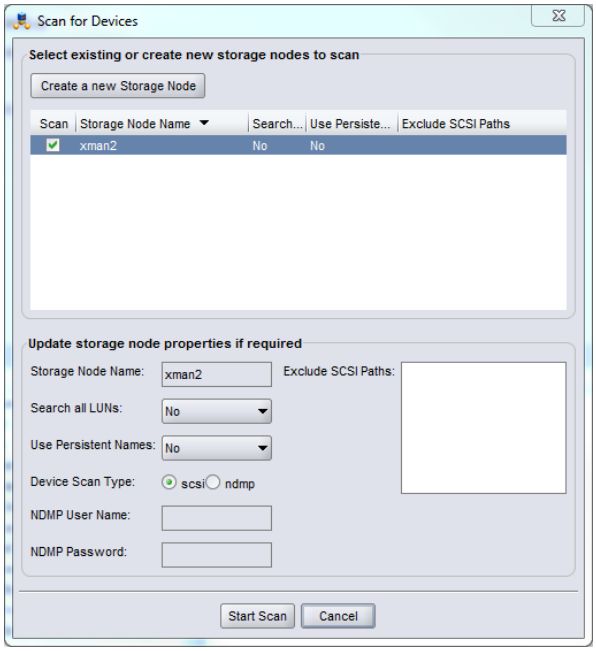

Figure 5: NetWorker Scan for Devices.

2) While still in the Devices section of the GUI, click on Libraries, select the discovered library, right click and select Configure Library. (See figure 6):

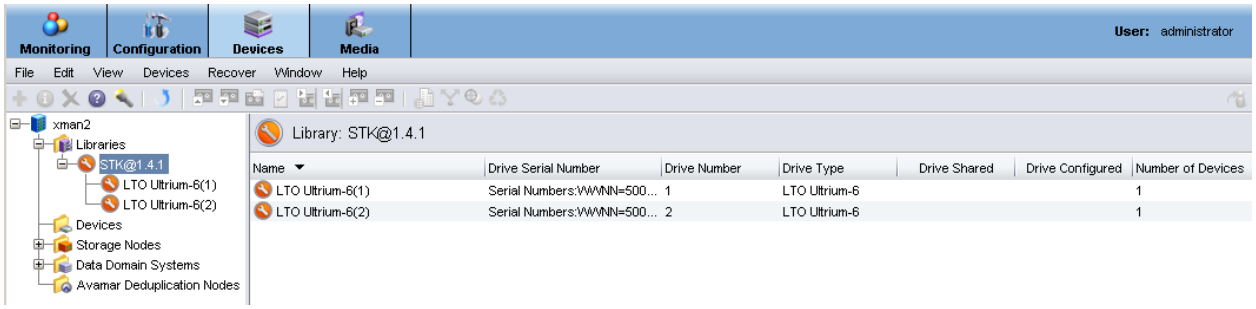

Figure 6: NetWorker Devices screen with Libraries expanded.

3) The Configure Library screen will appear. Select all tape devices that are part of the library and click Start Configuration. (See figure 7):

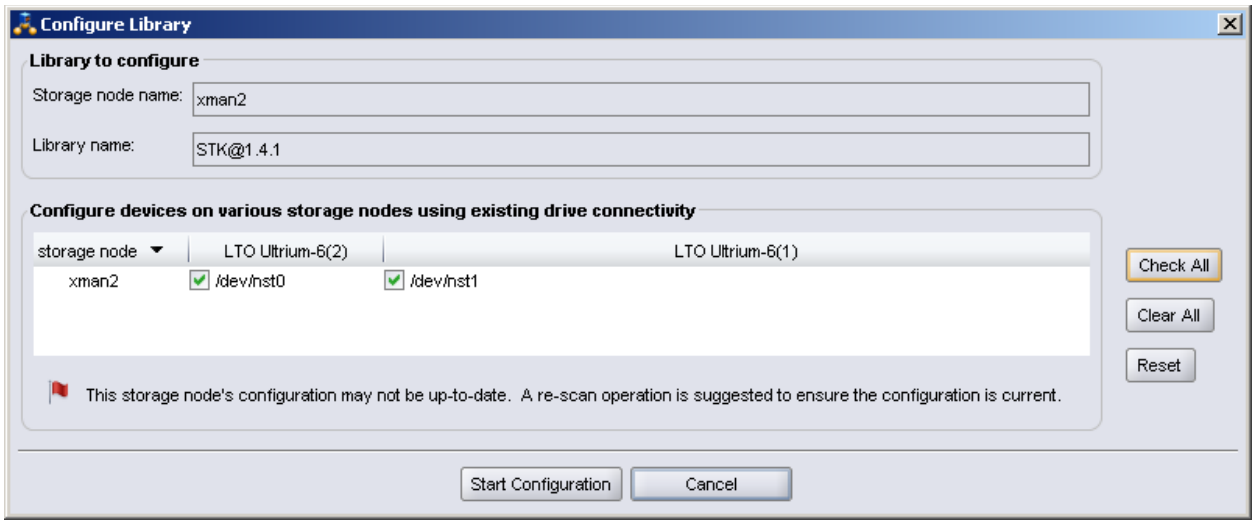

Figure 7: Networker Configure Library screen.

4) Modify each tape drive and set target sessions to 1 (default is 4) in order to evenly spread the backup load across the tape drives, otherwise all drives might not be utilized. (See Figure 8):

a) From the Devices section of the NetWorker GUI, right click each tape drive and select Properties.

b) Navigate to the Configuration tab.

c) Change Target Sessions to 1 and click OK.

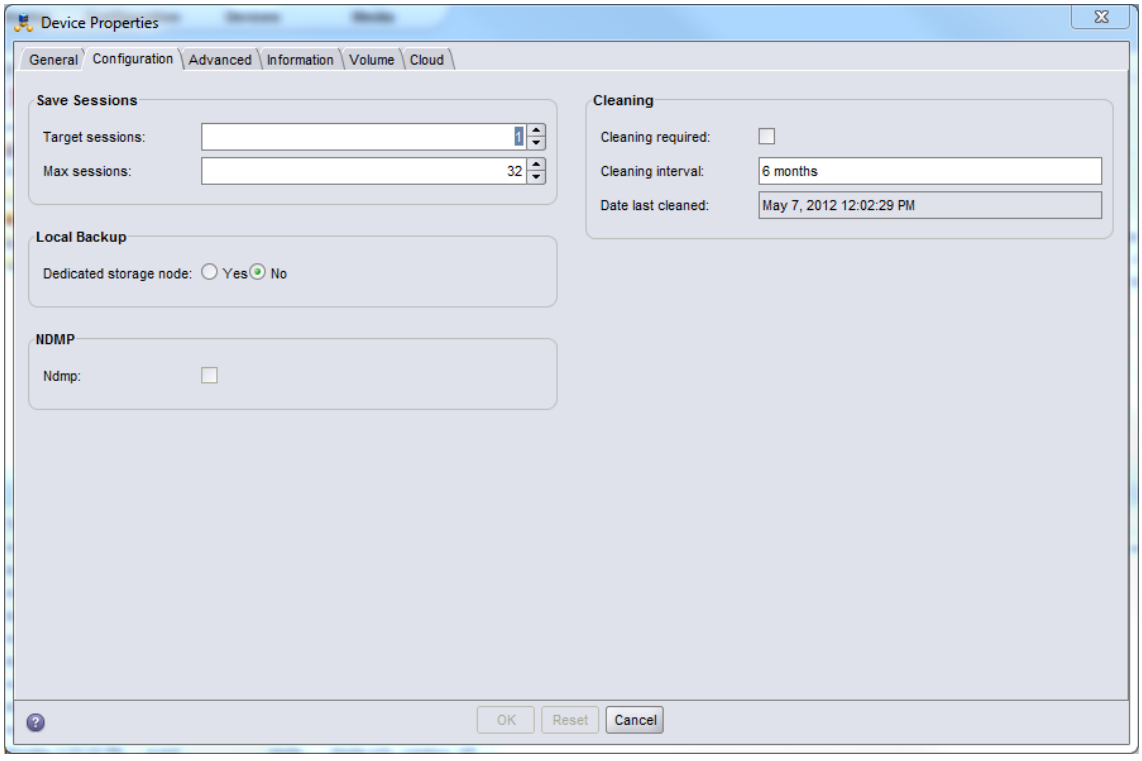

Figure 8: NetWorker Device Properties for tape drive.

Configure a NetWorker Group

1) From the NetWorker GUI, navigate to Configuration on the top level icon bar and select Groups.
2) Right click on Groups and select New.
3) Populate the Group Name and populate all other parameters per your configuration standards - Start time, Autostart, etc... (See figure 9):

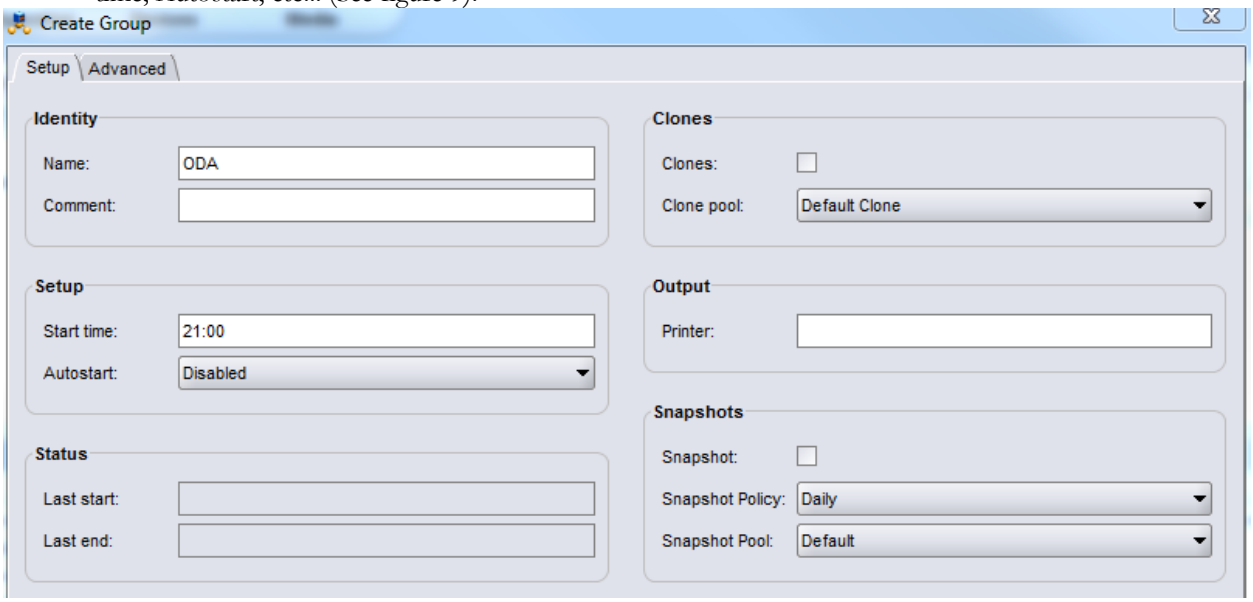

Figure 9: NetWorker Create Group.

Configure NetWorker Schedule

1) From the NetWorker GUI, navigate to Configuration on the top level icon bar and select Schedules.
2) Right click on Schedules and select New.
3) Provide a name and set parameters for full/incremental per your configuration standards. In this example full backups are being done every day. (See figure 10):

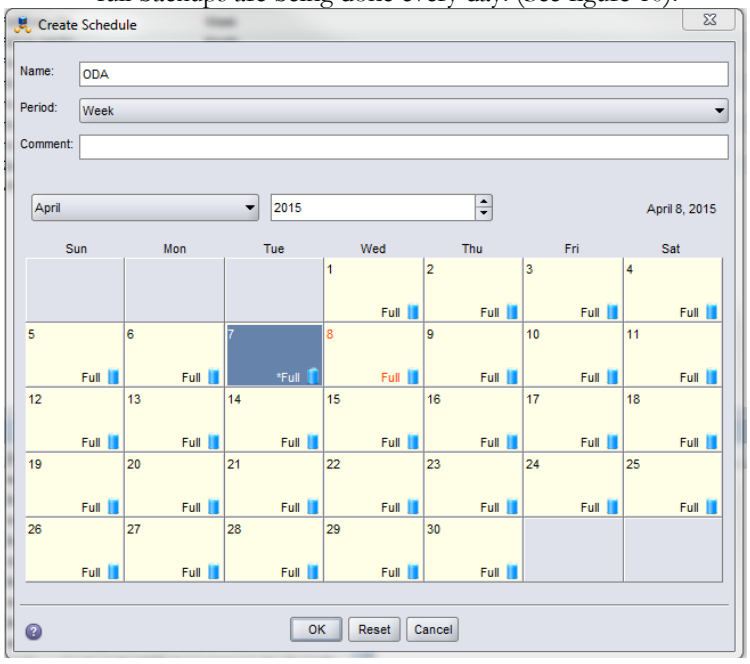

Figure 10: NetWorker Create Schedule.

Configure a Media Pool

1) From the NetWorker GUI, navigate to Media on the top level icon bar and select Media Pools.
2) Right click on Media Pools and select New.
3) Provide a name for the Media Pool.
4) Select the Group you created in a previous step (ODA in this example).
5) Select a Label template from the drop-down menu - Default in this example. (See figure 11):

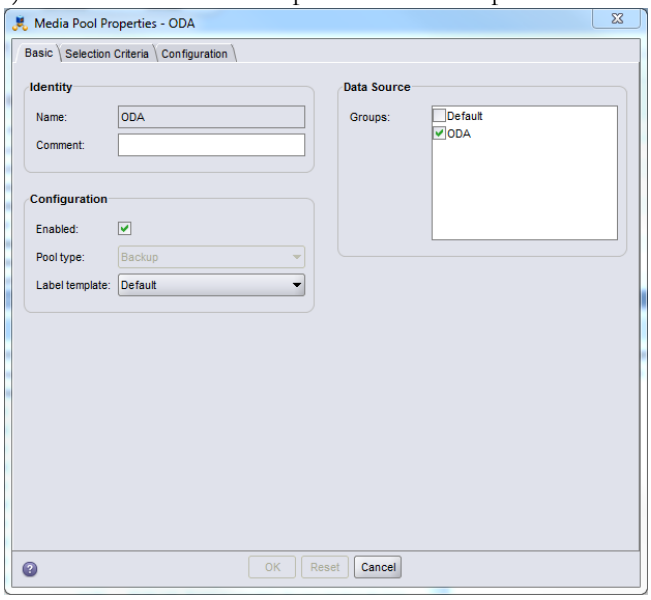

Figure 11: NetWorker Media Pool Properties – Basic tab.

6) Navigate to the Selection Criteria tab.
7) Select the appropriate check boxes for the required backup levels (Full in this example).
8) Select the appropriate check boxes for Devices (all drives are being selected in this example).
9) Click OK to save changes. (See figure 12):

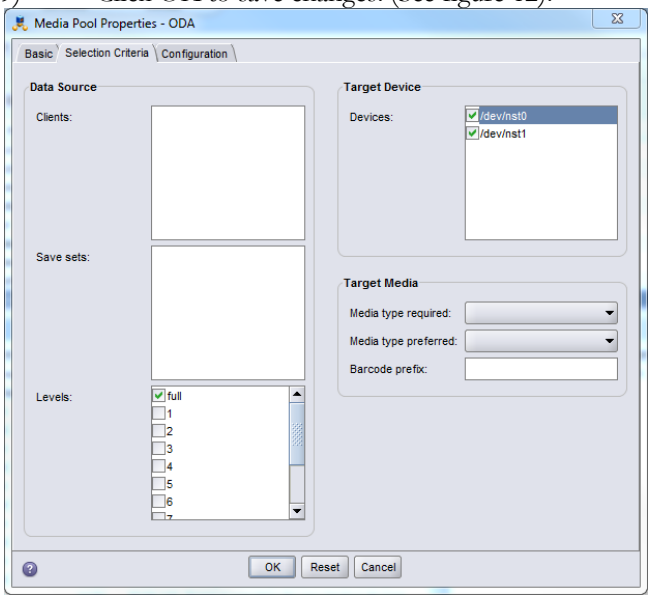

Figure 12: NetWorker Media Pool Properties - Selection Criteria tab.

Note: If you do not check any check boxes on the Selection Criteria tab in a particular section (i.e. Levels and Devices) it is the equivalent of checking all boxes and is considered to be wide open. The same is true of the Group check boxes.

Label Media

1) From the NetWorker GUI, navigate to Devices on the top level icon bar and select your library from the list of libraries.
2) A double pane will display showing the tape drives on the left and the media on the right.
3) Select the media to be labeled into the backup pool (you can use shift + highlight or ctrl + highlight to select multiples), right click and select Label. (See figure 13):

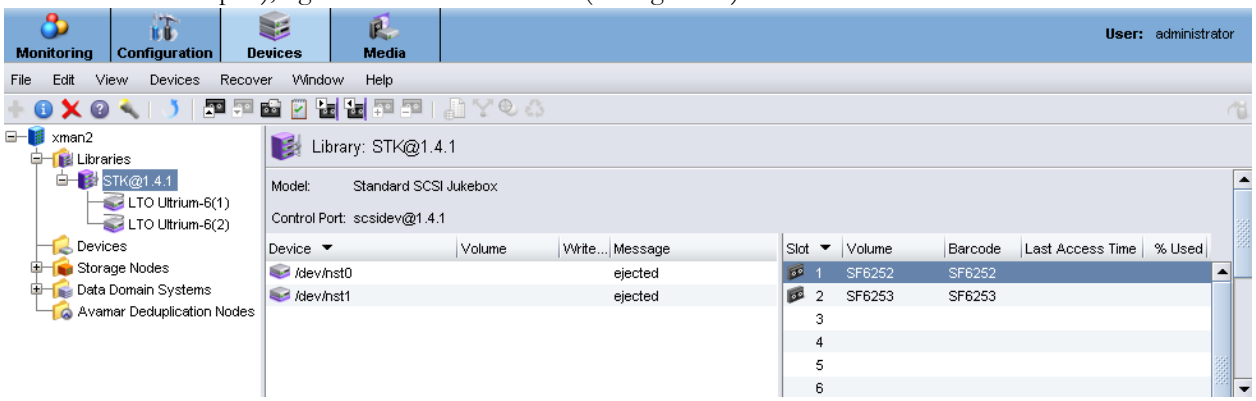

Figure 13: NetWorker Devices screen with Libraries expanded, the library selected and the media highlighted.

4) From the Label Library Media window choose the Target Media Pool defined in a previous step and deselect Prompt to Overwrite Existing Label. (See figure 14):

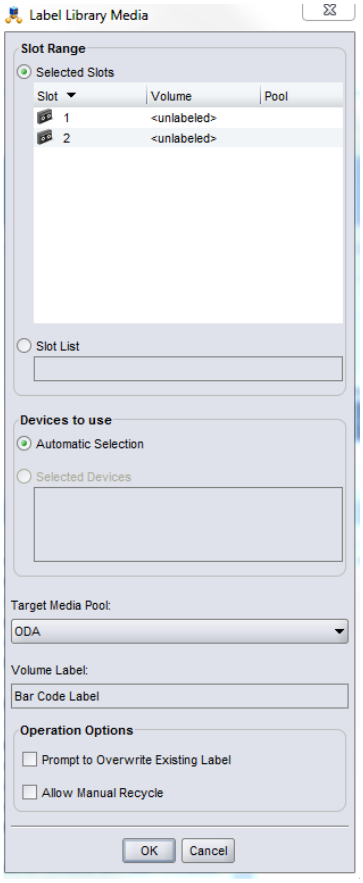

Figure 14: NetWorker Label Library Media screen

Configure Database Servers

Repeat steps 1-10 for all database servers (hamms1, hamms2):

1) From the NetWorker GUI, navigate to Configuration on the top level icon bar and select Clients.
2) Right click on Clients and select New.
3) Populate the Name field using the public Ethernet name of the host from the /etc/hosts file.
4) Select the Group defined in a previous step (ODA in this example).
5) Select the Media Pool defined in a previous step from the drop-down menu (ODA in this example).
6) Select the Schedule defined in a previous step from the drop-down menu (ODA in this example). (See figure 15):

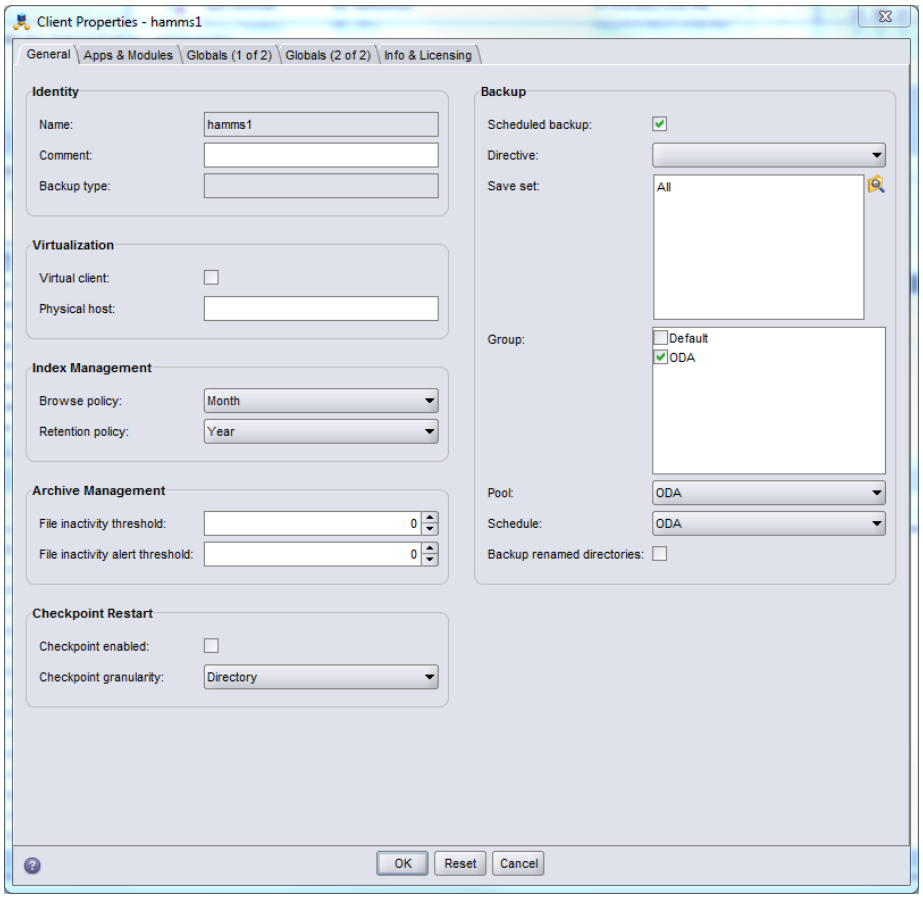

Figure 15: NetWorker Client Properties - General tab

7) Click OK to save the setup.
8) The newly added host will display in the Clients list on the Configuration screen in the NetWorker GUI. Right Click on the client and select Properties.
9) Navigate to the Globals (1 of 2) tab, add aliases and update parallelism settings.
a) The default Aliases list should look as follows (example using hamms1). (See figure 16):

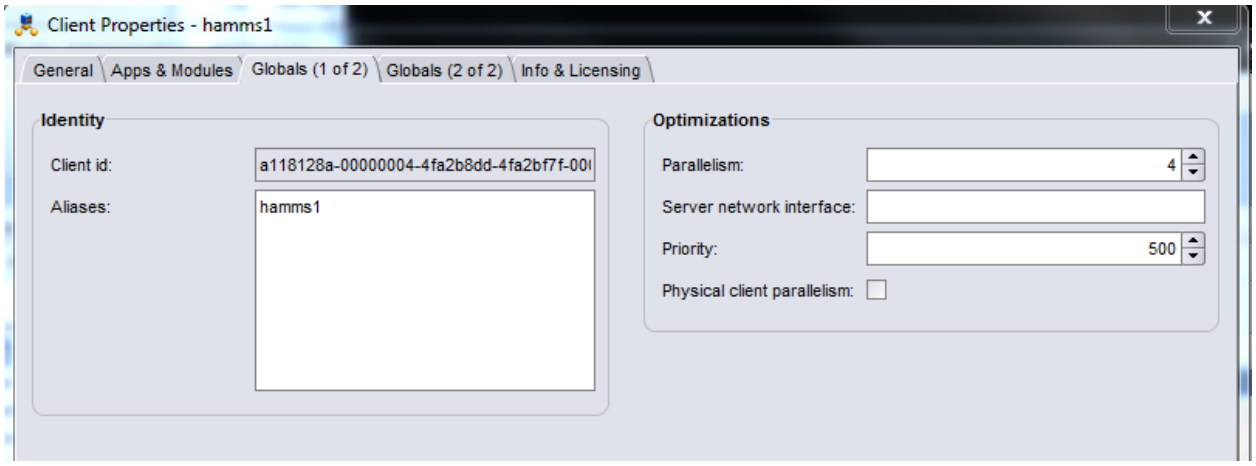

Figure 16: NetWorker Client Properties - Globals (1 of 2) tab, default.

b) Add the following entries to Aliases:
hamms1.us.oracle.com

Note: You must add aliases for any defined aliases that exist in /etc/hosts or the naming service.

c) Set the Parallelism to 1:

The Aliases and Parallelism should look as follows when complete (example using hamms1). (See figure 17):

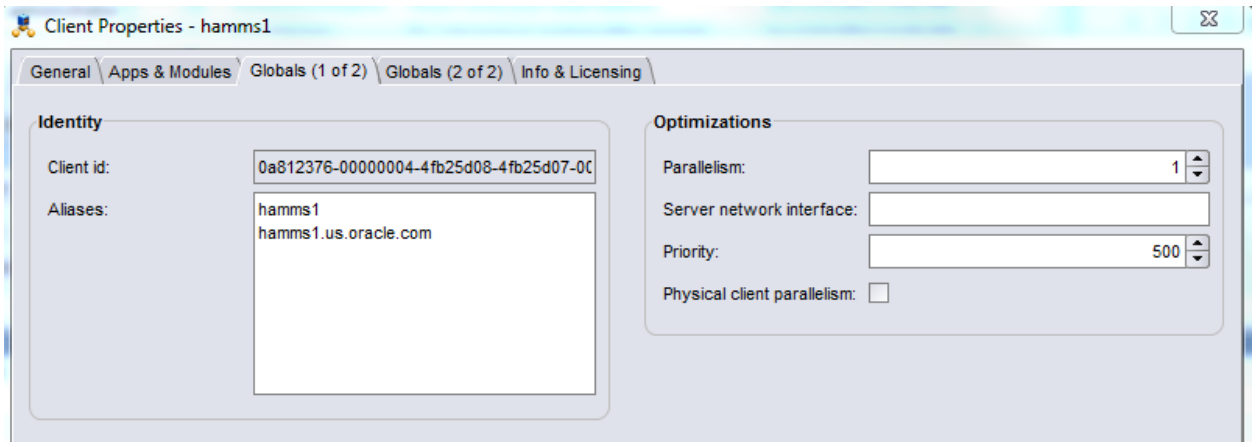

Figure 17: NetWorker Client Properties - Globals (1 of 2) tab, modified.

d) While still in Client Properties navigate to the Globals (2 of 2) tab.
e) Add an entry in the Remote Access field for the other node:
user=oracle,host=hamms2

This entry is required to allow hamms2 to access hamms1's backup pieces and conversely for hamms1 to access hamms2's backup pieces during restores (when you repeat steps 1-10 for hamms2 you will add user=oracle,host=hamms1 to the Remote Access field on hamms2). See figure 18:

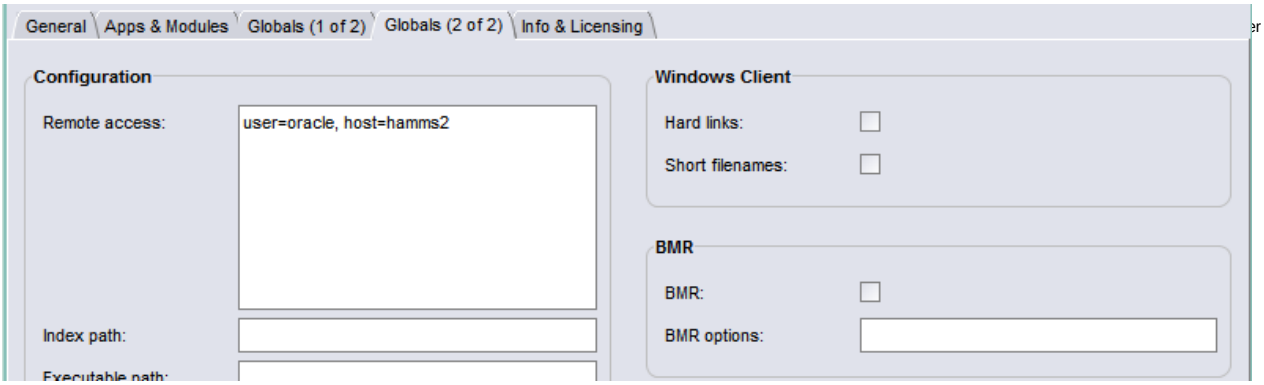

Figure 18: NetWorker Client Properties - Globals (2 of 2) tab Remote Access field.

10) Click OK to save changes.

RMAN

There are multiple methods available to execute database backups with EMC Networker (RMAN prompt, NetWorker Management Console, & RMAN script). For this example we are executing the backup from the RMAN prompt.

Configure RMAN to backup database

Prior to running RMAN the correct environment variables must be set for the oracle user on the database server which will be used to execute the RMAN script. This example demonstrates setup and execution of RMAN from database server hamms1.

1) Switch user to the oracle user - **su - oracle**
2) Modify the user environment variables and specify the following parameters (bash shell being used in this example):

vi .bash_profile

export ORACLE_HOME=/u01/app/oracle/product/12.1.0.2/dbhome_1 **Set to match your Oracle home**

export PATH=$ORACLE_HOME/bin:.:$PATH **Make sure you have a path to all needed Oracle binaries**

export ORACLE_SID=isr1 **Set to match your SID**

Connect to RMAN with the appropriate credentials

Example: rman target sys/welcome1@hamms1/isr

RMAN Script

Create an RMAN script containing the following entries to backup the data files, archive logs, and controlfile. Allocate tape channels for each drive in your configuration and round robin the connection to each of the database servers (this is how load balancing is achieved). Also be sure to release each tape channel after each section of the backup. For this example, the script is nw.script on hamms1 located at /oracleBU/NetWorker:

Required tnsnames.ora Changes

In order to evenly spread the backup load across each of the database servers, the database server executing the RMAN script (hamms1 in this example) must be able to open RMAN channels on the other database server. This requires modifications to the tnsnames.ora file on each database server.

RUN {

```
ALLOCATE CHANNEL ch00 TYPE 'SBT_TAPE' CONNECT='@isr1';
ALLOCATE CHANNEL ch01 TYPE 'SBT_TAPE' CONNECT='@isr2';
send 'NSR_ENV=(NSR_SERVER=xman2,NSR_CLIENT=hamms1,NSR_DATA_VOLUME_POOL=ODA)';
BACKUP AS BACKUPSET INCREMENTAL LEVEL 0 DATABASE INCLUDE CURRENT
CONTROLFILE PLUS ARCHIVELOG;
RELEASE CHANNEL ch00;
RELEASE CHANNEL ch01;
}
```

1) Modify the /u01/app/oracle/product/12.1.0.2/dbhome_1/network/admin/tnsnames.ora file with a text editor

Original file:

```
# tnsnames.ora Network Configuration File:
/u01/app/oracle/product/12.1.0.2/dbhome_1/network/admin/tnsnames.ora
# Generated by Oracle configuration tools.

ISR =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = hamms-scan)(PORT = 1521))
    (CONNECT_DATA =
      (SERVER = DEDICATED)
      (SERVICE_NAME = isr)
    )
  )
```

2) Modify the file to look as follows:

```
# tnsnames.ora Network Configuration File:
/u01/app/oracle/product/12.1.0.2/dbhome_1/network/admin/tnsnames.ora
# Generated by Oracle configuration tools.

ISR =
  (DESCRIPTION =
   (ADDRESS = (PROTOCOL = TCP)(HOST = hamms-scan)(PORT = 1521))
   (CONNECT_DATA =
   (SERVER = DEDICATED)
   (SERVICE_NAME = isr)
   )
  )

ISR1 =
  (DESCRIPTION =
    (ADDRESS = (PROTOCOL = TCP)(HOST = hamms1)(PORT = 1521))
    (CONNECT_DATA =
    (SERVER = DEDICATED)
    (SERVICE_NAME = isr)
    (SID = isr1)
   )
  )
ISR2 =
 (DESCRIPTION =
  (ADDRESS = (PROTOCOL = TCP)(HOST = hamms2)(PORT = 1521))
  (CONNECT_DATA =
```

```
 (SERVER = DEDICATED)
 (SERVICE_NAME = isr)
 (SID = isr2)
  )
 )
```

3) After modifying tnsnames.ora verify ownership/permissions on the file to ensure they are correct:
i) Owner should be oracle
ii) Group should be oinstall
iii) Permissions should be rw-r----- or 640 octal

Execute Backup Tests

Choose one of the clients to execute the RMAN script, in this example we use hamms1:

```
[root@ hamms1/]# su – oracle
[oracle@ hamms1 ~]$ rman target /
```

From the RMAN prompt provide the path to the previously created RMAN script in order to execute the script:

```
RMAN>@/oracleBU/NetWorker/nw.script
```

Restoring the Database

In the event of a logical database corruption, or a complete disaster, restoration of the database from tape can be executed. In most instances the Database Administrator (DBA) will be conducting the restoration, and will be executing the restore job from the machine where the database resides. The DBA will use RMAN to request the needed backup pieces from the Media Management Layer. The RMAN backup pieces are cataloged in the controlfile, or RMAN Catalog if using Recovery Manager with catalog, and NetWorker also knows about the pieces in its own catalog. If a complete disaster has occurred and the Oracle Database Appliance has been re-imaged, you will also require the DBID of your database to perform the restore.

Restore Demonstration

There are many different restore scenarios available with RMAN, depending on the type of problem encountered in the database (consult RMAN documentation for complete information). For this example, assume that one or more controlfiles is damaged and so are some of the data files that underlie the database. Also assume all archive logs are intact in the Fast Recovery Area (FRA). The basic steps in the RMAN restore process are to restore the controlfile, restore the database, and then recover the database. After the controlfile is restored, the database will know which backup pieces are needed based on data contained in the restored controlfile. If the archive logs are still available in the FRA you can use them to recover up to present or to a specific point in time (they are available in this example). If the archive logs have to be recovered you can only recover up until the point in time of the last archive log. This is known as an incomplete recovery.

Example of steps to restore and recover database:

Note: Restore performed using a single node (hamms1) and using a 10Gbe interface (private network).

From hamms1 execute the following

```
[root@hamms1 /]# su – oracle
[oracle@ hamms1~]$ rman target /
```

```
Recovery Manager: Release 12.1.0.2.0 - Production on Thu Apr 9 10:20:26 2015
```

connected to target database: ISR (DBID=2670003667)

RMAN> shutdown immediate;

using target database controlfile instead of recovery catalog
database closed
database dismounted
Oracle instance shut down

** Also login to hamms2 with SQL Plus and execute a shutdown immediate;**
[root@hamm2 /]# su - oracle
[oracle@ hamms2~]$ sqlplus / as sysdba
SQL> shutdown immediate;

RMAN> startup nomount;

connected to target database (not started)
Oracle instance started

Total System Global Area 25769803776 bytes

Fixed Size 4511656 bytes
Variable Size 3489663064 bytes
Database Buffers 22145925120 bytes
Redo Buffers 129703936 bytes

Make sure your DBID is set. The DBID can be found when connecting to RMAN;

connected to target database: ISR (DBID=2670003667)

RMAN> set DBID 2670003667

executing command: SET DBID

RMAN> run
2> {
3> ALLOCATE CHANNEL ch00 TYPE 'SBT_TAPE';
4> send
'NSR_ENV=(NSR_SERVER=xman23,NSR_CLIENT=hamms1,NSR_DATA_VOLUME_POOL=ODA)';
5> restore controlfile from autobackup;
6> }

allocated channel: ch00
channel ch00: SID=612 instance=isr1 device type=SBT_TAPE
channel ch00: NMDA Oracle v8.2.0

sent command to channel: ch00

Starting restore at 10-APR-2015 11:41:44

channel ch00: looking for AUTOBACKUP on day: 20150410
channel ch00: looking for AUTOBACKUP on day: 20150409
channel ch00: looking for AUTOBACKUP on day: 20150408

```
channel ch00: AUTOBACKUP found: c-2670003667-20150408-00
channel ch00: restoring control file from AUTOBACKUP c-2670003667-20150408-00
channel ch00: control file restore from AUTOBACKUP complete
output file name=+DATA/isr/control01.ctl
Finished restore at 10-APR-2015 11:43:31
released channel: ch00

RMAN> alter database mount;

database mounted


RMAN> run
2> {
3> ALLOCATE CHANNEL ch00 TYPE 'SBT_TAPE';
4> ALLOCATE CHANNEL ch01 TYPE 'SBT_TAPE';
5> send 'NSR_ENV=(NSR_SERVER=xman2-xbond0,NSR_CLIENT=hamms1-
10g,NSR_DATA_VOLUME_POOL=ODA)';
6> restore database;
7> }

allocated channel: ch00
channel ch00: SID=765 instance=isr1 device type=SBT_TAPE
channel ch00: NMDA Oracle v8.2.0

allocated channel: ch01
channel ch01: SID=917 instance=isr1 device type=SBT_TAPE
channel ch01: NMDA Oracle v8.2.0

sent command to channel: ch00
sent command to channel: ch01

Starting restore at 10-APR-2015 12:35:43
Starting implicit crosscheck backup at 10-APR-2015 12:35:43
Crosschecked 9 objects
Finished implicit crosscheck backup at 10-APR-2015 12:35:44

Starting implicit crosscheck copy at 10-APR-2015 12:35:44
Finished implicit crosscheck copy at 10-APR-2015 12:35:44

RMAN> run
2> {
3> SET AUTOLOCATE ON;
4> ALLOCATE CHANNEL ch00 TYPE 'SBT_TAPE' CONNECT='@ isr1';
5> ALLOCATE CHANNEL ch01 TYPE 'SBT_TAPE' CONNECT='@ isr1;
6> send 'NSR_ENV=(NSR_SERVER=xman2-xbond0,NSR_CLIENT=hamms1-
xbond0,NSR_DATA_VOLUME_POOL=ODA)';
7> recover database;
8> }

allocated channel: ch00
channel ch00: SID=765 instance=isr1 device type=SBT_TAPE
channel ch00: NMDA Oracle v8.2.0

allocated channel: ch01
channel ch01: SID=917 instance=isr1 device type=SBT_TAPE
```

channel ch01: NMDA Oracle v8.2.0

sent command to channel: ch00
sent command to channel: ch01

Starting recover at 10-APR-2015 15:28:47

starting media recovery

archived log for thread 1 with sequence 6 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_08/o1_mf_1_6_blc9opqr_.arc
archived log for thread 1 with sequence 7 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_1_7_blf5c3jo_.arc
archived log for thread 1 with sequence 8 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_1_8_blf9q654_.arc
archived log for thread 1 with sequence 9 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_1_9_blfkvo9f_.arc
archived log for thread 1 with sequence 10 is already on disk as file
/u01/app/oracle/oradata/datastore/isr/ISR/onlinelog/o1_mf_2_b67s23t8_.log
archived log for thread 2 with sequence 4 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_2_4_blfkvmlq_.arc
archived log for thread 2 with sequence 5 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_2_5_blfkvnr3_.arc
archived log for thread 2 with sequence 6 is already on disk as file
/u01/app/oracle/fast_recovery_area/datastore/isr/ISR/archivelog/2015_04_09/o1_mf_2_6_blfkvo28_.arc
media recovery complete, elapsed time: 00:00:13
Finished recover at 10-APR-2015 15:29:02
released channel: ch00
released channel: ch01

RMAN> alter database open resetlogs;

database opened

Also login to hamms2 and run startup to bring the 2nd instance back online

Private Network Configuration

The NetWorker configuration in this paper utilized the public network interface for the database backup traffic. It is a perfectly valid configuration as you may have idle time overnight to execute a database backup. However, depending on your organization's backup requirements, it may also be necessary to offload backup traffic to one of the other interfaces on the Oracle Database Appliance (Ex. alleviate traffic on the public network, faster backup time required, etc.). The following example details how to setup NetWorker to use a 10GbE bonded interface for database backups.

OS Setup

First you must configure the 10GbE interfaces on the NetWorker Server/Storage Node, and each of the database nodes. For this example, assume you have configured the following host names and IP addresses for the NetWorker Server/Storage Node and the database nodes:

192.168.20.100 hamms1-xbond0
192.168.20.101 hamms2-xbond0
192.168.20.102 xman2-xbond0

If the hostnames are not in the DNS map, or other naming service map, they must be in the local hosts file on each of the servers in the configuration (xman2, hamms1, and hamms2).

Configure Private Network Interface in NetWorker

For this configuration the goal is to route database server traffic across a 10GbE network and also distribute the data load across each of the database servers. In order to accomplish splitting the load between the database servers, the Storage Node Affinity list must be setup to use the 10GbE network:

1) From the NetWorker GUI, navigate to Configuration on the top level icon bar and select Clients.
2) Select the first database server (hamms1 in this example), right click and choose Properties.
3) Navigate to the Globals (1 of 2) tab and make the following changes:
   a) Add the following entries to the Aliases section:
      hamms1-xbond0
      hamms1-xbond0.us.oracle.com

   b) Ensure Parallelism is set to 1: (See figure 19):

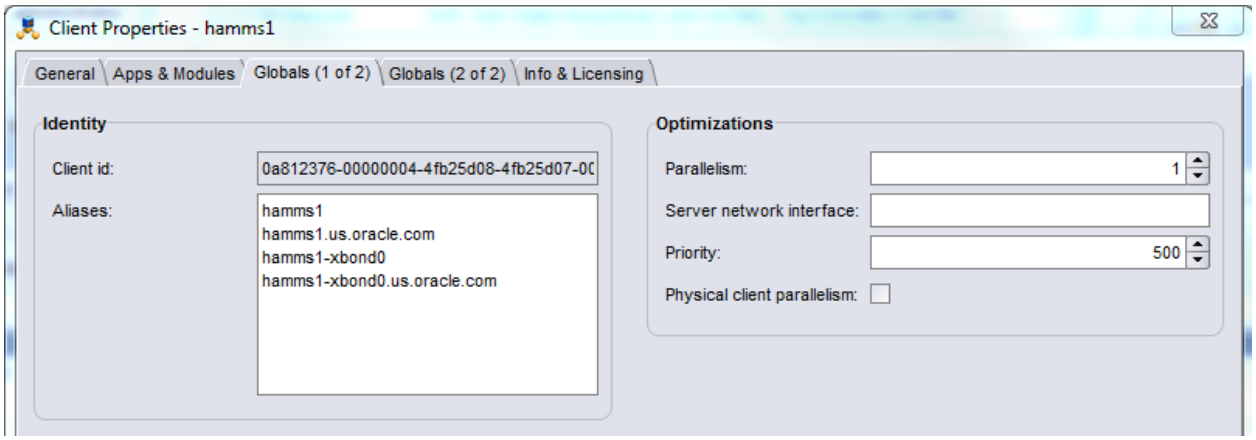

Figure 19: NetWorker Client Properties - Globals (1 of 2) tab, modified for private network.

4) While still in the properties for hamms1 navigate to the Globals (2 of 2) tab.
5) In the Remote Access field change the entry to user=oracle, host=hamms2-xbond0. This field is being populated with the 2nd node to allow hamms2 to access hamms1 backup pieces if a restore is being executed from hamms2. When you modify these settings for hamms2 you will populate the Remote Access field with user=oracle,host=hamms1-xbond0 to allow hamms1 to restore hamms2's backup pieces.
6) In the Storage nodes field (this is the Storage Node Affinity list) populate the Storage Node to be used as the primary Storage Node when backing up this host - xman2-xbond0 in this example. (See figure 20):

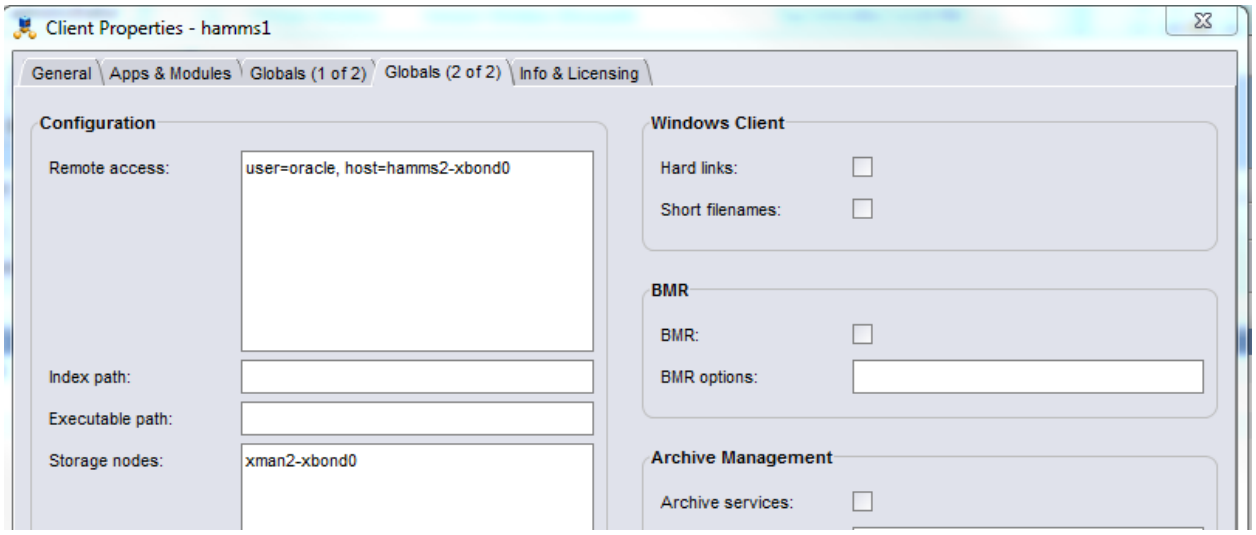

Figure 20: NetWorker Client Properties - Globals (2 of 2) tab, modified for private network.

7) Click OK to save changes.
8) Repeat this procedure for each of the other database servers.

NetWorker is now setup for private network backups.

Recommended tuning by tape drive

In order to achieve optimal performance, tape settings in NetWorker must be tuned for your environment. NetWorker tape drive tuning consists of modifying the block size that gets written to tape.

Set NetWorker Block Size

NetWorker block size settings must be tuned to achieve optimal transfer rates. The setting is per tape drive and can be modified as follows:

1) From the NetWorker GUI, select View from the menu bar and check the box for Diagnostic Mode.
2) Navigate to Devices from the top level icon bar in the NetWorker GUI.
3) Expand the Library tree in the left hand pane and select your library.
4) Highlight a drive in the middle pane, right click and choose Properties.
5) Navigate to the Advanced tab.
6) Set the Device block size setting using the drop-down menu. (See figure 21):

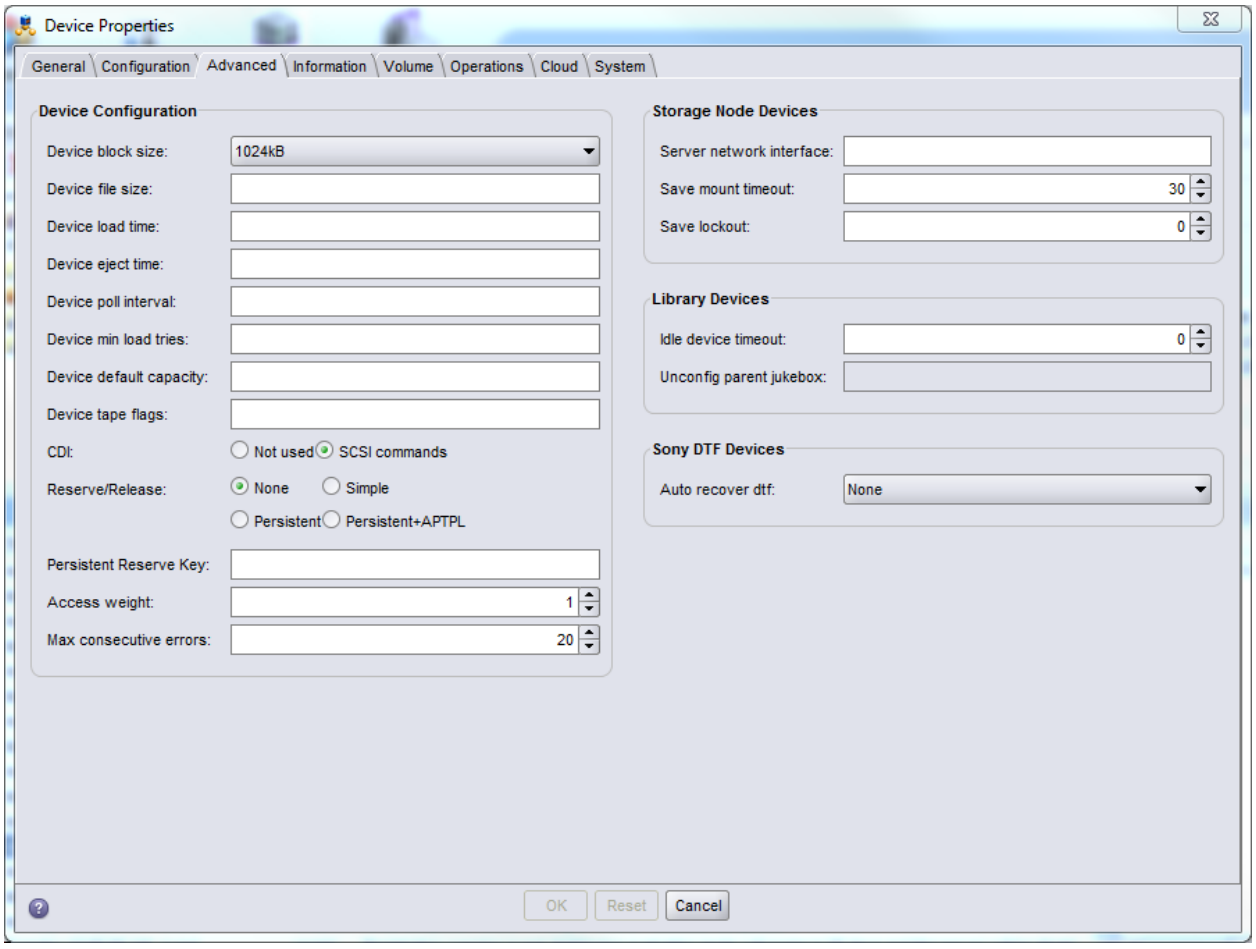

Figure 21: NetWorker Device Properties - Advanced tab.

7) Repeat for each drive that requires changes.
8) Label tapes with the block settings.

Note: The block size setting in NetWorker is determined when the media is labeled. Any tapes labeled prior to changing the block size settings may not have the same block size as the block size set on the tape drives.

Verify NetWorker Block Size

After modifying tape drive settings for block size and labeling media with the new block size, it is recommended to mount one or more of the newly labeled tapes to verify the block size setting. To verify the block size on a tape, follow these steps:

1) From the NetWorker GUI, select View from the menu bar and check the box for Diagnostic Mode.
2) Navigate to Devices from the top level icon bar in the NetWorker GUI.
3) Expand the Libraries tree in the left hand pane and select the library containing the drives to use for verification.
4) Mount a tape to one of the tape drives by using the mouse to drag a piece of media from the volume list to a tape drive (repeat if you want to check more than one tape).
5) Highlight the drive mounted with the tape in the middle pane, right click and choose Properties.
6) Navigate to the Volume tab.
7) The block size of the tape will be listed in the right hand pane in the Volume block size field. (See figure 22):

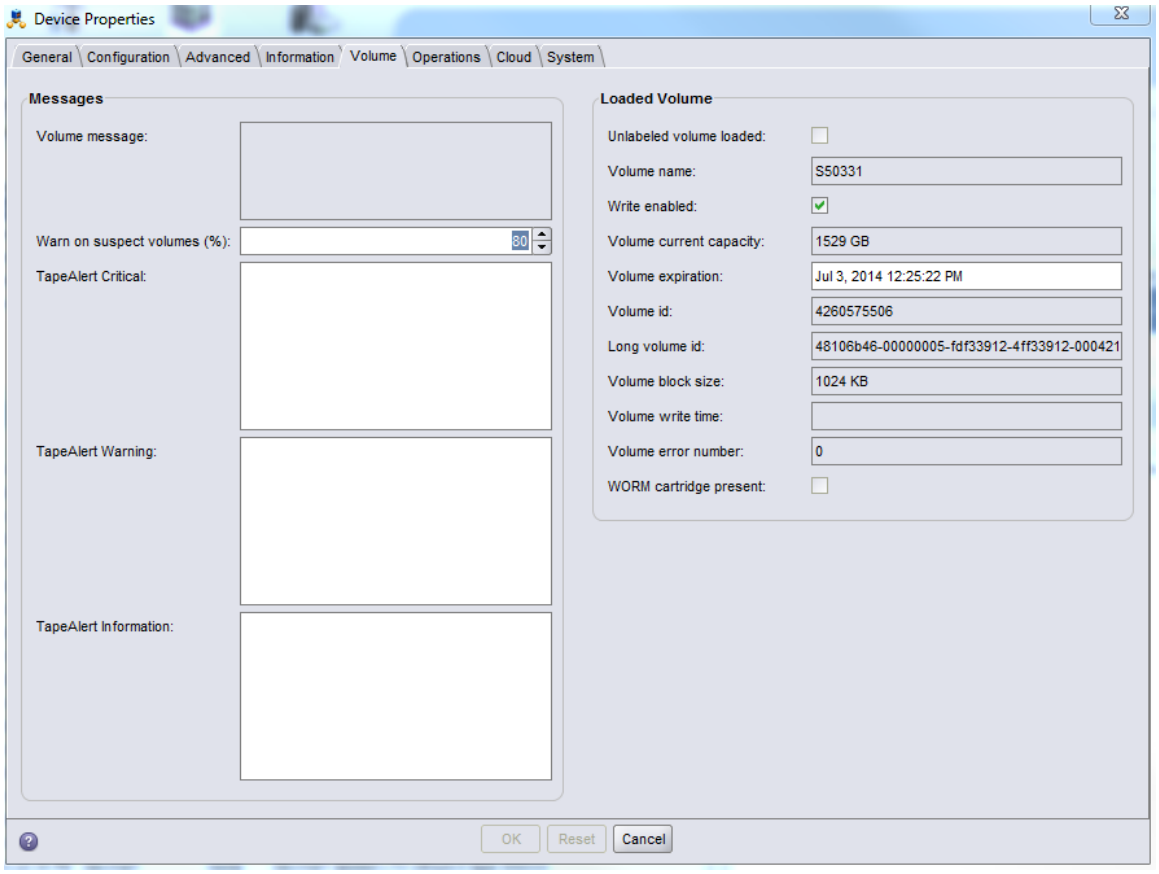

Figure 22: NetWorker Device Properties - Volume tab.

Hardware Compression

By default most tape drives have compression enabled, and it is recommended to compress at the tape drive level. You can experiment with compression using RMAN, but if you opt to enable compression at a different layer of the backup architecture you must disable tape drive compression to avoid doubling compression, which can result in larger backups and slower transfer rates.

The table below shows the transfer rates achieved in the test environments following tuning.

TABLE 2. PERFORMANCE STATISTICS ORACLE DATABASE

DRIVE TYPE	BLOCKING FACTOR	INTERFACE	AVERAGE BACKUP TRANSFER RATE PER TAPE DRIVE WITH HARDWARE COMPRESSION	AVERAGE RESTORE TRANSFER RATE PER TAPE DRIVE WITH HARDWARE COMPRESSION
LTO-5	1024	10GbE	221MBs	195MBs
LTO- 5/6	1024	GbE	58MBs	58MBs
LTO-6	1024	10Gbe	312MBs	200MBs

Note: The limiting factor on a GbE interface with this configuration is the interface, not the tape drives. Each node can send up to 120Mbs per second through an interface (bond is active-passive), but the Master/Media can only consume 120MBs total as that is the capacity of the interface. If active-active bonding is configured, and/or more NICs or multiple Medias Servers are used, higher rates could be achieved, as the tape drives were not saturated.

Conclusion

In conclusion, Oracle StorageTek tape products offer cost effective data protection for the Oracle Database Appliance, and when coupled with EMC NetWorker provide a complete solution for data protection.

Additional Resources

- NetWorker Documentation
- Database Appliance Collateral
- RMAN Documentation

ORACLE

Oracle is committed to developing practices and products that help protect the environment

Protecting Oracle Database Appliance -Tape Backup with EMC NetWorker
April 2015
Author: Mike Foss – Integrated Storage Releations
Contributing Authors: Kyle Noonan – Integrated Storage Releations, Dennis Frederickson – Integrated Storage Releations

Oracle Corporation
World Headquarters
500 Oracle Parkway
Redwood Shores, CA 94065
U.S.A.

Worldwide Inquiries:
Phone: +1.650.506.7000
Fax: +1.650.506.7200

oracle.com