

Novell NetWare™: Backup and Recovery Using a NetApp Filer in a SAN Environment

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TECHNICAL REPORT

Network Appliance, a pioneer and industry leader in data storage technology, helps organizations understand and meet complex technical challenges with advanced storage solutions and global data management strategies.

Abstract

This document details the implementation of file system freeze/thaw functionality in NetWare 6.5 and above with the NetApp filer Snapshot™ ability to perform backup and recovery using iSCSI and Fibre Channel filers.

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1. Purpose and Scope

This document covers the techniques for utilizing Snapshot technology available in Network Appliance™ storage systems with Novell NetWare. Specifically, this report covers the following procedures:

- Backing up a Novell Storage System (NSS) pool using Snapshot
- Restoring an NSS pool from a Snapshot backup
- Connecting writable Snapshot LUNs to a NetWare Server

2. Requirements and Assumptions

For the methods and procedures in this document to be useful to the reader, several assumptions are made:

- The reader has at least basic NetWare administration skills, has access to the administrative login for the server, and has administrative access to the server console.
- The reader has at least basic Network Appliance administration skills and has administrative access to the filer via the command-line interface.
- The filer has the licenses necessary to perform the activities outlined in this document.
- The target system has the required block-level and network protocol interconnects to perform the activities outlined in this document.
- NetWare 6.5 or later is required. Earlier versions of NetWare lack the pool freeze/thaw functions.
- NSS file systems are employed on the server. NWFS (traditional) file systems do not have the freeze/thaw capabilities.
- In the examples in this report, all administrative commands are performed at the server or filer console for clarity. Web-based management tools can also be used.

3. Best Practices for File System Layout

To utilize NetApp Snapshot most effectively, several recommendations for designing the storage configuration are presented in this section. These recommendations are designed to prevent configuration issues from impacting data integrity or the ability to take or restore Snapshot.

Pools should contain only one volume—Since the pool must be taken offline, all volumes within the pool will be offline during any restore operations, and all volumes within the pool must be restored as a unit. With only one volume in each pool, data availability is preserved during restores.

Each pool should consist of only one LUN—Snapshot restore operations must be performed from the filer's command line or via FilerView®. If the pool spans multiple LUNs, all LUNs in the pool must be restored from the same Snapshot. A single LUN per pool will reduce the chance of error during the restore.

All pools with LUNs in a given filer volume should have Snapshot backups taken at the same time—Snapshot backups occur at the volume level on the filer. All LUNs within the filer volume are in the Snapshot and should be consistent at the time the Snapshot copy is taken. All pools using those LUNs should be frozen for the Snapshot creation. By doing this, any LUNs that are restored from Snapshot copies will be consistent.

If a pool's LUNs span filer volumes, Snapshot copies on all volumes must be taken at the same time—Special care must be taken to ensure that if a given pool's LUNs span filer volumes,

the Snapshot backups occur on all filer volumes containing those LUNs while the pool is frozen. The script presented in this document will correctly handle this case if multiple volumes are specified in the configuration.

If multiple hosts have LUNs in a single filer volume, prefix the Snapshot name with the host name—Snapshot can only be synchronized with one host at a time. Using the host name as the prefix will allow the administrator to quickly identify which Snapshot copies are consistent for a given host. In these environments, only the single LUN SnapRestore® operation should be used.

The "salvage" option should be enabled on all NetWare volumes—The salvage feature gives the administrator an efficient way to recover individual files. Individual files can be restored by mounting Snapshot copy-backed LUNs as detailed in this document, but the process is more labor-intensive than using the salvage feature. Salvage can be turned on for a given volume by using the command `nss /salvage=<volume_name>` on the server's console.

4. Using Snapshot with NetWare

4.1. Overview

The process of creating Snapshot backups in the SAN environment differs from the NAS environment in one very fundamental way: in the SAN environment, the filer does not control the state of the file system. For this reason, Snapshot must be initiated from the host after the appropriate operations have been performed to ensure that a consistent file system image is obtained in the Snapshot backup.

Novell provides an interface into NSS via the "_ADMIN" volume with NetWare 6.5 to flush and freeze a file system prior to taking a Snapshot. This interface takes XML formatted requests, which specify the pool name, a timeout, and a hold timer. When requests are submitted, they are assigned keys that are unique to the given request. When queried with this key, the interface will return an XML formatted response that includes the freeze status, among other information.

The simplest way to automate the freeze/snap/thaw process is to make use of the PERL interpreter included with NetWare. As a language, PERL easily handles string manipulation and parsing. In addition, the open-source and business communities have contributed hundreds of modules that can be used to extend the capabilities of PERL without significant development effort. A standard set of modules ships with NetWare. Additional PERL modules provided by Network Appliance are used to interface with the filer's storage management facilities. Locations for downloading these modules are included in the references near the end of this document.

This document presents a script named "nasnapnw.pl," which implements the freeze/thaw and Snapshot creation functions in PERL. It can be found in the appendix of this document. The script also performs housekeeping functions such as Snapshot rotation with a configurable retention. Since PERL is an interpreted language, this script can be modified and extended with little effort to fit the configuration and business requirements of any environment.

4.2. NetWare Snapshot Script Installation

Several additional components are required on the NetWare server to perform the activities outlined in this paper. The steps required to prepare the NetWare server are outlined below.

1. Install the PERL modules provided in the Network Appliance ONTAPI Software Development Kit into the directory "SYS:\perl\lib\NetApp" on the NetWare server. A link to the ONTAPI program can be found in the references section.

2. If the system is running NetWare 6.5 SP3 or has been upgraded to SP3, download and install the XML Parser and Expat modules. A link to this package can be found in the references section of this document.
3. Install the PERL script called `nasnapnw.pl` into a directory on the SYS: volume of the NetWare server. This script is provided in Appendix A of this paper.
4. Edit the sample configuration file included in the appendix of this paper and install it in a directory on the NetWare server. It contains configuration variables that include the filer hostname as found in the "sys:\etc\hosts" or Domain Name Server (DNS), the filer's administrative password, the NetWare pools involved in the Snapshot backup, and other site-specific information.

NOTE: To enable host address-based authentication using the "hosts.equiv" file, issue options `httpd.admin.hostsequiv.enable` on at the filer command line, configure the `hosts.equiv` file on the filer with the correct host address information, and specify a blank password in the configuration file on the NetWare server to enable this feature.

5. It is recommended that the debug flag and debug output file be used to ensure that the script runs correctly. This flag can be turned off after initial testing to suppress output when the system is used in a production capacity.

4.3. Creating Snapshot Backups of NSS Pools

To take a Snapshot image of an NSS pool, execute the script from the command line as in the following example:

```
SERVER: perl SYS:\nasnapnw.pl -d SYS:\hourly.conf
```

The script will run to completion, generating Snapshot images named "hourly.0", "hourly.1", etc. Under certain conditions, one of two error cases may be encountered that cause abnormal termination:

1. If the Snapshot creation fails, the specific error returned from the filer will be printed to the screen and the debug file, if configured.
2. If the freeze fails to occur within the 30 seconds from the time the request is issued, the script will print an error and abort.

In both cases, no Snapshot rotation is performed and the NetWare pool is thawed if it was frozen.

If the perl script is to be run using the scheduler, use "perl --noscreen" to invoke the script. This way, output will be sent to the system log screen and the perl interpreter will exit cleanly.

4.4. Restoring NetWare Pools Using SnapRestore

Snapshot and SnapRestore provide a very efficient and time-conserving way to restore file systems. Restoring a pool on NetWare is easily accomplished. The steps to restore a pool are detailed below:

1. Deactivate the pool to be restored. If a volume-level SnapRestore is used, all pools with LUNs in the filer volume must be deactivated.

```
SERVER: nss /pooldeactivate=iSCSI
```

2. Use the appropriate SnapRestore command on the filer. To restore a single LUN:

```
filer> lun offline /vol/netware/netware0.lun
filer> snap restore -t file -s snap.0 /vol/netware/netware0.lun
filer> lun online /vol/netware/netware0.lun
```

To restore a filer volume and all of its LUNs:

```
filer> snap restore -t vol -s snap.0 netware
```

WARNING! This will revert the volume to a previous snapshot.
All modifications to the volume after the snapshot will be irrevocably
lost.

Volume netware will be made restricted briefly before coming back online.

Are you sure you want to do this? **y**

You have selected volume netware, snapshot snap.0

Proceed with revert? **y**
Volume netware: revert successful.

3. Reactivate the pool and remount all volumes once the SnapRestore operation has completed.

```
SERVER: nss /poolactivate=iSCSI
```

4.5. Mounting Writable Snapshot LUNs

Writable Snapshot LUNs can be used to restore individual files or to connect to other machines for backup purposes. This process requires a second host machine regardless of whether or not the LUN will be mounted back to the original server. When mounted back to the original machine, the pool must be renamed using a second host before it can be connected back to the original server.

This section will not provide specific command examples, but will instead present the basic steps required.

1. Create the writable Snapshot image for each LUN in the pool using the `lun create -b` command on the filer.
2. Map the LUNs to the second host.
3. If the Snapshot LUNs are to be mounted to the original host:
 1. Use the "nssmu" utility to rename the pool and volume(s) on the Snapshot LUNs.
 2. Execute the command "nss /zlsspoolsnapshot="
 3. Deactivate the pool.
 4. Unmap the LUN(s) from the second host and map them to the original host.
4. Activate the pool using the `nss /poolactivate=` command on the NetWare server.
5. When the Snapshot LUNs are no longer needed, deactivate the corresponding pools on the server using the `nss /pooldeactivate=` command.
6. Delete the LUN from the filer using the `lun destroy -f` command on the filer.

4.6. Snapshot Considerations for NetWare Cluster Environments

Any machine in a NetWare cluster can own a storage pool and its associated volumes. For the freeze/thaw operation to be successful, the Snapshot script must run only on the machine that owns that pool. The easiest way to implement this is to place the configuration file onto a volume in the shared pool and configure the scheduler on all machines to run the Snapshot script. All machines other than the current owner of the pool will fail and exit since they cannot read the config file. Only the machine that currently owns the pool will succeed and create the Snapshot backup.

For cluster environments where this Snapshot script is used, it is strongly recommended that LUNs from different shared pools not be placed in the same volume on the NetApp storage system. Each shared pool should get its own NetApp volume(s) for its LUNs.

5. Conclusions

A Network Appliance filer offers the Novell NetWare administrator compelling advantages in terms of backup and recovery. Use of Snapshot, combined with conventional backup-to-tape techniques, can dramatically optimize the NetWare server backup operation. Retaining a number of online Snapshot backups allows the system administrator to restore file systems and pools without the need to restore from tape in many circumstances. Backup and recovery performance are dramatically improved over conventional local disk and SAN configurations, dramatically improving mean-time-to-recovery (MTTR) intervals.

6. Caveats

This paper is not intended to be a definitive implementation guide. There are many factors that may not be addressed in this document. Expertise may be required to solve logistical problems when the system is designed and built. NetApp has not tested this procedure with all of the combinations of hardware and software options available on Novell NetWare. There may be significant differences in your configuration that will alter the procedures necessary to accomplish the objectives outlined in this paper. If you find that any of these procedures do not work in your environment, please contact the [author](#) immediately.

7. References

Novell Forge Web site:
<http://forge.novell.com/>

Network Appliance Manage ONTAP™ Program
<http://www.netapp.com/solutions/dfms/manage-ontap.html>

Novell NetWare NSS XML interface documentation
<http://developer.novell.com/ndk/doc/vfs/>

Network Appliance SAN System Administrator's Guide
http://now.netapp.com/NOW/knowledge/docs/ontap/rel641/html/ontap/san_sag/index.htm

8. Appendices

8.1. nasnapnw.pl PERL source code

- [nasnapnw-pl.txt](#)

8.2. Sample configuration file

```
# Configure the filer information
$filer="opaka";           # filer hostname
$user="root";           # Admin login on the filer
$password="root";       # Admin password
#$password="";         # Use null password for hosts.equiv authentication
                        # (options httpd.admin.hostsequiv.enable on)

# List of filer volumes (NOT NetWare volumes)
# Syntax: @volumes=(volume1[,volume2,volume3,...,volumeN]);
@volumes=(vol0,netware); # All LUNs/pools must reside
                        # in the volume(s) named

# Enter the NetWare pool(s) to snap, as a set - NOT VOLUMES
# NOTE: All LUNs for named pools must exist in volume(s) above
# Syntax: @pools=(pool1[,pool2,pool3,...,poolN]);
@pools=(iSCSI1,iSCSI2);

# Name prefix for snapshots
# Recommendation: Name by frequency
$snapprefix="whenever";

# How many snapshots
$snapsave=7;

# Name of logfile (when debugging is used)
$debugfile="SYS:\\whenever.log";
```

