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White Paper

Backup of Oracle in EMC Symmetrix Environments with EMC NetWorker PowerSnap

Applied Technology

Abstract

EMC® NetWorker®, the cornerstone of recovery management solutions at EMC, and its modules can be used effectively in EMC Symmetrix® environments to complement and enhance backup and recovery capabilities for Oracle databases using the snapshot technologies of EMC storage arrays and backup and recover capabilities of NetWorker.

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Executive summary

The Oracle database is a leading database management system across different operating systems, and is a critical component in many organizations. IT managers regard data corruption, which is a source of many database server failures, as the most immediate threat to their Oracle database environment. Most of the challenges that a backup administrator faces are related to methods of how to offload the application server during backups and how to shorten the backup window.

This white paper provides information on the synergy between EMC® NetWorker®, NetWorker Module for Oracle (NMO), and the NetWorker PowerSnap™ Modules to effectively perform backups and recoveries with Oracle databases using the snapshot technologies of EMC Symmetrix® arrays.

Introduction

The EMC NetWorker family of products helps to protect data by simplifying and centralizing backup and recovery operations. With its record-breaking performance, NetWorker is the ideal backup software for small offices as well as large data centers. With support for leading applications, such as Oracle, Microsoft SQL Server, and SAP, and advanced backup and recovery technologies such as snapshot management and data de-duplication, NetWorker customers can realize the highest levels of flexibility, management, and cost control over their data protection operations, while protecting their overall investments in these technologies.

The EMC Symmetrix family of products provides industry-proven storage arrays and maintains a high degree of robustness and availability. Symmetrix can centralize and simplify data protection management with local continuous data protection or remote replication, protecting an organization from data loss due to server failures, data corruption, software errors, viruses, end-user errors, and catastrophic events.

Integration of Symmetrix storage arrays' snapshot technologies with NetWorker provides use of these proven snapshot technologies through the NetWorker Management Console (NMC) interface and creates point-in-time snapshots for rapid recoveries and long-term backup to disk or tape. Centralized management from NetWorker allows customers to schedule snapshots, set policies, and browse the index of these snapshots. When using the NetWorker Module for Oracle, customers can take advantage of reduced recovery time through higher-frequency snapshots of their Oracle databases.

Audience

This white paper is targeted to corporate management and business decision-makers, including storage, server, and database administrators; IT managers; and application engineers; as well as storage integrators, consultants, and distributors.

Terminology

The terminology used in the white paper is only related to PowerSnap, Oracle, and the NetWorker Module for Oracle

Backup

Backup provides a copy of original data that is created from a variety of media. Given its low cost, tape media has been the most common media type for backup. Today, disk-based media provides a more ideal medium for reliability, speed, and overall recovery associated with backups. Advanced backup capabilities connect backup with array-based replication and replication management.

File level recovery

The file level recovery process is individual file restoration from a mounted replica. It is also referred to as instant recovery or file-by-file recovery.

Instant backup

A replica or point-in-time copy of data that is initiated and stored on the array as a snapshot session or instance is called an instant backup. An instant backup is a block-level snapshot created from the application server but not written to tape. In the case of NetWorker PowerSnap, the replica is registered within the NetWorker media database to facilitate tracking for recovery.

Live backup

Live backup is a backup to secondary storage such as tape that occurs from a replica via a proxy host without impact to the original application or data host.

Recovery management

Recovery management is a strategic approach to data protection that focuses on fast, reliable recovery as the aggregate goal of all protection activities. Key EMC solutions that comprise the recovery management portfolio include NetWorker (for backup and recovery), Backup Advisor (for reporting and analytics), EMC CLARiiON® CX3 series (storage array hardware), CLARiiON SnapView™ (local replication for CLARiiON), RepliStor® (host-based remote replication), RecoverPoint (continuous data protection), and Replication Manager (common management for EMC replication technologies).

Restore from disk or tape backup

Data that has been saved to disk or tape through the live backup process is recoverable in the same manner as any basic restore. Save sets, individual folders, or files can be restored from the command line.

Rollback

A rollback is the process of returning data to an earlier point-in-time copy in response to a recovery operation, and it is a complete restore from a point-in-time copy to a standard volume without host involvement.

Rollforward

A rollforward is the process of progressing data from a rollback using one or more instant backups. For example, if three snapshots were created at 10 A.M., 11 A.M., and 12 P.M., the user can perform a rollback to the 10 A.M. snapshot and then a rollforward to the 11 A.M. snapshot or even the 12 P.M. snapshot. Users may perform a rollback from a more recent copy to approximate the same effect.

What is a snapshot?

A snapshot is an image of your data set (a data set can be just a bunch of file systems or specific application data such as Oracle/Microsoft SQL Server). There are different snapshot technologies available to cater to the need of snapshots. This white paper will talk in detail about the snapshot technologies of Symmetrix arrays, which are the baseline of the solution using EMC NetWorker, PowerSnap, and the NetWorker Module for Oracle, to back up Oracle databases.

Snapshot backups

Snapshot backups of Oracle databases are configured as scheduled backups on the NetWorker server.

The EMC NetWorker Module for Oracle supports:

- Full snapshot backups of Oracle databases
- Backups of one or multiple tablespaces per scheduled backup
- Backups of one or multiple datafiles per scheduled backup
- Instant, nonpersistent, and serverless snapshot backup types

The EMC NetWorker Module for Oracle does not support archive log backups for databases under a snapshot schedule.

Instant backup

An instant backup creates a PiT (point-in-time) copy, or snapshot, of an Oracle database and retains the snapshot on the primary storage subsystem, for example, Symmetrix. Depending on how backups are configured, a snapshot created during an instant backup may or may not be moved to secondary storage on the NetWorker server or storage node. The retention period of the snapshot is dependent on the snapshot policy. Figure 1 explains the instant backup creation process.

There are three ways to manage PiT snapshot backups:

- A PiT copy of the data is created and immediately backed up to tape or disk, and the original snapshot is deleted after the backup is complete. A save set that is created on tape is called a "rollover save set." This process enables you to perform a tape restore.
- An existing PiT copy of the data can be copied to a tape or disk, much like a traditional EMC NetWorker backup, and the original PiT copy is retained on the primary storage subsystem. Thus, two copies of this backup exist. This process enables you to perform a rollover or PiT restore.
- A PiT copy of the data is created and retained on the primary storage subsystem and no other copy is maintained. You can use this copy to perform a PiT restore only once. If the PiT restore fails for any reason, you must restore from another backup (another snapshot or normal tape).

While the snapshot resides on the primary storage subsystem, it is referred to as a persistent snapshot. Retaining persistent snapshots on primary storage enables the EMC NetWorker Module for Oracle to perform an instant restore.

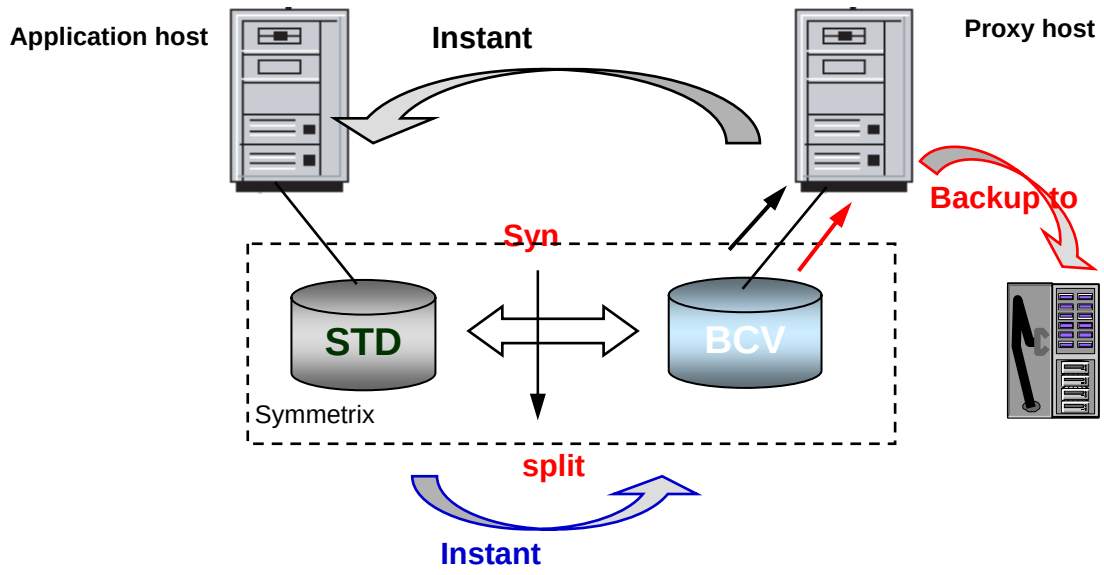

Figure 1. Instant backup to a PiT

Nonpersistent backup

A nonpersistent snapshot backup creates a point-in-time copy of a Oracle database, and then immediately moves it to secondary storage on the EMC NetWorker server or storage node. The original snapshot is automatically deleted from primary storage.

Serverless backup

In a serverless backup, a snapshot is created on the primary storage subsystem and is immediately moved to secondary storage by a proxy client. There is no need for the Oracle Server host to move the data to the secondary storage medium (typically tape).

File-logical image backup (FLIB)

PowerSnap is optimized to perform nondisruptive backups of large data sets quickly. PowerSnap file-logical image backups (FLIB) are best suited for backups of large files. Currently this capability is provided through a data mover on Solaris 9 and Application Host/Production Host on HP-UX, Microsoft Windows, and IBM AIX platforms.

The FLIB tape data format is identical to that of backups performed with traditional NetWorker software using the network, allowing the flexibility of all recovery choices. This includes FLIB and a network recovery or a network backup and a FLIR of the same data.

Snapshot recoveries

Besides restoring databases from tape media using EMC NetWorker and the NetWorker Module for Oracle, several advanced restore capabilities exist, including instant recovery and rollback.

Instant restore

A snapshot recovery operation can be performed at the file, file group, or database level from a full database snapshot. The EMC NetWorker Module for Oracle supports one type of snapshot restore operation called an instant restore.

An instant restore operation recovers data from a PiT snapshot but does not eradicate the original snapshot.

Rollback

EMC NetWorker Module for Oracle backups can use EMC NetWorker PowerSnap functionality to create a PiT copy, or instant backup, of a Oracle database. Many instant backups can be performed in a single day, thus reducing the exposure to data loss.

A rollback recovers a specific PiT copy to one or more volumes. You can request a rollback without having to retrieve data from a secondary storage system, such as tape. Rollback of a managed or nonmanaged volume prevents the snapshot from being maintained and causes the snap set to become invalid. To minimize risk to data, first perform a tape backup of the snapshot before performing a rollback operation. Rollbacks are destructive by nature, which means that the entire contents of the file system are overwritten. As a default safety check, a rollback can only restore the original volume.

File-logical image recovery (FLIR)

A file-logical image recover (FLIR) is obtained directly from the proxy client host to the production volume (STD), and consists of only data blocks. This requires that earlier file preallocation, extension, and truncation are complete on the application host by using native operating system input/output paths before the recovery. Data movement is bounded by data blocks of files that have requested for recovery. This is a nondestructive recovery. In a FLIR, a BCV or VDEV may be used to keep a copy of the STD volume as it was prior to the recovery.

In case of FLIR recovery, STD should be made visible to the data mover.

SC Restore (SymmConnect Restore, FLIR that uses a mirror)

FLIR using a mirror recovers to a BCV rather than to a STD device, and then synchronizes the BCV with the STD. Such recoveries do not go over the LAN, but instead, the recovered data travels from the PowerSnap server to the Symmetrix storage array. Also, by performing a BCV recovery/rollback to the standard, the data is immediately available to the client and does not wait for the BCV recovery/rollback to complete. PowerSnap also supports performance of granular recoveries from tape to the BCV, and then initiates a full BCV rollback to the standard. The file system is unmounted by PowerSnap prior to recovery.

Conventional restore

Conventional restores are performed from tape attached to the NetWorker storage node directly to the standard device (STD) on the application host.

EMC Symmetrix storage arrays

The NetWorker PowerSnap Module interacts with the Symmetrix storage system, using its EMC TimeFinder® functionality to create and maintain snapshots of the data.

Symmetrix TimeFinder is a business continuance solution that allows you to use *business continuance volumes* (BCV) or Symmetrix *virtual devices* (VDEV) to create a point-in-time copy.

TimeFinder/Mirror

The EMC TimeFinder/Mirror feature provides for the creation of copies of the data simultaneously on multiple target devices from a single source device. The data is available to a target's host instantly. You can copy data from a single source device to as many as 16 target devices.

For TimeFinder/Mirror the target device can be a standard device or TimeFinder business continuance volume (BCV).

A BCV is a Symmetrix device with special attributes created when the Symmetrix is configured. It can function either as an additional mirror to a Symmetrix logical volume or as an independent, host-addressable volume. Establishing BCV devices as mirror images of active production volumes allows the user to run multiple simultaneous business continuance tasks in parallel. The principal device, known as the *standard device*, remains online for regular Symmetrix operation from the original production server. Each BCV contains a unique host address, making it accessible to a separate backup/recovery server.

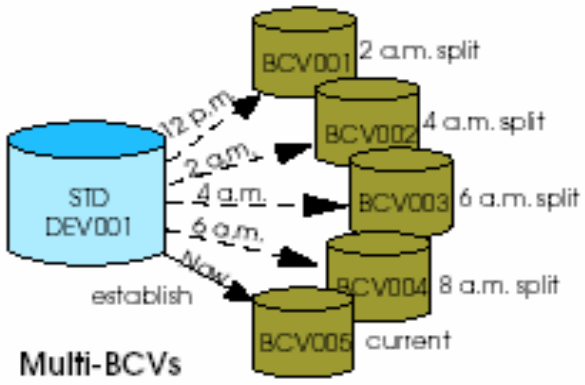

Figure 2. Multiple copies of a single source volume using TimeFinder Mirror (BCV)

Note: PowerSnap supports only a BCV as the target device for TimeFinder/Mirror

TimeFinder/Snap

The TimeFinder/Snap features allow you to make copies of data simultaneously on multiple target devices from a single source device. The data is available to a target's host instantly. You can copy data from a single source device to as many as 16 target devices.

With TimeFinder/Snap, the target device is a Symmetrix virtual device that consumes negligible physical storage through the use of pointers to track data.

The virtual device is a host-addressable Symmetrix device with special attributes created at configuration time. But unlike the BCV, which contains a full volume of data, the virtual device is a "slim" device that offers a space-saving way to create instant point-in-time copies of logical volumes. Any updates to a source device after its activation with a virtual device cause the pre-update image of the changed tracks to be copied to a save device. The virtual device's indirect pointer is then updated to point to this original track data, preserving a point-in-time image of the volume. TimeFinder/Snap uses this copy-on-first-write technique to conserve disk space, since only changes to tracks on the source cause any incremental storage to be consumed. Figure 3 displays this concept.

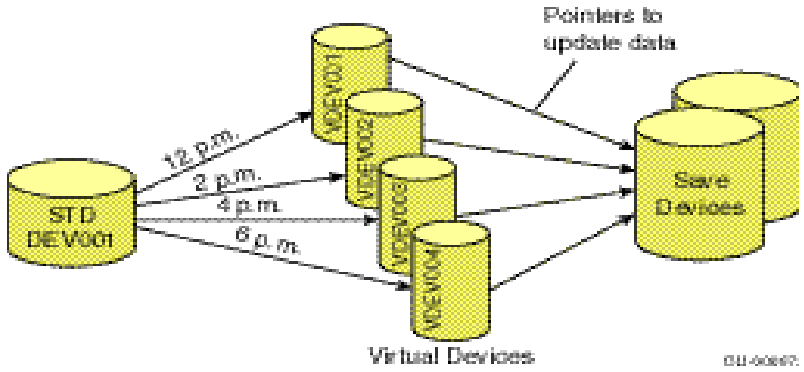

Figure 3. Virtual devices as point-in-time copies

EMC NetWorker

The NetWorker software comprises a high-capacity, easy-to-use data storage management solution that protects and helps to manage data across an entire network. NetWorker simplifies the storage management process and reduces the administrative burden by automating and centralizing data storage operations. The NetWorker software enables a user to:

- Perform automated backups during nonpeak hours.
- Administer, configure, monitor, and control NetWorker functions from any computer on a network.
- Centralize and automate data management operations.
- Increase backup performance by simultaneously sending more than one save stream to a single device.
- Optimize performance by using parallel save streams to multiple backup devices or storage nodes.

EMC NetWorker PowerSnap

The PowerSnap Module enhances NetWorker by allowing continuous snapshot-based data protection and availability during backups for the Symmetrix storage system. The backup is virtually instantaneous, despite the size of the volume. The PowerSnap Module software enables frequent backups with little impact to the

network or application server to provide nondisruptive backups of large databases or data stored in file systems.

The PowerSnap Module solution provides high-performance block level (image) as well as traditional file- and operating system-based backup technology. Traditional backups are often called conventional backups. Block level (image) backups are similar to traditional NetWorker backups, but when the file data is saved, the file system and volume manager are circumvented, and the data is read from the disk directly. The index format on tape is exactly the same as that of a traditional backup index format. The advantage of block level or image backups is that they are faster than conventional backups, that is, if the file or raw volume size is predominately over 2 MB.

PowerSnap is a seamless integration of snapshot technology with NetWorker software. Moreover, PowerSnap features are configured through NetWorker. The application server with the PowerSnap Module communicates with the NetWorker server to back up a volume or file system belonging to a client. The group of files, volumes, or file systems from a single client, describing the collection of data for which a PiT copy is created on an external disk subsystem, such as a storage array, is referred to as a snap set.

For instant backups, the PowerSnap Module software creates a PiT copy, or snapshot, of the snap set and stores the copy on the Symmetrix array as a snapshot session. This is known as an instant backup, which is a snapshot that is not written to tape but has some metadata that is written to tape.

All backups can be performed with a second-host proxy client (data mover), which results in better performance because the load (CPU and memory utilization) is shared with the proxy host. An instant backup, for non-image backups, of the data is created from the application server, but the proxy client moves the actual data to the tape or disk medium. The proxy client is specified in the client resource of the NetWorker Management Console interface.

EMC NetWorker Module for Oracle

Figure 4 illustrates the workflow and the interactions of different components of the NetWorker Module for Oracle, PowerSnap, and the NetWorker server.

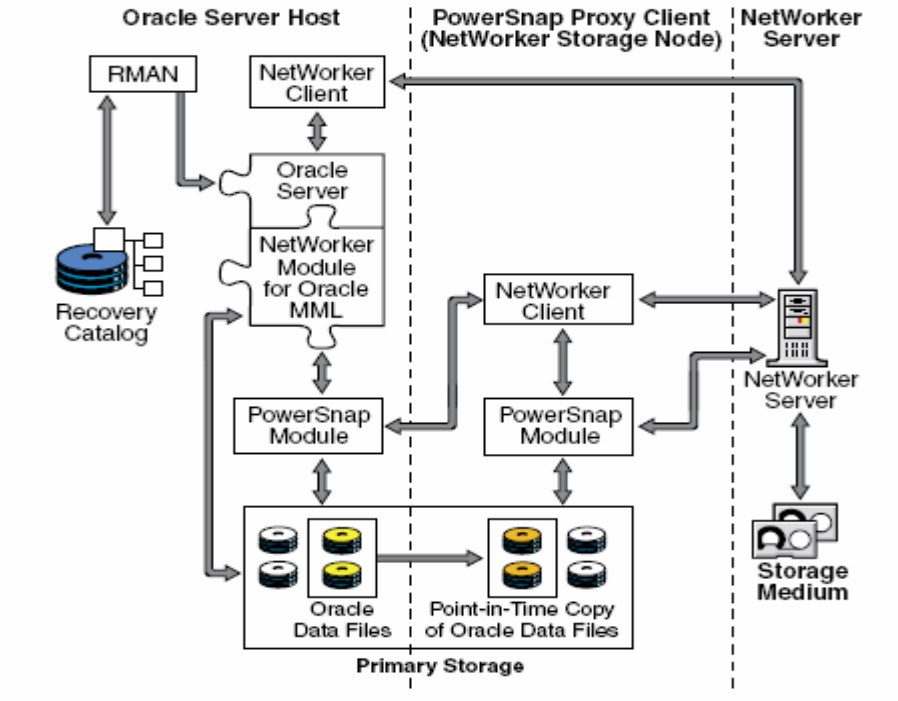

Figure 4. Backup/restore workflow of NMO and PowerSnap

Backup workflows

There are several types of backup workflow.

Homogeneous workflow

For homogeneous workflow the proxy client/data mover should be with the same operating system, hardware architecture, and storage stack as the application host for which it performs the backup or recovery.

The backups supported in this workflow are the following:

- PiT backup
- PiT + Rollover backup
- Serverless backup

The restores supported in this workflow are the following:

- PiT restore
- Rollback restore
- Conventional restore

Snapshot management

When a PiT copy is created, a unique save set ID is assigned. In addition, when the data from that PiT copy is backed up to a tape or disk medium, a different save set ID is assigned to that data. By having two unique save set IDs, the snapshots (PiT copies) can be handled separately from the backed up data. The copy of the data is removed only when all snapshots and backups of the data have been deleted.

Heterogeneous workflow

For a heterogeneous workflow, the proxy client/data mover is supported only on the Solaris 9 platform. Under this workflow, only the file-logical image backup (FLIB) is supported. PiT copies cannot be retained. Once the PiT is created, the BCV/VDEV is split and the data is rolled over to secondary media on the NetWorker storage node.

The backup supported in this workflow are the following:

- Serverless backup (FLIB)

The restores supported in this workflow are the following:

- Conventional restore
- FLIR restores
- SC restores

PowerSnap snapshot backup of Oracle

Both the homogeneous and heterogeneous workflows are supported by the NetWorker Module for Oracle software and PowerSnap for the Oracle database backups.

Snapshot backups of the Oracle database can be backed up at the following levels:

- Oracle database
- Tablespace
- Datafile

Restores can also be performed at the same granular level at which the backups are performed.

Configuring an Oracle production host for snapshot backups

These procedures discuss the configuration of the Oracle production host for snapshot backups.

Configuring the nwora resource file (nwora.res)

Proxy Oracle backups require the nwora.res file in the default installation directory of the production host:

- For UNIX: /nsr/res/nwora.res
- For Windows: <IINSTALL DIR>/res/nwora.res

To enable instant backups and catalog synchronization, specific NWORA resources must be added to the file with the **nsrnmoadmin** program.

For the proxy backup to operate properly, the user must set the following parameters in the nwora.res file using the **nsrnmoadmin** program:

- NSR_ORACLECAT_MODE
- NSR_ORACLE_CONNECT_FILE
- NSR_ORACLE_HOME
- NSR_ORACLE_SID
- NSR_ORACLECAT_DEBUG_FILE (optional)
- NSR_ORACLECAT_LOG_FILE (optional)

The NSR_ORACLECAT_MODE parameter should be set to either *enabled* or d*isabled* for the proxy backups to operate. If the parameter is set to disabled, the proxy backups will operate well, but the catalog synchronization will not occur when the entries from the RMAN catalog are removed.

Example

The command to set the parameter: **nsrnsmoadmin –r update NSR_ORACLECAT_MODE enabled**.

The command to view the parameter values*:* **nsrnmoadmin –r list**.

NSR_ORACLE_CONNECT_FILE, NSR_ORACLE_HOME and NSR_ORACLE_SID must be set with the correct values for the proxy backups to perform properly. If there are two databases running on the same host, then there should be two entries in the nwora.res file for catalog synchronization to occur on both the databases.

Example
The command to set the parameters is **nsrnmoadmin –r update sid=test home=/u01/app/oracle connect=/u01/connect**.

The connect file will have the connect string to the database to be backed up. For example, the contents in the connect file: connect target sys/test.

The log file and the debug files can be giving an absolute path to NSR_ORACLECAT_DEBUG_FILE and NSR_ORACLECAT_LOG_FILE. This helps to troubleshoot the issues that may occur during catalog synchronization.

Configuring the nsrnmo script

The sample nsrnmo file is found in the default installation directory where all the NetWorker binaries are installed. The sample script file names are:

- For UNIX, nsrnmo
- For Windows, nsrnmo.bat

The following parameters need to be set in the nsrnmo script for a proxy scheduled backup:

- ORACLE_HOME – Home directory of the ORACLE installation
- ORACLE_SID – Oracle instance Name
- LD_LIBRARY_PATH (UNIX) – Library path
- NSR_RMAN_OUTPUT – NMO logs
- NSR_SB_DEBUG_FILE – NMO logs
- PRECMD (optional) – Script provided by user, to be executed at the start of the backup
- POSTCMD (optional) – Script provided by user, to be executed at the start of the backup

The script provided for PRECMD will be executed as the first step of the NMO backups. If the script returns a success, the backup continues, or else the backup exists with a error message in the NMO logs.

The script provided for POSTCMD will be executed upon backup completion, and if the script execution fails, a warning message is displayed in the NMO logs.

Configuring the Oracle database

For proxy backups, the Oracle database should be running in the archivelog mode. The Oracle database must be brought to archivelog mode for the online backups to operate properly.

Configuring the Symmetrix Groups and Resource file

The symm.res file should be created by the user. The symm.res file has entries for the Symmetrix ID, device ID of the standard device (STD), and the device ID of the BCV or VDEV based on the chosen snapshot technology.

The STD where the database data is residing should be identified. To take a snapshot backup of a database, each of the disks should be mapped to at least one BCV. Also, ensure that the BCV, which is mapped to the source STD, is not paired with any other STD. Follow these checklisted items:

Considerations are as follows:

- Ensure that the appropriate version of Solutions Enabler (SymAPI) is installed on both the application server and on the proxy host. Refer to the *EMC Information Protection Software Compatibility Guide* for the most accurate and up-to-date information.
- Ensure that STD devices used by the Microsoft SQL Server database are visible to the application host.
- Ensure that all BCV devices that share the same exact size as the STD are visible to the proxy host (there could be up to eight BCV devices for each STD).
- On the application server and on the proxy host, run the command **symcfg list.**
- The **symcfg** command returns a list of available Symmetrix arrays visible to the host.

C:\Documents and Settings\Administrator>symcfg list

```
                                S Y M M E T R I X
                                          Mcode    Cache      Num Phys  Num Symm
SymmID          Attachment  Model         Version  Size (MB)  Devices   Devices

000187461273    Local       1000P-M2      5671       65536         17      2609
000387940030    Local       DMX800        5671       16384          4      2278
000187461276    Remote      1000P-M2      5670       65536          0      2265
```

- Record the SymmID and compare it between the application server and the proxy host. On the application host run the command **syminq.** The **syminq** command returns a list of all available Symmetrix drives visible to the host.

C:\Documents and Settings\Administrator>syminq

```
          Device                        Product                    Device
--------------------------- ---------------------------- ---------------------
Name                    Type   Vendor    ID             Rev  Ser Num      Cap (KB)
--------------------------- ---------------------------- ---------------------
\\.\PHYSICALDRIVE0          DELL      PERC 5/i       1.03 N/A                N/A
\\.\PHYSICALDRIVE1  GK      EMC       SYMMETRIX      5671 730014B291        2880
\\.\PHYSICALDRIVE2  GK      EMC       SYMMETRIX      5671 730014C291        2880
\\.\PHYSICALDRIVE3          EMC       SYMMETRIX      5671 730014D291     5242560
\\.\PHYSICALDRIVE4          EMC       SYMMETRIX      5671 730014E291     5242560
\\.\PHYSICALDRIVE5          EMC       SYMMETRIX      5671 730014F291     5242560
\\.\PHYSICALDRIVE6          EMC       SYMMETRIX      5671 7300150291     5242560
\\.\PHYSICALDRIVE7          EMC       SYMMETRIX      5671 7300151291     5242560
\\.\PHYSICALDRIVE8  BCV     EMC       SYMMETRIX      5671 7300152291     5242560
\\.\PHYSICALDRIVE9  BCV     EMC       SYMMETRIX      5671 7300153291     5242560
\\.\PHYSICALDRIVE10 BCV     EMC       SYMMETRIX      5671 7300154291     5242560
\\.\PHYSICALDRIVE11 BCV     EMC       SYMMETRIX      5671 7300155291     5242560
\\.\PHYSICALDRIVE12 BCV     EMC       SYMMETRIX      5671 7300156291     5242560
```

- Write down the Symmetrix device number that is used to hold the Oracle data. To identify the device number, look at the third, fourth, and fifth digits of the Ser Num.

- For Symmetrix DMX™, the Symmetrix device number will be a four-digit number and would be represented by the fourth, fifth, sixth, and seventh digits of the Ser Num. In this example, device \\.\PHYSICALDRIVE5 is Symmetrix device number 014F.
- On the proxy host, run the syminq command and write down the BCV device number that you are planning to use.
- Ensure that the BCV device size is identical to the source device size. In our example, an option is to match Symmetrix device 014F with BCV device 015F as their sizes are identical.
- Match standard Symmetrix devices with BCV devices.
- Create a Symmetrix disk group (symdg).
  This group could be created either on the application and would be used by PowerSnap.

  To create the device group, execute **symdg create*gr oup_name***

  For example:
  symdg create pstest

  - Add the Symmetrix STD devices (the production devices) to the newly created group by executing:

    symld –g *group_name* –sid *SymmId* add dev *dev#*

    For example:

    symld –g pstest –sid 000387940030 add dev 014F.

    Repeat the symld command for all STD devices.
  - Add the BCV devices to the group by executing:
    symbcv –g *group_name* –sid *SymmId* associate dev *bcv_dev_#*

    For example:

    symbcv –g pstest –sid 000387940030 associate dev 015F

    Repeat the symbcv command for every BCV device to be added.
- Verify the configuration: C:\Documents and Settings\Administrator>symdg list

```
                              D E V I C E      G R O U P S

                                                                                Number of
    Name            Type      Valid  Symmetrix ID  Devs   GKs  BCVs  VDEVs  TGTs
   pstest         REGULAR   Yes    000387940030     1     0     1      0     0
```

C:\Documents and Settings\Administrator>symld -g pstest list

```
Device Group (DG) Name: pstest
DG's Type             : REGULAR
DG's Symmetrix ID     : 000387940030

        Standard Device Name           Directors              Device
---------------------------------   ------------- ----------------------------
                                                                          Cap
Logical     Physical          Sym    SA :P DA :IT  Config        Att Sts   (MB)
---------------------------------   ------------- ----------------------------

DEV001      DRIVE20           014F + 15C:1 01A:C0  Unprotected       RW    8192

Legend for STD devices:

(+): Paired with a BCV device that is associated with this dg.

(-): Paired with a BCV device that is non-associated with this dg.

BCV Devices associated with this dg:

             BCV Device                    Standard Device          Status
---------------------------------- --------------------------- ------------
```

```
                                 Inv.                          Inv.
Logical          Sym  RDF Att. Tracks Logical          Sym  Tracks BCV <=> STD
---------------------------------- ----------------------------- ------------

BCV001           015F        +      0 DEV001           014F      0 Split

Total                        --------                     --------
  MB(s)                           0.0                          0.0


Legend for BCV devices:

(+): BCV is paired with a member STD device.

(-): BCV is paired with a non-member STD device.
```

C:\Documents and Settings\Administrator>Example of the symm.res 000387940030: 014F 015F

By default, PowerSnap will look for the symm.res file at /nsr/res. The user can then store the file in a non-default location and specify the path of the res file using the parameter SYMM_PROVIDER_DB=*absolute path of the symm.res file*. The variable should be mentioned in the Application Information listing of the NetWorker client in the Console.

The user has to manually create the symdg group and add the standard and the BCV or VDEV devices that are used for backup.

Configuring a NetWorker client for homogeneous workflows

In homogeneous workflows, a user can retain single or multiple snapshots based on the necessity, and roll over the required snapshot to tape connected on the NetWorker storage node. The snapshot will then be deleted.

The user can perform only an instant backup and then perform a delayed rollover to tape from the **nsrsnapadmin** program.

For the Oracle client, the backup command should be mentioned in the Client properties **nsrnmo** for UNIX and **nsrnmo.bat** for Windows. Figure 5 shows the backup command configuration in the NetWorker client properties.

The user has to specify the Application Information variable in the client properties section. The following are the parameters that need to be mentioned in the Application Information variable section.

- NSR_DATA_MOVER=<Data mover name>
- NSR_SNAP_TYPE=symm-dmx
- SYMM_ON_DELETE=RELEASE_RESOURCE / RETAIN_RESOURCE

For Oracle backups the NetWorker client save set should be a RMAN script with the absolute path. Figure 6 shows the client configuration for NMO backups.

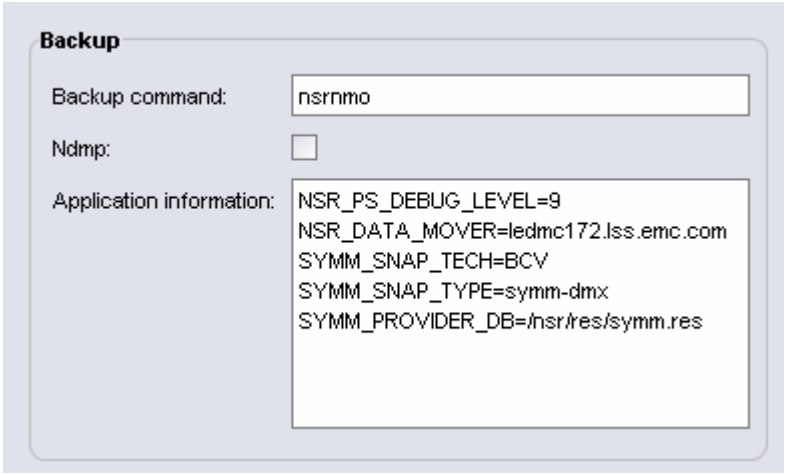

Figure 5. Backup command and application information listing for homogeneous workflow

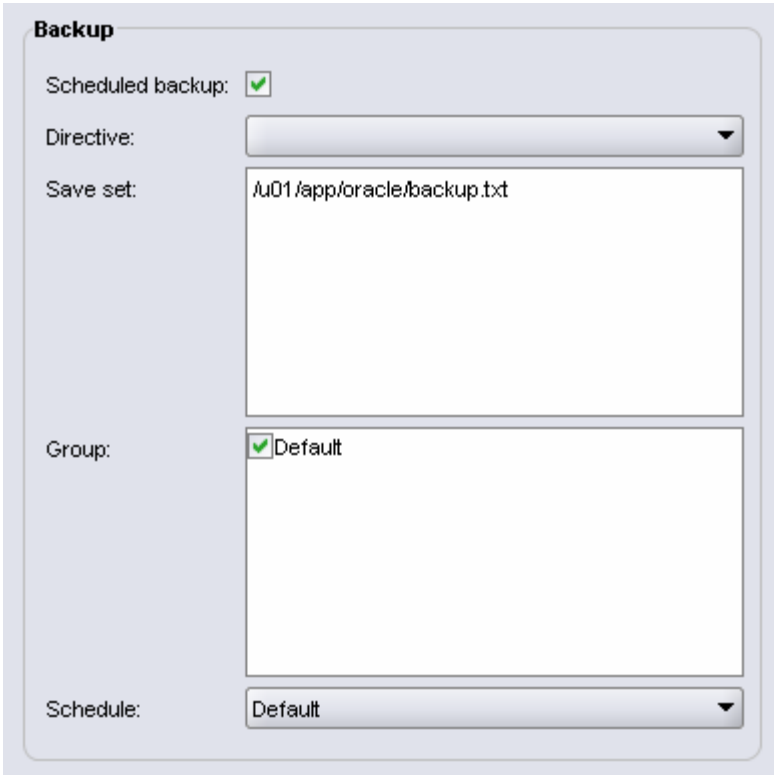

Figure 6. Client save set and application information for homogeneous workflow

Create a snapshot policy and enable the snapshot flag for the group. Assign the client to the group and run the backup.

Example
A user has created a 1, 1, Day, All Snapshot policy (Take One Snapshot; retain 1, and rollover the snapshot to tape; set retention for snapshot to Day). Initially one snapshot of the tablespace is created, the BCV is mounted on the proxy client, and then the data is rolled over to a tape device on a NetWorker storage node.

Sample RMAN script for a proxy backup of a tablespace

```
connect target sys/test@test;
run {
allocate channel t_1 type SBT_TAPE
parms 'ENV=(NSR_SERVER=server,NSR_DEBUG_FILE=c:\nmologs\test.log)';
backup proxy tablespace oracle;
release channel t_1;
}
```

Recoveries with a homogeneous workflow

All Oracle recoveries are performed from RMAN by using the RMAN scripts. These are the recoveries supported by PowerSnap in homogeneous workflows for Oracle.

Instant restore (PiT restore)

The restore will be performed from a PiT copy. The following variables must be set in a text file and should be provided as input by using NSR_PROXY_PFILE in the RMAN script.

Example
A user creates a file named restore1.cfg. Under c:\scripts, this file should be given as input for the parameter NSR_PROXY_PFILE.

- NSR_DATA_MOVER=*data mover name*
- NSR_SNAP_TYPE=symm-dmx
- RESTORE_TYPE_ORDER=pit

Sample RMAN script for restores

```
Connect target sys/test@test;
run{ sql 'alter tablespace test offline';
allocate channel t_1 type SBT_TAPE
parms   'ENV=(NSR_DEBUG_FILE=C:\test.log)';
send 'NSR_ENV=(NSR_SERVER=server, NSR_PROXY_PFILE=C:\scripts\restore1.cfg)';
restore tablespace test;
recover tablespace test;
sql 'alter tablespace test online';
release channel t_1; }
```

Conventional/tape restore

Conventional restores are performed from tape that is attached to the NetWorker storage node directly to the standard device (STD) on the application host. The parameter RESTORE_TYPE_ORDER should be provided in the restore configuration file and provided as an input for NSR_PROXY_PFILE.

- NSR_DATA_MOVER= *data mover name*
- NSR_SNAP_TYPE=symm-dmx
- RESTORE_TYPE_ORDER=conventional

Rollback restore

A rollback restore is a destructive restore, and the user must manually configure the psrollback.res file to avoid the safety check on the rollback file systems.

The parameter RESTORE_TYPE_ORDER should be provided in the restore configuration file, and provided as an input for the NSR_PROXY_PFILE.

Example

- NSR_DATA_MOVER=*data mover name*
- NSR_SNAP_TYPE=symm-dmx
- RESTORE_TYPE_ORDER=rollback

PowerSnap safety check

PowerSnap applies the safety check rules during a rollback restore to avoid overwriting the source data accidentally during a rollback restore. To allow the rollback restore to succeed without a safety check failure, the user must manually add the files that are allowed to be overwritten in the powersnap.res file. This file is located in C:\Progra~1\Legato\nsr\res.

In general terms, a safety check should complain about any object that would be affected by the rollback that is not included within the object being supplied for the rollback.

Example

A Symmetrix disk with the following layout:

STD1

- /fs1
  - datafile1
  - datafile2
  - dir1
    - datafile3
- /fs2
  - datafile4

When a snapshot is taken of any object on the STD, a snapshot containing everything above is obtained. A rollback always results in fs1 and fs2 being reverted to their states at the time of the snapshot. The purpose of the safety check is to inform the PowerSnap user that there are objects outside the scope of their rollback request. The restore objects have a direct effect on whether or not the safety check will pass or fail.

If these files are added to the file system, the safety check will behave as follows in each rollback scenario:

- /fs1/newdatafile5
- /fs1/dir1/newdatafile6
- /fs2/newdatefile7

Case 1: A rollback is requested for /fs1. /fs2 would cause the safety check to fail.

None of the new files affect the safety check. This is because the first two files are within the scope of what was specified to roll back (/fs1), and the third file is within the scope of /fs2.

Case 2: Rollback requested for /fs1/dir1

/fs2 would cause a safety check failure

/fs1/newdatafile5 would cause a safety check failure.

The other two new files don't fail the safety check. This is because /fs1/dir1/newdatafile6 is within the scope of what we were told to roll back and the last file is within the scope of /fs2.

Now let's consider the Oracle restore. If a rollback is being done and there are any additions to the affected file systems it will in a safety check failure. The user has to add all other files (on the source disk(s)) that are not part of rollback restore in the psrollback.res file

Figure 7 shows a sample psrollback.res file.

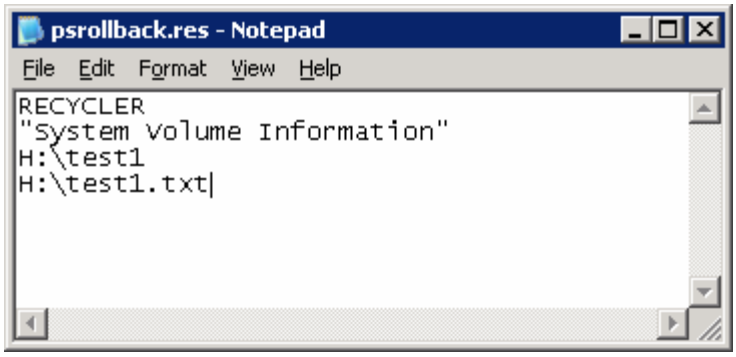

Figure 7. Sample psrollback.res file

Configuring a NetWorker client for heterogeneous workflow

In a heterogeneous workflow, a user cannot retain any snapshots. All snapshots are rolled over to tape on the NetWorker storage node, and then the snapshot is deleted.

A Serverless Backup snapshot policy is the only supported snapshot policy for heterogeneous workflows.

For the Oracle client, the backup command should be mentioned in the Client properties: **nsrnmo** for UNIX and **nsrnmo.bat** for Microsoft Windows. Figure 5 illustrates the backup command configuration in the NetWorker client properties Console window.

Application Information variables must be entered in the client attributes (properties) section. The following are the parameters that need to be mentioned in the Application Information section.

- NSR_IMAGE_SAVE=TRUE
- NSR_PS_DEBUG_LEVEL=9
- NSR_DATA_MOVER= *data mover name*
- NSR_SNAP_TYPE=symm-dmx
- SYMM_ON_DELETE=RELEASE_RESOURCE / RETAIN_RESOURCE

For NMO backups, the NetWorker client save set should be specified as the RMAN script with the absolute path. Figure 6 illustrates the client configuration for NMO backups.

Recoveries supported in heterogeneous workflow

All Oracle-related recoveries are performed from RMAN using the RMAN scripts. The following are the recoveries supported by PowerSnap in heterogeneous workflow for Oracle.

FLIR

For FLIR restores, the standard device (STD) should also be visible on the proxy client (data mover). The RMAN script is similar to the Sample RMAN scripts section.

The user has to explicitly mention the variables in a file and provide the file as input to the RMAN script by using the NSR_PROXY_PFILE parameter to specify the name of the file. The restore type order variable should be mentioned as below:

- NSR_IMAGE_SAVE=TRUE
- NSR_DATA_MOVER=*data mover name*
- NSR_SNAP_TYPE=symm-dmx
- `RESTORE_TYPE_ORDER=FLIR`

FLIR using a mirror (SC Restore)

The FLIR using a mirror feature causes PowerSnap to recover data to a BCV rather than to a STD device, and then synchronizes the BCV with the standard. Such recoveries do not go over the LAN, but instead, the recovered data travels from the PowerSnap server to the Symmetrix storage array. Also, by performing a BCV recovery/rollback to the standard, the data is immediately available to the client and does not wait for the BCV recovery/rollback to complete. PowerSnap also supports performance of granular recoveries from tape to the BCV, and then PowerSnap initiates a full BCV rollback to the standard. The file system is unmounted by PowerSnap prior to recoveries.

A user has to explicitly mention the variables in a file and provide the file as input to RMAN script by using the NSR_PROXY_PFILE parameter. The restore type order variable should be mentioned as listed below:

- NSR_IMAGE_SAVE=TRUE
- NSR_DATA_MOVER=*data mover name*
- NSR_SNAP_TYPE=symm-dmx
- RESTORE_TYPE_ORDER=FLIR
- RESTORE_TO_MIRROR=YES
- SYNC_FROM_MIRROR=YES

Conventional restores

Conventional restores are performed from a tape device that is attached to the NetWorker storage node directly to the standard device (STD) on the application host. The parameter RESTORE_TYPE_ORDER should be provided in the restore configuration file and provided as an input for the NSR_PROXY_PFILE.

Example

- NSR_IMAGE_SAVE=TRUE
- NSR_DATA_MOVER=*data mover name*
- NSR_SNAP_TYPE=symm-dmx
- RESTORE_TYPE_ORDER=conventional

Selection of a remote storage node

The storage node to be used for backups may be specified in the NetWorker Console program. The objective is to avoid backing up data over the network, thereby shortening the backup window. PowerSnap backups can benefit by the installation of the storage node on the data mover and then directing backups to the devices attached to this storage node.

PowerSnap can leverage a remote NetWorker storage node's functionality when the user sets the affinity of the client to a particular storage node.

Note: By default, all the backups are directed to devices attached to the NetWorker server.

A remote storage node provides the flexibility to direct the backup data to go to a particular storage node, which indirectly means to a set of devices belonging to that storage node. Figure 7 illustrates the settings for specifying the affinity for a storage node.

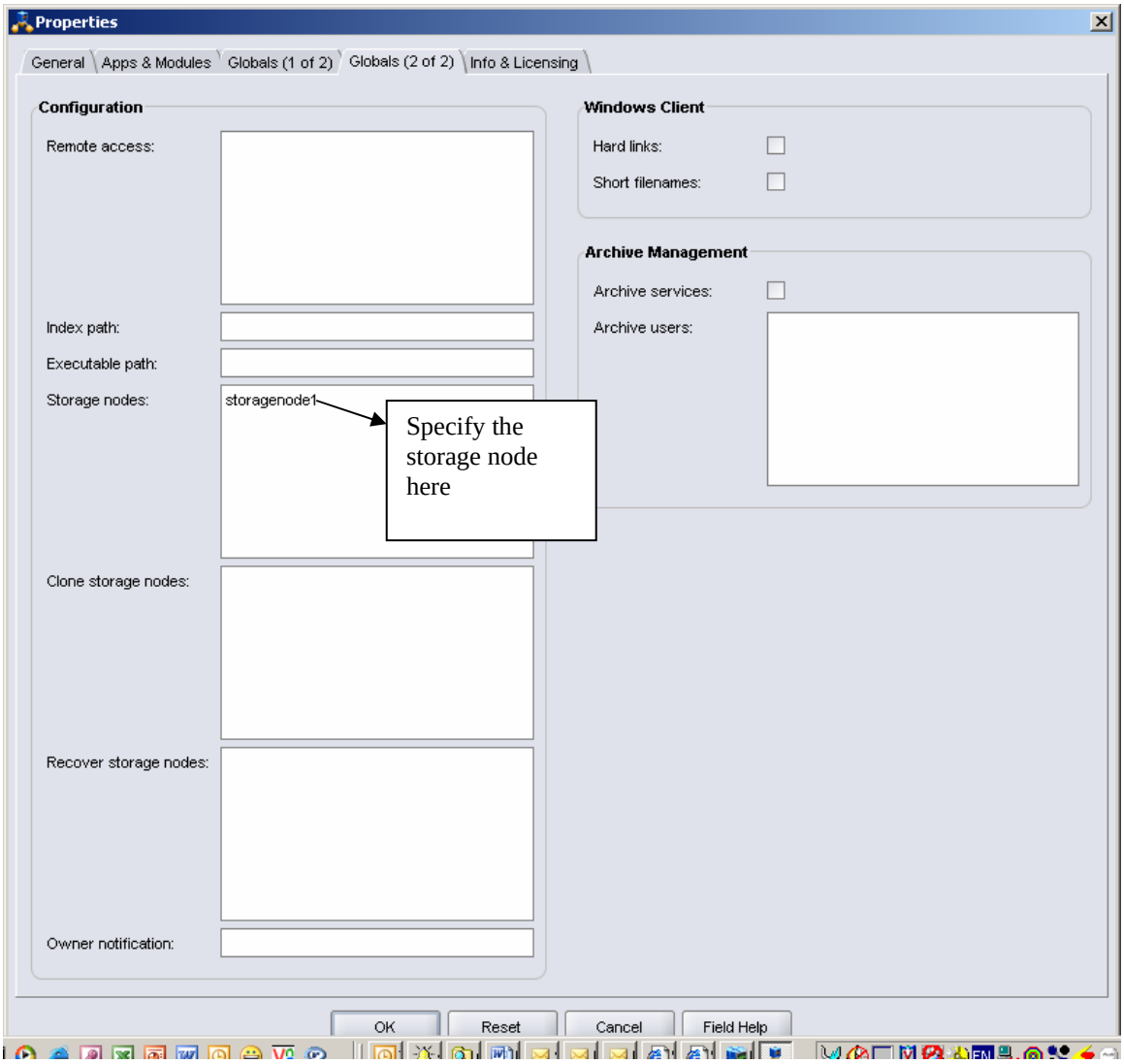

Figure 8. Storage node designation

Using this functionality, a user can set the affinity for different storage nodes. For instance, the remote host that has the remote storage area can set the storage node affinity to itself (if a storage node is installed) or to a different storage node, nearer to itself, in order to avert network traffic. By default, the storage node is set to "nsrserverhost", which means the data is to be backed up to devices connected directly to the NetWorker server. A remote device is configured using this convention:

rd=storagenode1:\\.\Tape0 or rd=storgaenode1:/networkerdevice

Where storagenode1 is the hostname of the remote storage node.

Figure 9 is a screenshot of the NMC illustrating a remote device configured on a NetWorker server.

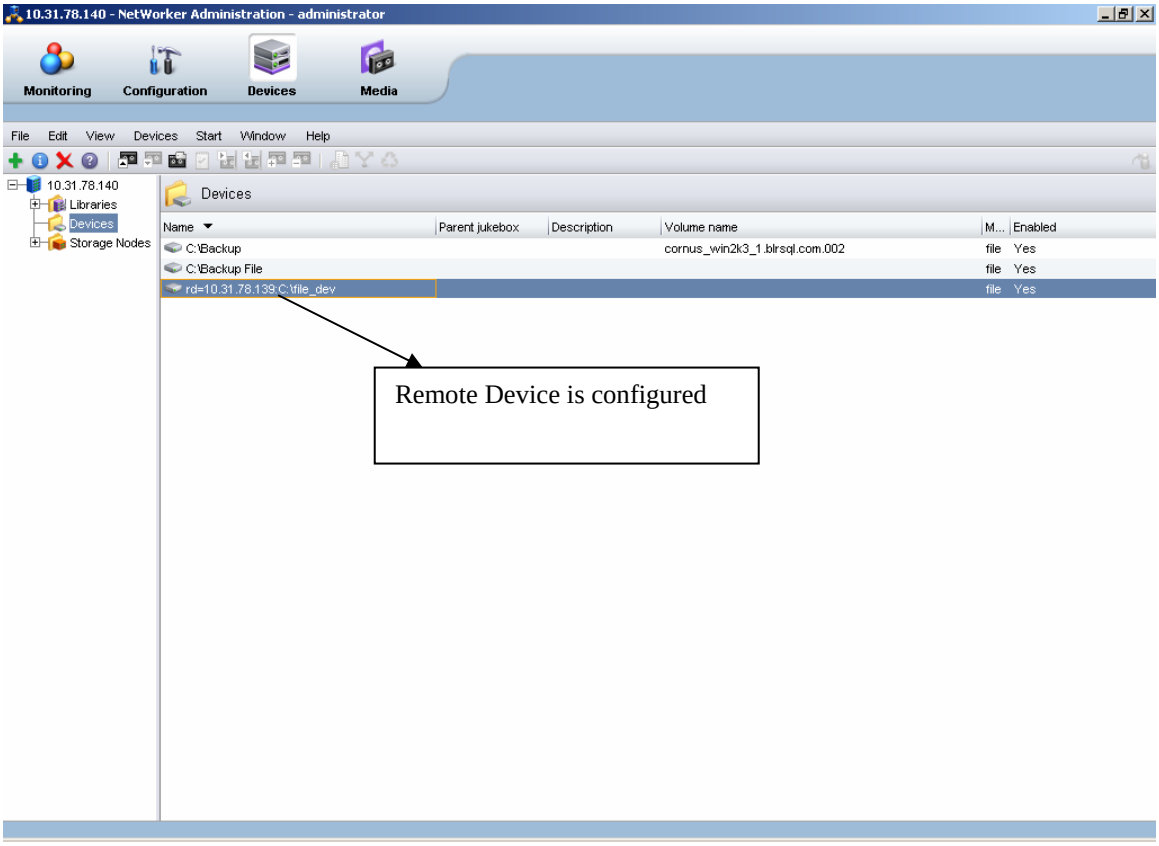

Figure 9. NetWorker Management Console with a remote device

Troubleshooting tips

The following are two scenarios that you may need to troubleshoot, and their solutions.

Not enough resources to create the snapshot:

ERROR [BrcBackupOp.cpp 707] Not enough resources to create snapshot: No matching device found

ERROR [BrcBackupOp.cpp 711] Failed to prepare the snapshot of F:\1.DBF.

To solve this issue:

1. Check the retain snapshots number should be same as the number of BCVs paired for the STD in the resource file symm.res.
2. Run symcfg discover on the proxy client to check whether the BCVs are still visible to the datamover.
3. Check the BCV status, and make the BCV to ready state.
4. Check the configurations in the symm.res, and make sure that the STD <-> BCV pair is correct.

Cannot obtain exclusive enqueue for datafile:

RMAN-03002: failure of restore command at 11/21/2007 15:02:29

ORA-19573: cannot obtain exclusive enqueue for datafile 10

To solve this issue, make sure that the tablespace is in an offline state.

Conclusion

The innovative technologies of EMC NetWorker PowerSnap and EMC Symmetrix storage arrays combine to provide key customer benefits within a NetWorker-protected SAP environment.

Organizations implementing such a solution are expected to see the following benefits:

- Seamless integration into an existing IT storage infrastructure with no impact to the Oracle database applications
- Instantaneous access to Oracle database backups at specific points in time to provide a greatly reduced recovery time over tape-based recovery solutions
- Reduced Oracle server downtime due to the low overhead of creating snapshots with EMC NetWorker PowerSnap and EMC Symmetrix arrays
- Reduced backup and restore windows by using block-based backups

References

- *EMC NetWorker PowerSnap Module for EMC Symmetrix DMX Installation Guide*
- *EMC NetWorker PowerSnap Module for EMC Symmetrix DMX Administration Guide*
- *EMC NetWorker PowerSnap Module for EMC Symmetrix DMX Release Notes*
- *EMC NetWorker Module for Oracle Multiplatform Version Installation Guide*
- *EMC NetWorker Module for Oracle Multiplatform Version Administration Guide*
- *EMC NetWorker Module for Oracle Multiplatform Version Release Notes*
- *EMC NetWorker Multiplatform Version Administration Guide*
- *EMC NetWorker Multiplatform Version Release Notes*
- *EMC Information Protection Software Compatibility Guide*
- *Configuring PowerSnap with Microsoft SQL Databases on EMC Symmetrix and EMC CLARiiON Systems Technical Note*

View EMC's proven solutions for data replication, data lifecycle management, disaster recovery and continuous data protection at http://www.EMC.com.

View detailed information on the EMC NetWorker family of products at http://www.emc.com/products/detail/software/networker.htm.