Data ONTAP 7G Cook Book v4.0

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A compilation of step-by-step instructions for performing common tasks in Data ONTAP 7G. Most of the content is based on Data ONTAP 7.2. Features exclusive to Data ONTAP 7.3 are indicated by [7.3] See the Data ONTAP 8.x 7-Mode Cookbook for ONTAP 8 commands and procedures.

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DISCLAIMER: This unofficial document is intended for NetApp and NetApp Authorized support personnel and experienced storage administrators who understand the concepts behind these procedures. It should never be used as the definitive source for carrying out administrative tasks. Always defer to Data ONTAP documentation, the NetApp Support website, and instructions from the Tech Support Center (888-4NETAPP). Send any corrections to mcope@netapp.com

Follow Best Practices by running WireGauge and generating an AutoSupport email before and after making changes to a production storage system.

Community Forums: http://communities.netapp.com

TechNet: http://tech.netapp.com

Field Portal: http://fieldportal.netapp.com

IBM Redbooks and Redpapers: http://www.redbooks.ibm.com/cgi-bin/searchsite.cgi?query=ONTAP

Best Practices for Installation and Maintenance

The most important consideration when working on a system in production is to always work from a 'known-good configuration.' This will make troubleshooting problems easier because recent changes are most likely the cause. Follow these best practices to identify existing issues and prevent new ones.

Log console output to a file. A console log is the best source of information concerning changes made to the system and any error or warning messages generated. Console logs are invaluable to technical support as supplement to AutoSupport emails.

Run the WireGauge tool before and after performing any maintenance. Improper cabling is a primary source of system failures. Identify cabling issues before starting maintenance and verify no issues were created during the maintenance process.

Perform a failover/giveback or system reboot before and after performing any maintenance. Oftentimes, we forget to update configuration files after make configuration changes from the command line. You want to discover and resolves any issues with system functionality prior to beginning maintenance.

Logger command. The logger command allows manually inserting commends into the system log. Used in conjuction with manually created AutoSupport emails, the logger command helps break out the messages in the system log related to system maintenance.

AutoSupport. AutoSupport emails are the cornerstone of proactive and reactive technical support. At least once a month, verify AutoSupport emails are being received by NetApp.

Keep firmware up-to-date. The heart of a storage system is its disks and disk shelves. Keep them running optimally by applying the latest manufacturers' firmware updates.

Create and use checklists. Checklists ensure you don't miss a step and help make your work Consistent, Efficient, and Repeatable.

Read Release Notes. Before upgrading to a new version of Data ONTAP, read the Release Notes to learn what is new and what has changed between the current running release and the new release.

Search the Knowledge Base and Communities websites. These two websites are the primary source for customer or field engineer created articles related to the maintenance you will perform or issues you are experiencing.

1 Aggregates and FlexVols

1.1 Creating Aggregates

Refer to the *Data ONTAP Storage Management Guide* for more information.

1.1.1. Software Disk Ownership

NetApp storage controllers rely on ownership labels written to disk rather than physical connections to a shelf to determine ownership of a disk drive. This section describes how to assign and remove disk ownership.

NOTE: Unowned disks cannot be used for data or as spares without being assigned ownership.

Step	Command/Action	Description
1	*> disk upgrade_ownership	Used in Maintenance Mode to convert hardware-based disk ownership systems to use software disk ownership
2	FAS> disk show -v	Display all visible disks and whether they are owned or not
3	FAS> disk show -n	Show all unowned disks
4	FAS> disk assign 0b.43 0b.41	Assigns the listed unowned disks to FAS1
OR	FAS> disk assign 2a.*	Assigns all unowned disks connected to the 2a adapter interface to FAS1
OR	FAS> disk assign all **Warning**: Use with caution. Not restricted by A and B loop in clusters	Assign all unowned disks to current FAS controller
-	V-FAS> disk assign <lun_id_list> -c {block | zoned}	Assign LUNs to a V-Series FAS controller

1.1.1.1 Modifying disk ownership

Step	Command/Action	Description
1	FAS> disk assign 0b.43 0b.41 -s unowned [-f]	Change disks from owned to unowned
OR	FAS> priv set advanced FAS*> disk remove_ownership 0b.41 0b.43	
2	FAS> disk show -n	Verify disks are available for assignment.
	Alternative: reboot system and go into Maintenance Mode	
1	*> storage release disk	Used in Maintenance Mode to release disk reservations

2	*> disk reassign -s <old sysid> -d <new sysid>	Used in Maintenance Mode to reassign disk ownership of all disks owned by a single system to another system

1.1.1.2 Associated Key OPTIONS

Option	Default	Description
FAS> options disk.auto_assign	on	Specifies if disks are auto assigned to a controller. Occurs within 10 minutes of disk insertion.

1.1.2 Aggregates

Create an aggregate of physical disks to store Flexible Volumes. See the matrix below for the maximum number of disks an aggregate can use based on disk size and ONTAP version.

Step	Command/Action	Description
1	FAS> aggr status -s	View all available spare disks
2	FAS> aggr create aggr03 -t raid_dp -r 14 9	Create an aggregate called "aggr03" using raid_dp, a maximum raid size of 14 disks with an initial size of 9 disks
3	FAS> snap reserve -A aggr03 3	Optional: Reduces aggregate snapshot reserve from 5% to 3%. Do not set to 0.
4	FAS> aggr status -v	View the options settings for the aggregate. Also lists all volumes contained in the aggregate.

1.1.2.1 Add disks to Aggregates

Step	Command/Action	Description
1	FAS> aggr status -s	Display list of available spare disks and their disk IDs
2	FAS> aggr options aggr0	Verify the value of the raidsize option
3	FAS> aggr status aggr0 -r	Check the RAID groups in the aggregate to see if there are any 'short' RAID groups
4	FAS> aggr add aggr0 -d 7a.17 7a.26	Add disks 7a.17 and 7a.26 to aggr0. They will be added to the last RAID group created (if it is incomplete) or will create a new RAID group
OR	FAS> aggr add aggr0 4@272 -f -g rg1	Add four 300GB disks to aggr0 by adding them to RAID group number 1 **Note**: See disk size matrix below for size values

5	FAS> snap delete -A -a aggr0	Delete aggregate snapshots to allow reallocate access to all data blocks
6	FAS> reallocate on	Enable block reallocation **OPTIONAL**: Temporarily affects performance and may significantly increase snapshot consumption, but recommended when adding 3 or more disks
7	FAS> reallocate start -f vol01 ...	Run reallocate -f on all volumes in the aggregate to redistribute them across the new drives **Note**: Avoid using reallocate on volumes with deduplication enabled

1.1.2.2 Disk right-size and max disk per aggregate matrix

Use these values when creating an aggregate and when adding disks using *n@size* The max size numbers include the parity and diagonal-parity drives. Optimal RAID group sizes indicate what value to use for the raidsize option to use the least amount of parity drives, have the most data disks, and not harm performance by creating short raid groups (# of raid groups@raidsize value).

Manufacturer size	Right-sized value	Max drives 7.2	Optimal 7.2 RAID size	Max drives 7.3	Optimal 7.3 RAID size
72 GB FC	68 GB	241	15@16 disks	282	15@19 disks
144 GB FC/SAS	136 GB	120	8@15 disks	141	8@18 disks
300 GB FC/SAS	272 GB	59	4@15 disks	69	4@18 disks
450 GB FC/SAS	408 GB	39	2@19 disks	46	3@15 disks
600GB FC/SAS	560 GB	Unsupported	Unsupported	33	2@17 disks
250 GB SATA	212 GB	76	6@13 disks	86	7@13 disks
300 & 320 GB	274 GB	61	4@16 disks	71	5@15 disks
500 GB SATA	423 GB	39	3@13 disks	45	3@15 disks
750 GB SATA	635 GB	26	2@13 disks	30	2@15 disks
1 TB SATA	847 GB	15	1@15 disks	23	2@12 disks
2 TB SATA (8.0)	1,695 GB	Unsupported	Unsupported	11	1@11 disks

1.1.2.3 Key aggregate OPTIONS

Option	Default	Description
fas> aggr options raidsize**	16 (FC/SAS) 14 (SATA)	Maximum number of disks in each RAID group
fas> aggr options raidtype	raid_dp	Set RAID parity type to **raid4**, **raid_dp** or **raid0**
fas> aggr options nosnap	Off	When on, disables aggregate snapshots

options raid.disktype.enable	Off	Enforces separations of disks by disk type
options raid.rpm.ata.enable	On	Enforce separation of ATA drives by rotational speed (5400 and 7200 RPM)
options raid.rpm.fcal.enable	On	Enforces separation of FC drives by rotational speed (10k and 15k RPM)

1.1.3 Modifying RAID groups

Command/Action	Description
FAS> aggr options *aggr_name* raidtype [raid_dp | raid4]	switch RAID type in an aggregate or traditional volume to RAID-DP or RAID 4
FAS> aggr options *aggr_name* raidsize *value***	Change the number of disks that compose a raid group in an aggregate or traditional volume. **Note**: Only affects last RAID group created (if not fully populated) and new RAID groups
FAS> disk replace start *old_disk new_spare*	Uses Rapid RAID Recovery to copy data from a disk to a new spare. Useful when replacing a mismatched size disk.

1.1.4 Create Flexible Volumes (FlexVols)

Step	Command/Action	Description
1	FAS> df -A aggr05 OR FAS> aggr show_space -g aggr05	Displays available free space in aggr05
2	FAS> vol create vol01 aggr05 7g	Create a flexible volume called "vol01" on aggregate "aggr05" of size 7GB.
3	FAS> vol options vol01 create_ucode on	Turn on Unicode for CIFS and SAN
4	FAS> vol options vol01 convert_ucode on	Turn on conversion to Unicode for any files copies into the volume
5	FAS> qtree security vol01 unix	The security style is inherited from the root volume. Change it if the new volume will use a different security style

1.1.4.1 Root volume minimum size recommendations

The *Data ONTAP System Administration Guide* recommends setting the root volume to 5x the amount of system memory. In practice, 2x is often enough or 20GB, whichever is larger. You must increase the size of the root volume for ONTAP 8. Therefore on ONTAP 7.3.x systems we recommend using the 8.0 settings on systems capable of running ONTAP 8 7-Mode.

Platform	7.x size	8.0 size
FAS3020	12 GB	Not Supported
FAS3050	16 GB	Not Supported
FAS3040	16 GB	160 GB
FAS3070	23 GB	230 GB
FAS2020	10 GB	Not Supported
FAS2040	16 GB	160 GB
FAS2050	12 GB	Not Supported
FAS3140	20 GB	160 GB
FAS3160	24 GB	230 GB
FAS3170	38 GB	250 GB
FAS3210	10 GB	100 GB
FAS3240	15 GB	150 GB
FAS3270	30 GB	300 GB
FAS6030/6040	37 GB	250 GB
FAS6070/6080	69 GB	250 GB

1.1.5 Manage Flexible Volumes (FlexVols)

1.1.5.1 General management commands

Command/Action	Description
FAS> vol options <vol_name> <option>	Change volume specific options
FAS> vol rename flex1 vol1	Rename volume flex1 to vol1 **NOTE**: Do NOT change names of SnapMirror or SnapVault volumes
FAS> vol container flex1	Displays which aggregate the volume is contained within
FAS> aggr status aggr05 -i	Lists all flexvols contained in aggr05
FAS> df -[k | m | g] <vol_name>	Display volume size and space usage in kilobytes, megabytes, or gigabytes.
FAS> df -x <vol_name>	Suppress the display of the .snapshot output. May be combined with other command flags
FAS> vol restrict <vol_name>	Make a flexvol read-only

1.1.5.2 Resize a FlexVol

Step	Command/Action	Description
1	FAS> vol container vol4	Determine which aggregate vol4 resides in.
2	FAS> df -A aggr07 OR FAS> aggr show_space -g aggr07	Check size and available space in the containing aggregate named “aggr07”
3	FAS> vol size vol4 150g	Set the size of flexvol vol4 to 150GB **Note**: size includes snapshot reserve space
	FAS> vol size vol4 [+ | -] 30g	Add or remove 30GB from flexvol vol4

Note: See chapter 5 of this guide for procedures to auto-manage volume growth.

1.1.5.3 Prioritize volume I/O with FlexShare

FlexShare is built into ONTAP for prioritizing system resources for volumes. If you assign a priority to one volume, you should assign a priority to all volumes. Any volumes without a priority are assigned to the default queue where they share the same resources. This may degrade their performance.

Step	Command/Action	Description
1	FAS1> priority on ***FAS2> priority on***	Enables FlexShare. Both nodes of an HA cluster must enable FlexShare even if only one uses it
2	FAS> priority set volume dbvol level=VeryHigh system=30	dbvol is given the highest priority and system operations (e.g, SnapMirror) are selected over user operations 30% of the time
3	FAS> priority set volume dbvol cache=keep	Instruct ONTAP to retain data in the buffer cache from dbvol as long as possible
4	FAS> priority set volume db_logs cache=reuse	Instruct ONTAP to quickly flush data in the buffer cache from db_logs
5	FAS> priority show volume user_vol03	Display the priority assigned to user_vol03
6	FAS> priority set volume testvol1 service=off	Temporarily disable priority on testvol1 and places it into the default queu
7	FAS> priority delete volume testvol1	Removes all priority settings on testvol1 and places it into the default queue

1.1.5.4 Key Volume command Options

Since new volumes inherit many of their settings from the root volume, plan accordingly by setting the options on the root volume most likely to be used on the system. The *Data ONTAP System Administration Guide* contains a chapter dedicated to the root volume.

Volume option	Default	Description
convert_ucode	off	Turns UNICODE character set on/off. Should be on for SnapMirror and SnapVault volumes
create_ucode	off	Force UNICODE character use on/off when files are created. Turn on for SnapMirror and SnapVault volumes
guarantee	volume	**Volume** setting preallocates disk space for entire volume. **File** only allocates space for space reserved files and LUNs in the volume. **None** means no disk space is guaranteed
minra	off	When on, turns speculative file read-ahead OFF and may reduce performance.
no_atime_update	off	When on, prevents update of access time in inode when a file is read, possibly increasing performance. Use with caution.
nosnap	off	When on, disables automatic snapshots of the volume
nosnapdir	off	When on, disables the .snapshot directory for NFS
root	N/A	Designates the volume as the root volume.

1.1.6 SnapLock volumes

SnapLock volumes are special volumes (WORM) which turn the files inside to read-only and cannot be edited or deleted until a user defined retention period has expired. Not all versions of Data ONTAP support SnapLock volumes.

Read the SnapLock documentation before creating or altering SnapLock volumes.

TR-3618 Understanding SnapLock Compliance Clock
TR-3738 SnapLock Record Retention Date Implementation Strategy
TR-3501 Configuring SnapLock with Symantec Enterprise Vault
TR-3752 Hardware Upgrade of WORM Data
KB 3011760: SnapLock FAQ (Internal only)

Step	Command/Action	Description
1	FAS> aggr create *aggr_name* -L <compliance | enterprise> -t raid_dp [other aggr create options]	**NOTE**: ALL volumes in this aggregate will be SnapLock volumes by default and inherit the aggregate's SnapLock attributes.
2	FAS> aggr status	Verify creation and SnapLock settings of new aggregate
3	FAS> date	Verify the date and time on the system is accurate

4	FAS> date -c initialize	Runs a wizard to initiate the ComplianceClock
5	FAS> date -c	View the ComplianceClock time
6	FAS> vol create lock_vol01 lock_aggr01 100g	Create a 100GB FlexVol named lock_vol01 inside the lock_aggr01 aggregate
7	FAS> vol options lock_vol01 snaplock_minimum_period 6m	Sets the minimum retention period that can be assigned to WORM files in lock_vol01 to 6 months
8	FAS> vol options lock_vol01 snaplock_maximum_period 10y	Sets the maximum retention period that can be assigned to WORM files in lock_vol01 to 10 years
9	FAS> vol options lock_vol01 snaplock_default_period 7y	Sets the default retention period for WORM files in lock_vol01 to 7 years

1.1.6.1 Associated Key OPTIONS

Option	Default	Description
snaplock.compliance.write_verify	Off	An immediate verification occurs after every write to provide an additional level of data integrity. NOTE: effects performance and may affect data throughput. Only valid with a Compliance license
snaplock.autocommit_period none | {count|h|d|m|y}	none	When set, files not changed during the delay period are turned into WORM files

1.1.7 Create Qtrees

Step	Command/Action	Description
1	FAS> qtree status flex1	Display lists of qtrees in the volume flex1
2	FAS> qtree create /vol/flex1/qt_alpha	Create a Qtree called "qt_alpha" on flexible volume flex1
3	FAS> qtree security /vol/flex1/qt_alpha [ntfs | unix]	Configure the security style for the Qtree to be NTFS or Unix

2 NAS Implementation

This section describes procedures to access data using NFS or CIFS. Data can also be accessed using HTTP or FTP protocols, but will not be covered in this guide. Refer to the *Data ONTAP File Access and Protocols Management Guide* for more information.

2.1 NFS exports

Step 1. On FAS controller: Create new NFS export:

Step	Command/Action	Description
1	FAS> license add <code>	Install license for NFS protocol
2	FAS> qtree security /vol/flex2 unix	Configure qtree security settings on volume to be exported. Only a concern on systems also licensed for CIFS
3	FAS> exportfs -i -o rw,root=adminhost /vol/flex2	Immediately create export.
4	FAS> exportfs -p /vol/flex1	Make export persistent by adding to /etc/exports file. **Note:** By default, all newly created volumes are added to /etc/exports - even on CIFS only systems
OR	Edit /etc/exports with a text editor FAS> exportfs -a	Activate all entries in edited /etc/exports file
5	FAS> exportfs -q /vol/flex1/qtree1	Displays the export options. This can be faster than using rdfile on systems with a long /etc/exports file
6	FAS> exportfs -u /vol/flex1/qtree1	Unexport /vol/flex1/qtree1 but leave its entry in the /etc/exports file
7	FAS> exportfs -z /vol/flex1/qtree3	Unexport /vol/flex1/qtree3 and disable the entry in /etc/exports

Note: The implementation of NFS in Data ONTAP performs reverse DNS lookups for all hosts trying to access NFS exports. Hosts without a reverse address in DNS will be denied access.

Step 2. On UNIX/Linux Server: Create new mount point and mount export:

Step	Command/Action	Description
1	# showmount -e FAS2	Verify available mounts on FAS2
2	# mkdir /mnt/FAS2/unix_vol	Create a mount point
3	# mount FAS2:/vol/flex2 /mnt/NA-2/unix_vol	Mount the Unix export from FAS2.
4	# cd /mnt/FAS2/unix_vol	Change to new mount point
5	# ls -al	Verify mount was successful
6	Add mount command and options to /etc/vfstab (Solaris) or /etc/fstab (HP-UX, Linux)	Make mount persistent

Note: If you change the name of the exported volume or qtree you must update the /etc/fstab or /etc/vfstab file on the host. Data Ontap will automatically modify the /etc/exports entry.

2.1.1 Support NFSv4 clients

There are numerous limitations in Data ONTAP's support for NFSv4 so refer to the documentation before implementing NFSv4.

Step	Command/Action	Description
1	FAS> options nfs.v4.enable on	Turn on NFSv4 support
2	FAS> options nfs.v4.acl.enable on	Enable NFSv4 Access Control Lists (ACL)
3	Set ACLs on a NFSv4 client using the 'setfacl' command	**Note**: Files and sub-directories inherit the ACLs set on the parent directory
4	View ACLs on a file or directory on a NFSv4 client using the 'getfacl' command	
5	FAS> options nfs.v4.read_delegation on	Turn on read open delegations
6	FAS> options nfs.v4.write_delegation on	Turn on write open delegations
7	FAS> options nfs.per_client_stats.enable on	Turn on client stats collection
8	FAS> nfsstat -h	Show per-clients stats information for all clients
9	FAS> options locking.grace_lease_seconds 70	Change the file lock grace period from the default of 45 seconds to 70 seconds

2.1.2 Associated Key NFS OPTIONS

Option	Default	Description
[7.3] interface.nfs.blocked	Null	A comma-separated list of network ports for which NFS is blocked
nfs.export. allow_provisional_access	On	Controls whether access is granted in the event of a name service outage. A security setting that continues to allow client access, but may give clients more access than desired.
nfs.export.auto-update	On	Determines whether /etc/exports is automatically updated when volumes are created or destroyed **NOTE**: Works even when NFS is not licensed
nfs.tcp.enable	Off	Transmit NFS requests over TCP rather than UDP
nfs.udp.xfersize	32768	Maximum packet transfer size for UDP requests
nfs.access	N/A	Restrict NFS access to specific hosts or networks

2.2 CIFS shares

Step 1. On storage controller: Create new CIFS share:

Step	Command/Action	Description
1	FAS> license add <code>	Install license for CIFS protocol
2	FAS> cifs setup	Run the CIFS setup wizard
3	FAS> cifs sessions	Verify CIFS has connected to CIFS domain or workgroup
4	FAS> date	Compare with the Active Directory servers. Configure time synchronization using the steps in section 4.2.1
5	FAS> qtree security /vol/flex_cifs ntfs	Configure qtree security settings. Only necessary on systems with NFS licensed
6	FAS> cifs shares -add cifs_share /vol/flex_cifs -comment 'New CIFS Share'	Create a CIFS share called "cifs_share"
7	FAS> cifs access cifs_share SysAdmins Full Control	Set access rights to provide the user or group named SysAdmins with full control rights to the share
8	FAS> cifs access -delete cifs_share Cust_svc	Removes access by the user or group named Cust_svc to the share
9	FAS> cifs shares -change Cust_svc -accessbasedenum	Enables Access Based Enumeration (ABE) on the share for added security
-	Apply folder and file security using Windows administration server (e.g, AD or Domain server)	CIFS share security settings on the FAS apply broadly to the entire share. Specific settings should be managed in Windows.

Step 2. On Windows Server:

Step	Command/Action	Description
1	* Log into Windows 2000 domain controller as Administrator * Start -> Programs -> Administrative Tools -> Active Directory Users and Computers. Click on "Action", select "New" then "User" * Create a new user to access the FAS.	Create a new user in the Domain if applicable
2	* Open Computer Management: Start -> Programs -> Administrative Tools -> Computer Management * Click on Action and select "Connect to another computer…". Enter the name of the storage appliance * System Tools -> Shared Folders -> Shares	View the available shares on the storage appliance

3	* At the Windows desktop, right click on My Network Places, select Map Network Drive * \\fbfiler2\cifs_share	Map the storage appliance's cifs_share folder to the server

Note: If you change the name of the shared volume or qtree the share will still be accessible because CIFS tracks an unique SSID rather than the pathname.

2.2.1 Associated Key CIFS Shares OPTIONS

Option	Default	Description
cifs.audit.enable	Off	CIFS audit events may be generated during file access and/or during logon and logoff. Requires additional options be set in order to function
cifs.client.dup-detection	Name	Determines how ONTAP detects and terminates CIFS sessions that did not close when a client rebooted
cifs.enable_share_browsing	On	When turned off, prevents users from seeing directories they do not have permission to access
cifs.gpo.enable	Off	When on, enables support for Active Directory Group Policy Objects
cifs.home_dir_namestyle	Null	Specifies how the name portion of the path to a user's home directory is determined
cifs.idle_timeout	1800	Time in seconds before an idle session (no files open) is terminated
cifs.ms_snapshot_mode	XP	Specifies the mode for Snapshot access from a Microsoft Shadow Copy client
cifs.netbios_aliases	Null	Deprecated in favor of /etc/cifs_nbalias.cfg
cifs.nfs_root_ignore_ACL	Off	When on, ACLs will not affect root access from NFS
cifs.oplocks.enable	On	Allows clients to use opportunistic locks to cache data for better performance
cifs.per_client_stats.enable	Off	When turned On, gathers statistics on a per-client basis. Can cause significant performance degradation
cifs.perm_check_use_gid	On	Affects how Windows clients access files with Unix security permissions
cifs.preserve_unix_security	off	When on, preserves Unix security permissions on files modified in Windows. Only works on Unix and mixed-mode qtrees. Makes Unix qtrees appear to be NTFS
cifs.save_case	On	When off, forces filenames to lower-case
cifs.search_domains	Null	Specifies a list of domains that trust each other to search for a mapped account
cifs.show_dotfiles	On	When off, all filenames with a period (.) as first character will be hidden
cifs.show_snapshot	Off	When on, makes the ~snapshot directory visible

cifs.signing.enable	Off	A security feature provided by CIFS to prevent 'man-in-the middle' attacks. Performance penalty when on.
cifs.smb2.enable	Off	Enables support for the SMB 2.0 protocol
cifs.smb2.client.enable	Off	Enables support for the FAS controller to communicate to Windows servers using SMB 2.0
cifs.snapshot_file_folding.enable	Off	When on, preserves disk space by sharing data blocks with active files and snapshots (unique to MS Office files). Small performance penalty when on
[7.3] interface.cifs.blocked	Null	A comma-seperated list of network interfaces for which CIFS is blocked

2.3 Using Quotas

This section describes the commands uses to manage qtree and volume quotas.

Step	Command/Action	Description
1	FAS> wrfile -a /etc/quotas <text>	Create/append to quota configuration file (See chapter 13 for sample /etc/quotas)
2	FAS> quota on /vol/vol2	Enables quotas if /etc/quotas exists or implement changes in /etc/quotas for vol2
3	FAS> quota off /vol/vol_db1	Disables quotas applied to /vol/vol_db1
4	FAS> quota resize	Implements updates made to /etc/quotas
5	FAS> quota off /vol/user_vol FAS> quota on /vol/user_vol	Reinitialize quotas after modifying a qtree or adding a new entry to /etc/quotas
6	FAS> quota report	prints the current file and space consumption for each user or group with a quota and for each qtree.

2.3.1 Guidelines for using quotas

a. Update the /etc/quotas file after renaming a qtree

b. Reinitialize quotas after changing the qtree security style. This process may take some time and quotas are not enforced until the process has completed.

c. When using quotas with MultiStore, the quotas for a volume are deactivated when the volume moves to another vfiler. Quotas are linked to a vfiler and not to a volume.

d. The syntax of a quota entry in the quotas file is *quota_target type*[@/vol/*dir*/*qtree_path*] *disk* [*files*] [*threshold*] [*soft_disk*] [*soft_files*]. Fields are separated by space characters or tabs.

Refer to the example /etc/quotas file in chapter 11

3 SAN Implementation

This section provides a summary of the procedures to enable access to a LUN on the storage appliance using either the Fibre Channel Protocol or iSCSI protocol. It is highly recommended to use SnapDrive rather than the CLI, Filerview, or OnCommand System Manager.

Refer to the *Data ONTAP Block Access Management Guide for iSCSI and FC* for more information.

3.1 Fiber Channel SAN

The following section describes how to access a LUN using the Fibre Channel Protocol.

3.1.1 Enable the Fibre Channel Protocol

Step 1. Enabling the Fibre Channel Protocol on a Storage Appliance

Step	Command/Action	Description
1	FAS> license add <license_key>	Add FCP License
2	FAS> fcp start	Start the FCP service
3	FAS> sysconfig -v	Locate Fibre Channel Target Host Adapter. Note FC Nodename and FC Portname for each.
4	FAS> fcp show cfmode	Display the Fibre Channel interface mode (partner, single_image, standby, mixed)

Step 2. Enabling the Fibre Channel Protocol on a Solaris Server

Step	Command/Action	Description
1	# /driver_directory/install	Install the Fibre Channel Card driver application
2	# reboot -- -r	Restart the Solaris server to enable the new hardware device
3	# /opt/NTAP/SANToolkit/bin/sanlun fcp show adapter -v	Show full details of the Fibre Channel card on the server
4	# /usr/sbin/lpfc/lputil	Light Pulse Common Utility to get information regarding Emulux host adapters.

Step 3. Enabling the Fibre Channel Protocol on a Windows Server

Step	Command/Action	Description
1	Locate the host adapter driver and install on the Windows server	Install the Host Adapter driver

2	Start -> Shutdown -> Restart	Restart the Windows Server
3	C:\WINNT\system32\lputilnt.exe	Run Light Pulse Common Utility to gather information regarding the host adapter

3.1.2 Configure FCP ports

Changes the settings of onboard adapter ports to serve as target or initiators.
NOTE: in most cases, expansion cards can not be disabled or configured

Step	Command/Action	Description
1	FAS> fcadmin config	lists all available FC ports and their current settings
2	FAS> storage disable adapter 0c OR FAS> fcadmin config -d 0c	disables adapter port 0c so it can be reconfigured.
3	FAS> fcadmin config -t [target] initiator] 0c	Changes the port to be a target or an initiator.
4	FAS> reboot	The system must be rebooted for the changes to take effect
5	FAS> storage enable adapter 0c	Turn the port back on

3.1.3 Create WWPN aliases [7.3]

Data ONTAP 7.3 introduces user created 32-character long aliases for World Wide Port Names which can be referenced by the fcp and igroup commands.

Command/Action	Description
FAS> fcp wwpn-alias set <alias> <wwpn>	Assign an alias to a WWPN
FAS> fcp wwpn-alias remove { -a <alias> | -w <wwwpn> }	Remove a given alias or all aliases from a specific WWPN
FAS> fcp wwpn-alias show	Displays all WWPN aliases

3.1.4 Change cfmode of an active-active cluster

Changing the cfmode requires downtime and can seriously impact access to LUNs, multipathing, zoning, and switch configuration and cabling. Use with caution.

Step	Command/Action	Description
1	FAS> fcp show cfmode	Displays current cfmode of cluster node
2	FAS> lun config_check -S	Identify and resolve LUN and igroup mapping conflicts
3	FAS> priv set advanced	Switch to advanced mode
4	FAS*> fcp stop	Turn off the FCP service
5	FAS> fcp set cfmode { single_image | partner | dual_fabric | standby | mixed }	Changes the cfmode. Return to step 2 to resolve any listed errors
6	FAS*> fcp start	Turn the FCP service on

7	FAS*> fcp nodename	Check the WWNNs of the cluster
8	FAS*> fcp config	List WWPNs if switch rezoning is necessary
9	FAS*> priv set admin	Return to administrative mode

3.1.5 Create a LUN

Step	Command/Action	Description
1	Create a LUN: * SnapDrive on client * lun setup * FilerView -> LUNs -> Wizard	Create a LUN on the storage appliance via a CLI script or through FilerView. **NOTE**: ALWAYS use SnapDrive to create and manage LUNs on clients with SnapDrive installed
2	Enter LUN details during setup process: * LUN Path: /vol/flex1/QTUser/UserLun * LUN Size: 2g * Space-reserved: Yes * Protocol: Solaris * Description: User LUNa * iGroup Name: UserIG * iGroup Type: FCP * OS: Solaris * Add Initiator to iGroup: WWNN of Solaris host adapter * Add LUN ID for iGroup Initiator	Enter the appropriate details for the LUN

Note: FAS> fcp show adapters
FAS> fcp show initiators

3.1.6 Access LUNs on a Solaris Host

Step	Command/Action	Description
1	# cd /opt/NTAPsanlun/bin or /opt/NTAP/SANToolkit/bin	Change to the directory of the NetApp HBA Attach Kit
2	# ./create_binding.pl -l root -n <FAS_ip>	Run the Perl script to locate the ports available on the FAS. **Note**: Do not reboot the server at the completion of the script.
3	# cat /kernel/drv/lpfc.conf | more	View the file to verify the bindings created.

4	# /usr/sbin/lpfc/lputil - Select "5. Persistent Bindings" - Select "1. Display Current Bindings"	View the persistent bindings
5	# vi /kernel/drv/sd.conf Entry e.g: name="sd" parent="lpfc" target="0" lun=1;	Update the sd.conf file with newly bound LUN target and LUN ID values.
6	# reboot -- -r	Reboot the Solaris server.
7	# sanlun lun show	Verify the new LUN can be viewed from the Solaris server. Locate and record the controller, target, disk and slice information of the LUN.
8	# devfsadm # sanlun lun show	If the devices are not located, re-scan for devices. Check again for the LUN.
9	# reboot -- -r	If required, reboot the Solaris server.
10	# format * Select the appropriate disk * Disk not labeled. Label it now? Y * format> partition * partition> modify * "1. All Free Hog" * Create the new partition? <CR> * Free Hog partition [6]? <CR> * Enter size of partition '0': 1c (1 Cylinder) * Enter size of partition '1': <CR> … * Enter size of partition '7': <CR> * Okay to make this the current partition table [yes]? <CR> * Enter table name: "multiprotocol" * Ready to label disk, continue? Y * partition> print * partition> quit * format> quit	Run the Solaris format command to create Solaris file system on the new LUN.
11	# sanlun lun show	Display a list of available LUNs. Locate and record the controller, target, disk and slice information of the LUN.
12	# newfs /dev/rdsk/c1t1d0s6	Construct a new file system on the new LUN.
13	# mkdir /mnt/slu2-luna	Create a mount directory for the LUN
14	# mount /dev/dsk/c1t1d0s6 /mnt/slu2-luna	Mount the new LUN

15	# cd /mnt/slu2-luna	Change to the mount point and verify

3.1.7 Multipathing Software for Solaris

If the Solaris client uses volume management software like VERITAS then the LUN must be placed under the control of VERITAS Volume Manager

Step	Command/Action	Description
1	# format	Label the LUN. **NOTE**: Will destroy any data on the LUN
2	# vxdctl enable	enable all LUN paths for VERITAS
3	# /etc/vx/bin/bxdisksteup -I c0t1d3	Initialize the LUN at device address c0t1d3
4	# vxdg init *diskgroup diskname*=c0t1d3	Add the LUN to an existing disk group
5	# vxassist -g *diskgroup* make *volname size*	Create a volume
6	# newfs /dev/vx/rdsk/*diskgroup/volname*	Create a filesystem on the new volume
7	# mount -F ufs /dev/vx/dsk/*diskgroup/volname /mountpoint*	Mount the new volume

3.1.8 Access LUNs on a Windows Host

Option 1: Use Computer Management to search for a pre-defined LUN.

Step	Command/Action	Description
1	Open Computer Management: Start -> Programs -> Administrative Tools -> Computer Management	Use the Computer Management console to view available LUNs
2	Storage -> Disk Management	View current local disks
3	Right click on Disk Management and select "Rescan Disks"	Rescan for any new disks. The FAS's LUN should appear automatically in the list of available drives.
4	Right click on the new disk and select Create Partition and format the new disk	Create a partition and format it.

Option 2: Use SnapDrive to create and attach to an FCP LUN.

Step	Command/Action	Description
1	Open Computer Management: Start -> Programs -> Administrative Tools -> Computer Management	Use the Computer Management console
2	Storage -> SnapDrive -> Disks	View the available disks via the SnapDrive manager

3	Right click on Disk and select "Create disk"	Create a new LUN via SnapDrive
4	Via the SnapDrive wizard, enter the details of the new LUN	Enter the details of the new LUN

3.1.9 Obtain HBA information

Step	Command/Action	Description
1	FAS> fcp nodename	Display the WWNN of a target HBA

2	FAS> fcp show initiator
	`Portname Group`
	`10:00:00:00:c9:39:4d:82 sunhost_1`
	`50:06:0b:00:00:11:35:62 hphost`
		display the port name and igroup name of initiator HBAs connected to target HBAs.

3	FAS> fcp show adapter FAS> fcp show initiator	Display the node name, port name, and link state of all target HBAs

3.1.10 Resolving "FCP Partner Path Misconfigured" messages

One of the most common errors with FCP configurations is the use of a non-optimal path to LUN, generally going through the partner controller rather than the hosting controller. KB article 3010111 contains detailed information on resolving this issue.
https://kb.netapp.com/support/index?page=content&id=3010111

3.2 iSCSI SAN

This section describes how to access a LUN on a storage appliance using the iSCSI Protocol.

3.2.1 Enable the iSCSI Protocol

Step	Command/Action	Description
1	FAS> license add <license_key>	Add iSCSI License
2	FAS> iscsi start	Start the iSCSI service
3	FAS> ifconfig -a	Determine the IP address that the appliance will be using for iSCSI
4	FAS> iscsi interface show	Display iSCSI network interface information for the appliance
5	FAS> iscsi initiator show	Display iSCSI initiator information for the appliance
6	**[7.3]** FAS> options iscsi.max_connections per session 24	Change maximum connections allowed per session from default of 32.

3.2.2 Install iSCSI Initiator and SnapDrive for Windows

This section provides instructions to install and use the SnapDrive snap-in for Microsoft Windows.

Step	Command/Action	Description
1	Download the "Microsoft iSCSI Initiator" driver and install on the Windows server	http://www.microsoft.com/downloads
2	Install the "NetApp SnapDrive for Microsoft Windows" application on the Windows server	http://now.netapp.com/NOW/cgi-bin/software?product=SnapDrive&platform=Windows
3	Start -> Programs -> Administrative Tools -> Computer Management	Load Computer Management
4	Computer Management (Local) -> Storage -> SnapDrive	Access SnapDrive

3.2.3 Connect Windows to a LUN with iSCSI

Step	Command/Action	Description
1	Start the "Microsoft iSCSI Initiator" application via the desktop shortcut.	MS iSCSI Initiator provides local server Initiator details and enables connections to remote Target adapters.
2	Target Portals panel: Click Add and enter: * Storage Appliance IP Address * Socket (3260) * Adapter (default) * Port (default)	Configure Storage Appliance IP address and port details.
3	Available Targets panel: Storage Appliance target adapter should be listed. Click "Log On" to connect to the Storage Appliance	Connect to the Storage Appliance
4	Persistent Target panel: Storage Appliance target adapter should now be visible in the persistent targets list.	Storage Appliance should now be a persistent connection
5	Active Targets panel: Storage Appliance target adapter should now be visible in the persistent targets list and "Connected" to.	Storage Appliance should now be an Active connection
6	FAS> iscsi show initiator	Windows host server initiator should now be available from the Storage Appliance

3.2.4 Create an iSCSI LUN using SnapDrive for Windows

Once the Windows server is connected to the FAS via iSCSI, use SnapDrive to create a new LUN.

Step	Command/Action	Description
1	FAS> qtree create /vol/vol1/LunQTree	Create a Qtree for the new Windows LUN

2	FAS> cifs shares -add LunQTree /vol/vol1/LunQTree	Create a CIFS share for the qtree
3	Using SnapDrive, right click on "Disks" and select "Create Disk". Enter the following details: * Virtual Disk UNC Path: /vol/vol1/LunQTree * Virtual Disk (LUN) Name: Xluna * Virtual Disk Type: Dedicated * Disk Space to Accommodate Snapshot (Space-reserved): Yes * Lun Size: 2g * Driver Letter: <any> * Select initiator for Windows Host	Create a LUN using SnapDrive
4	FAS> lun show -m	Verify the LUN wa created on the Storage Appliance
5	Use Windows Explorer to verify the disk is available. If not, log off and then back on to the server again.	Verify the drive is ready for use. Note: SnapDrive auto-formats the drive, no further management should be required.

3.3 Resize a LUN

Step	Command/Action	Description
1	FAS> df -k /vol/data	Check free space available in the volume containing the LUN
2	FAS> lun offline /vol/data/qtree1/lun2	Offline the LUN named lun2
3	FAS> lun resize /vol/data/qtree1/lun2 15g	Changes the size of the LUN to 15 GB
4	On the host, rescan or rediscover the LUN	

3.4 Clone a LUN

LUN clones are only intended to be used for a short time because they lock SnapShots which prevents them from being deleted. Additionally, when splitting a LUN clone from it's parent volume, the LUN consumes extra disk space.

Step	Command/Action	Description
1	FAS> lun show -v	Display list of current LUNs
2	FAS> snap create vol1 mysnap	Take a snapshot of the volume containing the LUN to be cloned
3	FAS> lun clone create /vol/vol1/LunQTree/Xluna.clone -b /vol/vol1/LunQTree/Xluna mysnap	Clone the existing LUN, entering the destination LUN name, source LUN name and most recent snapshot

4	FAS> lun clone split start /vol/vol1/LunQTree/Xluna.clone	Split the clone from the source Snapshot to make it permanent
5	FAS> lun create status /vol/vol1/LunQTree/Xluna.clone	Verify LUN cloning progress
6	FAS> snap delete vol1 mysnap	Delete source snapshot
7	Mount new LUN to host using commands in sections 3.1.6, 3.2.3, or 3.2.4	Connect the LUN to client systems
8	FAS> lun clone split start /vol/vol1/LunQtree/Xluna.clone FAS> lun clone split status *parent_lun_path*	Optional: Split the LUN from the backing Snapshot to delete the Snapshot. Check status of the splitting operation.

3.5 [7.3] FlexClone a LUN

Using FlexClone to clone a LUN is ideal for creating long-term LUNs because they are independent of SnapShots (no splitting needed) and only consume space for changes (like a FlexClone volume.)

Step	Command/Action	Description
1	FAS> license add <FlexClone code>	
2	FAS> clone start /vol/db_data/db_lun1 /vol/db_data/db_lun1_clone	Create a clone of the LUN named db_lun1. You must create the clone inside the source volume.
3	FAS> clone status <vol_name>	Reports status of running or failed clone operations
4	FAS> clone clear <vol_name> <ID>	Clears information about a failed clone operation
3	Mount the new LUN to a host using commands in sections 3.1.6, 3.2.3, or 3.2.4	Connect the LUN to client systems

3.6 Delete a LUN

Step	Command/Action	Description
1	FAS> lun show -m	Show lun mapping information
2	FAS> lun unmap /vol/vol1/lun1.lun	Unmap the LUN from any clients
3	FAS> lun destroy /vol/vol1/lun1.lun	Delete the LUN file from vol1

3.7 Access a LUN with NFS/CIFS protocols

NOTE: By default the LUN will be read-only. The LUN must be unmapped from FCP/iSCSI targets and taken offline to be writeable.

Step	Command/Action	Description
1	FAS> lun share /vol/data/lun2 [none|read|write|all]	Makes the LUN named lun2 accessible by NFS or CIFS and assigns the designated permissions.

4 Networking and Appliance Access

4.1 Configure Network Interfaces

Network interfaces are generally configured during initial setup in the setup wizard. Changes made on the command line **must** be added to /etc/rc or will not persist across system reboots.

Step	Command/Action	Description
1	FAS> ifconfig e3a netmask 255.255.252.0 192.168.17.58	Configure interface e3a with a netmask and IP address.
2	FAS> ifconfig e3a partner 192.168.17.59	Set the partner IP address for interface e3a to takeover during a cluster failover.
3	FAS> ifconfig e3a nfo	Turn on Negotiated Failover monitor to initiate cluster failover if e3a fails.
4	FAS> ifconfig e3a mtusize 9000	Enable jumbo frames on e3a by changing MTU size from 1500 to 9000.

4.2 Setting Time and Date

All network related services and protocols rely on accurate clock settings. Windows' Active Directory requires synchronization of +/- 5 minutes to provide authentications services.

Step	Command/Action	Description
1	FAS> date	Show current date and time
2	FAS> date 200905031847	Sets the date and time to 2009 May 3rd at 6:47 PM
	FAS> date 1753.26	Set the clock to 5:53 PM and 26 seconds
3	FAS> timezone	Show current time zone
4	FAS> timezone America/Los_Angeles	(/etc/zoneinfo holds available time zones)

4.2.1 Synchronize with a time server

Option	Default	Description
timed.enable	Off	Set to on to enable the timed daemon
timed.servers	Null	Add comma separated list of IP addresses or hostnames of NTP or rdate servers
timed.max_skew	30m	Set to 4m to ensure system never exceeds 5 minute synchronization requirements of Active Directory
timed.proto	rtc	Set to ntp for most time servers

4.3 Creating VLANS

This section describes the process of spanning an interface across multiple networks or sub-domains with a VLAN. Refer to the *Data ONTAP Network Management Guide* for more information.

NOTE: VLAN commands are NOT persistent across a reboot and **must** be added to the /etc/rc file to be permanently configured. See the example /etc/rc in chapter 11.

Step	Command/Action	Description
1	FAS> ifconfig -a	show configuration of all network interfaces
2	FAS> vlan create e4 10 20 30	Create three VLAN identifiers on interface e4
3	FAS> vlan add e4 40	Add fourth VLAN identifier to interface e4
4	FAS> ifconfig e4-10 172.25.66.11 netmask 255.255.255.0	Configure the VLAN interface e4-10 **NOTE**: Add to /etc/rc to make permanent
5	FAS> vlan delete e4 e4-40	Delete VLAN identifier e4-40 from interface e4
6	FAS> vlan delete e4	Delete all VLANs on interface e4

4.4 Managing Virtual Interfaces (VIF)

This section describes the process of trunking/bonding multiple network interfaces (link aggregation) into a virtual interface. **NOTE:** VIF commands are NOT persistent across a reboot and must be added to the /etc/rc file to be permanently configured. See the example /etc/rc in chapter 11.

4.4.1 Create a VIF

The commands in this section should be run from a console connection because they require downing network interfaces prior to aggregating them. Always verify VIF functionality by physically disconnecting network cables and observing how the VIF reacts.

Step	Command/Action	Description
1	Ensure the network port switches are configured to support trunking	On a Cisco Catalyst switch use `set port channel` commands
2	FAS> ifconfig <interfaces> down	Down the network interfaces to trunk
3	FAS> vif create {single | multi} <vif_name> <interface_list> e.g.: vif create multi MultiTrunk1 e0a e1a	Create a VIF from the listed interfaces. single - only one interface active multi – all interfaces are active
4	FAS> ifconfig MultiTrunk 172.25.66.10	Assign an IP address to the VIF
5	FAS> vif status	Verify VIF is functioning

6	FAS> vif favor e1a	Set the interface e1 to be the primary/active VIF interface
7	FAS> vif nofavor e1a	e1 became active when e0 failed. Now e0 is repaired and should be the primary.
8	FAS> vif stat <vif_name> <interval>	Display usage statistics of a VIF

4.4.2 Delete a VIF interface or VIF

Note: Remove or edit the VIF creation entries in /etc/rc to make these changes persistent

Step	Command/Action	Description
1	FAS> ifconfig Trunk1 down	Down the VIF named “Trunk1”
2	FAS> vif delete Trunk1 e4	remove interface e4 from the VIF “Trunk1”
3	FAS> vif destroy Trunk1	Delete the entire VIF

4.5 IP version 6 [7.3.1]

4.5.1 Associated Key OPTIONS

Option	Default	Description
ip.v6.enable	Off	Turn on to enable support for IPv6
ip.v6.ra_enable	off	Turn on to enable router-advertised address autoconfiguration.
cifs.ipv6.enable	Off	Turn on to pass CIFS traffic over IPv6
nfs.ipv6.enable	Off	Turn on to pass NFS traffic over IPv6

4.6 Baseboard Management Controller (BMC)

The FAS2000 series has a Baseboard Management Controller for remote management. Refer to the *Data ONTAP System Administration Guide* and KB 3101254 for more information

4.6.1 Configure the BMC

Step	Command/Action	Description
1	Obtain an IP address for the BMC and the gateway IP address.	
2	FAS> bmc setup	Run the setup wizard
3	FAS> bmc status	Verify functionality
4	FAS> bmc test autosupport	Send a test ASUP to verify network settings
5	FAS> bmc reboot	Reboot the BMC and perform a self-test

4.6.2 Using the BMC

Step	Command/Action	Description
1	SSH to the BMC IP address and log in as user "naroot"	The naroot user is a restricted account proving enhanced security
OR	Press Ctrl+G while in a console session	
2	bmc shell -> sensors show	Get current values of system sensors
3	bmc shell -> events [all | info | latest {N}]	Displays storage system events logged by the BMC
4	bmc shell -> system console	Access the system console CLI
5	bmc shell -> system core	Dump system core and reset the appliance
6	bmc shell -> system reset {primary | backup | current}	Reset the system using the specified firmware image
7	bmc shell -> system power { on | off | cycle }	Turn power on, off, or off and back on (performs a dirty shutdown)

4.6.3 Upgrade the BMC

Step	Command/Action	Description
1	Download the Data ONTAP software from the NOW website and place in the /etc/software folder on the root volume	
2	FAS> version -b	Display current firmware version info
3	FAS1> software update 7311_setup_e.exe -d -r	Extract the systems files but do not run the download or reboot commands
4	FAS1> priv set advanced FAS1> download -d FAS1> priv set	Copy the system firmware executable image to the CompactFlash card.
5	For standalone systems: FAS1> halt	Halt the system to get the system prompt
	For clustered systems: ***FAS2> cf takeover***	Takeover system from partner and press CTRL+C on FAS1 to get system prompt
6	LOADER> update_bmc	Install the new firmware
7	LOADER> bye	Reset the hardware and boot the system into Data ONTAP
	For clustered systems: LOADER> bye ***FAS2> cf giveback***	Reset the system then perform a giveback to boot FAS1 into Data ONTAP. Repeat steps 2 – 7 on FAS2
8	FAS1> bmc status	Check status of BMC
9	FAS1> version -b	Verify new firmware has been installed

4.7 Remote LAN Module (RLM)

The RLM is a management interface on the FAS3000, FAS3100 and FAS6000 series. The RLM is better than a console connection because it remains available when the storage controller has crashed or is powered off. RLM firmware version 3.0 and newer includes the Remote Support Agent (RSA) which provides more information to Technical Support which can reduce case resolution times. Refer to the *Data ONTAP System Administration Guide* and KB 3011169 for more information.

4.7.1 Configure the RLM

Step	Command/Action	Description
1	Obtain an IP address for the RLM, the gateway IP address, the mail server hostname and IP address.	
2	FAS> rlm setup	Run the setup wizard
3	FAS> rlm status	Verify proper functioning
4	FAS> rlm test autosupport	Send a test ASUP to verify network settings
5	FAS> rlm reboot	Reset RLM and force self-test

4.7.2 Configure the Remote Support Agent (RSA)

Step	Command/Action	Description
1	In a web browser, go to: https://remotesupportagent.netapp.com:443/	Verify Internet connectivity through the firewall to NetApp
2	For HTTP: FAS> options httpd.admin.enable on FAS> options httpd.autoindex.enable on	Setup communication between RSA and NetApp.
	For HTTPS: FAS> options httpd.admin.ssl.enable on FAS> options httpd.autoindex.enable on	
3	FAS> useradmin user add <username> -g Administrators	Create an account for RSA to use
4	% ssh naroot@<RLM IP address>	Use SSH to connect to the RLM
5	RLM fas1> rsa setup	Configure the RSA feature
6	RLM fas1> rsa show	View the configuration information
7	RLM fas1> rsa status	Show the status of the RSA feature

4.7.3 Use the RLM

Use RLM to perform remote management of a problematic or down storage appliance.

Step	Command/Action	Description
1	SSH to the RLM network port and log in as user "naroot"	The RLM port is active as long as the system is plugged into a power outlet
2	RLM FAS> rlm sensors -c	Get current values of environmental sensors
3	RLM FAS> system console	Access the system console CLI
4	RLM FAS> system core	Dump system core and reset the appliance
5	RLM FAS> system reset {primary | backup | current}	Reset the system using the specified firmware image
6	RLM FAS> system power { on | off | cycle }	Turn power on, off, or off and back on (performs a dirty shutdown)

4.7.4 Upgrade RLM firmware

Step	Command/Action	Description
1	Download RLM_FW.zip from the NOW website and place in the /etc/software folder on the root volume	
2	FAS> software install RLM_FW.zip	Extract the new firmware
3	FAS> rlm update	Install the new firmware and reboot the RLM when complete (~10 minutes)
4	FAS> rlm status	Verify new firmware has been installed

4.8 Service Processor (SP)

4.8.1 Configure the SP

The Service Processor allows you to access, monitor, and troubleshoot a storage system remotely. It is currently available on the FAS22xx, 32xx, and FAS62xx systems. It can also provide hardware-assisted takeover to reduce the time for a failure to trigger a cf failover. Refer to the *Data ONTAP System Administration Guide* and KB 3012997 for more information.

Step	Command/Action	Description
1	Obtain an IP address for the SP, the gateway IP address, the mail server hostname and IP address.	
2	FAS> sp setup	Run the setup wizard
3	FAS> sp status	Verify proper functioning

4	FAS> rlm test autosupport	Send a test ASUP to verify network settings
5	FAS> sp reboot	Reset SP and force self-test

4.8.2 Use the SP

Step	Command/Action	Description
1	SSH to the SP network port and log in as user “naroot”	The SP port is active as long as the system is plugged into a power outlet
	In a console session, press CTRL+G to enter the Service Processor. CTRL+D and Enter to exit	
2	SP fas1> events **{**all**|**info**|**newest ***number***|** oldest ***number***|**search ***keyword***}**	Display storage system events that are logged by the SP
3	SP fas1> system console	Access the system console CLI
4	SP fas1> system core	Dump system core and reset the storage system
5	SP fas1> system reset {primary | backup | current}	Reset the system using the specified firmware image
6	SP fas1> system power { on | off | cycle }	Turn power on, off, or off and back on (performs a dirty shutdown)

4.8.3 Upgrade SP firmware

Step	Command/Action	Description
1	Download the firmware from the NetApp Support website (select the image for installation from Data ONTAP prompt) and place it in the /etc/software folder on the root volume. Rename the file to SP_FW.zip	
2	FAS> software install SP_FW.zip	Extract the new firmware
3	FAS> sp update	Install the new firmware and reboot the SP when complete (~10 minutes)
4	FAS> sp status	Verify new firmware has been installed

4.9 Create Local User Accounts

Step	Command/Action	Description
1	FAS> useradmin user list	Display list of current user accounts
2	FAS> useradmin user add sc200 -g Administrators	Create a new user account named sc200
3	FAS> useradmin user delete ndmp	Remove the user account named “ndmp”
4	FAS> passwd	Change a local user account password

4.10 Key Network and FAS Security OPTIONS

Refer to *TR-3649 Best Practices for Secure Configuration Data ONTAP 7G* for more options.

Option	Default	Description
ip.match_any_ifaddr	on	A FAS accepts any packet addressed to it even if it came in on the wrong interface. Turn off for enhanced security against spoof attacks.
ip.ipsec.enable	off	Turn on/off Internet Security Protocol support. Affects performance
ip.ping_throtle.drop_level	150	Specifies the maximum number of ICMP echo or ping packets system will accept per second. Any further packets within one second are dropped to prevent ping flood denial of service attacks
telnet.enable	on	Enable/Disable the Telnet service
telnet.distinct.enable	on	When on, telnet and console sessions share the same user environment and can view each other's inputs/outputs
trusted.hosts	N/A	Specifies up to 5 clients that will be allowed telnet, rsh and administrative FilerView access

5 Space Management

5.1 Managing Volume Free Space

Refer to the *Data ONTAP System Management Guide* for more information.

5.1.1 Volume Space Management Settings

Step	Command/Action	Description
1	FAS> vol options vm_luns guarantee volume	'Volume' space guarantee is the default and ensures blocks are preallocated for the entire volume.
AND	FAS> vol options vm_luns fractional_reserve 65	FlexVols containing space-reserved LUNs and use the 'volume' guarantee can set the fractional reserve to less than 100%.
2	FAS> vol options oradb_vol guarantee file	'File' guarantee only preallocates blocks for space-reserved files (i.e., LUN and database files). May lead to out-of-space errors in the containing aggregate.
AND	FAS> file reservation /vol/db02/lun1.lun enable	Turn on space-reservation for the LUN
3	FAS> vol options log_vol guarantee none	'None' allocates blocks as data is written and may lead to out-of-space errors. This is also known as Thin Provisioning. Refer to *TR-3563* for more information:

Warning: When you take a FlexVol volume offline, it releases its allocation of free space in its containing aggregate. Other volumes can then use this space. On a nearly full aggregate, this may prevent the volume from coming back online since the aggregate can no longer honor the space guarantee.

5.1.2 FPolicy

FPolicy performs file screening which is like a firewall for files. FPolicy works with CIFS and NFS to restrict user-defined file types from being stored on the system. FPolicy can perform basic file blocking natively or work with third-party file screening software. Refer to the *Data ONTAP File Access and Protocols Management Guide* for more information.

Note: Antivirus scans bypass FPolicy and can open and scan files that have been blocked.

Note: FPolicy configuration information is maintained in the registry. Copying or recreating this information is extremely difficult. Therefore, it is highly recommended you keep updated documentation on the fpolicy settings applied to each volume.

Step	Command/Action	Description
1	FAS> license add <CIFS code> FAS> license add <NFS code>	FPolicy requires a CIFS license to operate, even in NFS environments
2	FAS> options fpolicy.enable on	Turn on the fpolicy engine

3	FAS> fpolicy create music_files screen	Create a policy named music_files and set it to a policy type of 'screen'
4	FAS> fpolicy	Display all policies and their status
5	FAS> fpolicy extensions include add music_files mp3,ogg,mid	Adds files with these filename extensions to the policy, restricting them from being stored or modified
6	FAS> fpolicy extensions exclude add music_files wav	Ignores .wav files during screening. **Warning**: Creating an exclude list causes all file types not excluded to be screened as if they were part of an include list
7	FAS> fpolicy extensions include remove music_files mid,???	Removes .mid files and the default ??? extension wildcard from the include list
8	FAS> fpolicy extensions include show music_files	Show the list of file extensions on the include list
9	FAS> fpolicy options music_files required on	Requires all files being accessed to be screened by the policy before access is granted. **Note**: If no third-party file screening server is available, screening reverts to native file blocking
10	FAS> fpolicy monitor set music_files -p cifs,nfs create,rename	Instructs the policy to activate when files are created or renamed. This example will prevent files from being copied and then renamed to avoid file screening
11	FAS> fpolicy enable music_files	Activates the policy to begin file screening
12	FAS> fpolicy volume include add music_files users_vol	Apply music_files policy only to users_vol volume rather than all volumes
13	FAS> fpolicy volume exclude add music_files rootvol	Do not screen the rootvol volume. **Warning**: Creating an exclude list causes all volumes not excluded to be screened as if they were part of an include list
14	FAS> fpolicy disable music_files FAS> fpolicy destroy music_files	Disable and delete the music_files policy

5.1.3 Reallocate

Reallocation is like a filesystem defrag – it optimizes the block layout of files, LUNs, and volumes to improve performance. You should define a reallocation scan when you first create the LUN, file, or volume. This ensures that the layout remains optimized as a result of regular reallocation scans. More info on reallocate and volume read_realloc is in the *Data ONTAP System Administration Guide* and *TR-3929 Reallocate Best Practices Guide.*

NOTE: Snapshots created before the reallocate hold onto unoptimized blocks and consume space. In most cases, NetApp recommends deleting snapshots before initializing the reallocate process

Warning: Do not use reallocate or volume read_realloc on deduplicated volumes.
Warning: Reallocate the SnapMirror source volume rather than the destination.

Step	Command/Action	Description
1	FAS> reallocate on	Turn on the reallocation process on the storage controller.
2	FAS> vol options oradb03 guarantee=volume	Set the space guarantee to 'volume' to ensure reallocate does no t create an overcommitment issue in the aggregate
3	FAS> snap list oradb3	Snapshots lock blocks in place so delete unneeded snapshots for better results
4	FAS> reallocate start /vol/oradb03	Enable reallocation on the oradb03 volume. now reallocate will run on the volume every day at midnight (see step 3)
	FAS> reallocate start -p /vol/oradb03	Run reallocate, but do not change logical layout so snapshots may be preserved. **Warning:** This will degrade performance when reading old, unoptimized snapshots (e.g,. SnapRestores and using cloned LUNs and volumes).
	FAS> reallocate start -A -o aggr03	Reallocate free space in aggr03. This will not move data blocks
5	FAS> reallocate schedule -s "0 23 * 6" /vol/db/lun1	Run reallocate on the LUN every Saturday at 11 PM.
6	FAS> reallocate status [pathname]	Display status of reallocation jobs for entire system or specified pathname.
7	FAS> reallocate stop /vol/exchdb/lun2.lun	Delete a reallocate job.

The read_realloc volume option is not part of the reallocation command but uses many of the same system processes to perform a similar function to defragment files read sequentially.

Note: Files in a volume are identified as defragmented only after they have been read into memory once and determined to be fragmented. Not all files will be reallocated and volumes with small files and mostly random reads may not see any benefit.

Step	Command/Action	Description
1	FAS> vol options testvol read_realloc on	Turn on file read reallocation . Use on volumes with few snapshots because it may duplicate blocks and consume space
2	FAS> vol options VM_vol05 read_realloc space_optimized	Turn on file read reallocation but save space by not reallocating files in snapshots. This will reduce read performance when reading files in a snapshot (during file restore or using FlexClone volumes)

5.1.4 Managing inodes

Inodes determine how many 'files' a volume can hold. The default inode points to a 32KB chunk of data blocks to handle a typical mix of large and small files. Volumes with many small files and volumes larger than 1TB can run out of inodes before they run out of free space.

Warning: Inodes consume disk space and some system memory. They can only be increased so make small changes. Aggregates can reference up to 2 billion inodes. For high file count environments refer to *TR-3537 High File Count Environment Best Practices.*

Step	Command/Action	Description
1	FAS> df -i users_vol	Display inode usage in the users_vol volume.
2	FAS> maxfiles users_vol	Display current maximum number of files as well as number of files present in the volume.
3	FAS> maxfiles users_vol <number>	Increase the number of inodes (increase by number divisible by 4).

5.1.5 Automatic Space Preservation (vol_autogrow, snap autodelete)

Data ONTAP can automatically make free space available when a FlexVol volume reaches 98% full by growing the volume and/or deleting snapshots. One or both options can be configured on a volume.

Note: These options are not recommended on volumes smaller than 100GB because the volume may fill up before the triggers execute.

Step	Command/Action	Description
1	FAS> vol options vol17 try_first volume_grow	When vol17 fills up ONTAP will try to grow the volume before deleting snapshots. This is the default.
	FAS> vol options vol17 try_first snap_delete	ONTAP will try to delete snapshots before growing the volume.
2	FAS> vol autosize vol17 on	Turn space preservation on using default settings. The volume will grow to 120% of original size in increments of 5% of the original volume size.
	FAS> vol size apps_vol FAS> vol autosize apps_vol -m 50g -i 500m on	Check size of volume then set maximum volume size to 50GB and grow by 500MB increments
3	FAS> vol autosize apps_vol	View the autogrow maximum size and increment settings
	[7.3] FAS> vol status -v apps_vol	View the autogrow maximum size and increment settings
4	FAS> snap autodelete vol17 show FAS> snap autodelete vol17 on	View current settings then enable snapshot autodelete

5	FAS> snap autodelete vol17 commitment [try | disrupt]	The default, **try** only permits snapshots not locked by data protection utilities (mirroring, NDMPcopy) AND data backing functionalities (volume and LUN clones) to be deleted. **disrupt** only permits snapshots not locked by data backing functionalities (volume and LUN clones) to be deleted.
6	FAS> snap autodelete vol17 trigger volume	The default, **volume** triggers snapshot delete when the volume reaches 98% full AND the snap reserve is full.
	FAS> snap autodelete vol17 trigger snap_reserve	**snap_reserve** triggers snapshot delete when the snap reserve reaches 98%.
7	FAS> snap autodelete vol17 target_free_space 10	Stop deleting snapshots when either volume or snap_reserve (determined by the 'trigger' setting) reaches 10%. Default setting is 20%.
8	FAS> snap autodelete vol17 delete order [newest_first | oldest_first]	The default is to delete oldest snapshots first.
8	FAS> snap autodelete vol17 defer_delete [scheduled | user_created]	By default, **user_created** (manual or script created snapshots - including SnapDrive, SnapMirror, and SnapVault) are deleted last. If set to **scheduled** then snapshots created by snap sched are deleted last.

5.2 Deduplication

Deduplication is a form of compression that looks for identical data blocks in a volume and deletes duplicates blocks by adding reference counters in the metadata of a few 'master' blocks. Read *TR-3505 NetApp Deduplication for FAS and V-Series Deployment and Implementation Guide* for more information.

Note: NDMP copies and backups, SnapVault and Qtree SnapMirror decompress or "rehydrate" the data which will consume space on the destination tape or disk system.

Warning: Each storage controller model has a volume size limit and limit on how much non-duplicate and deduplicated data those volumes can hold. Check the matrix in TR-3505 for your systems' limits. Data ONTAP 7.2 requires 1 - 6% free volume space to hold the deduplication metadata. Data ONTAP 7.3.x moves most of the metadata into the aggregate and requires 2% volume free space and 4% aggregate free space (if you have set aggregate snap reserve below 4%, you will want to increase it).

Step	Command/Action	Description
1	FAS> license add <code>	Add licenses for A_SIS and Nearstore to use deduplication.
2	FAS> sis on /vol/group_vol	Enable duplication on specified volume.

3	FAS> sis start -s /vol/group_vol	Start a scan of the volume and then run every day at midnight.
4	FAS> sis config /vol/group_vol	Display the schedules of SIS enabled volumes.
5	FAS> sis config -s /vol/group_vol wed, sat@03	Schedule deduplication scan every Wednesday and Saturday at 3 AM. **Note**: Stagger schedules because an HA cluster can only support 8 concurrent deduplication operations.
	FAS> sis config -s auto@35 /vol/vol01	No schedule. Run deduplication scans run when new or changed blocks changed since last scan exceed 35% of total deduplicated blocks. Without a number, the default for auto is 20%
6	FAS> sis status	Display status of all SIS enabled volumes.
7	FAS> df -s	Display space savings created by deduplication
8	FAS> sis stop /vol/temp_vol	Abort the currently active SIS operation.
9	FAS> options cifs.snapshot_file_folding.enable on	This option reduces the duplication of blocks from temp files (which are a copy-on-save process) in CIFS volumes. File folding compares blocks in the active file (temp file) with blocks in snapshot copies of the file and re-uses common blocks. There is a small trade-off between performance and space utilization. If the folding process begins to consume memory, it is suspended until later.

5.2.1 Maximum volume deduplication limits [7.3]

Model	max vol size WITHOUT dedupe (TB) 7.3	max deduped size (TB) 7.3	Deduped data size (TB) 7.3
FAS2020	16	1	17
FAS2040	16	3	19
FAS2050	16	2	18
3020	16	2	18
3040	16	4	20
3050	16	3	19
3070	16	16	32
3140	16	4	20
3160	16	16	32

3170	16	16	32
32x0	16	16	32
60x0	16	16	32
R200	16	4	20

5.2.2 Features not compatible with deduplication

- synchronous SnapMirror
- NDMP backup to tape
- read reallocation (realloc)
- DataFort encryption
- (not recommended) VM swap files, pagefiles, user and system temp directories

6 Data Replication, Migration and Recovery

This chapter introduces some of the data backup and recovery applications. Refer to the *Data ONTAP Data Protection Online Backup and Recovery Guide* for more information.

6.1 Network Data Management Protocol (NDMP) Copy

NDMP is an open standard allowing backup applications to control native backup and recovery function in NetApp and other NDMP servers. Refer to the Data ONTAP *Data Protection Online Backup and Recovery Guide* for more information.

6.1.1 Enable NDMP

Step	Command/Action	Description
1	FAS> ndmpd on OR FAS> options ndmpd.enable on	Enable NDMP on the system
2	FAS> options ndmpd.connectlog.enable on	Enables logging all NDMP connections to /etc/messages for security purposes
3	FAS> options ndmpd.access host=10.20.20.16	List the hosts that may access the FAS via NDMP
4	FAS> options ndmpd.authtype	Configure the authorisation method for NDMP access (Challenge and/or plaintext)

Note: Debugging NDMP connection: "ndmpd debug 50"

6.1.2 ndmpcopy

Copy volumes, qtrees or single files between multiples systems or within a single system.

Note: Even for internal copying, ndmpcopy requires an active network connection. Data is sent through the loopback adapter so use a fast network connection (i.e., a Gb/e switch rather than a 100Mb/e hub).

Step	Command/Action	Description
1	FAS1> ndmpcopy fas1:/vol/data/my_stuff fas2:/vol/users/	Copies the qtree my_stuff on FAS1 to the volume /vol/users on FAS2
2	FAS1> backup status	display all active instances of backup jobs

6.1.3 Associated Key OPTIONS

Option	Default	Description
ndmpd.ignore_ctime.enabled	off	When on, allows users to exclude files with their ctime changed from inclusion in incremental dumps.
ndmpd.preferred_interface <interface>	disabled	When enabled, restricts NDMP traffic to specific network interfaces

6.2 Volume Copy

Volume copy is a block-level copy of a volume, and optionally its snapshots, to another volume of equal or greater size. The destination volume may be on the same system or on a remote system.

Step	Command/Action	Description
1	***FAS2> vol restrict destination_vol***	Restrict the destination volume
2	***FAS2> options rsh.enable on***	Enable RSH on the destination FAS
3	Add an entry in /etc/hosts.equiv on both systems for the other system	Create a trusted relationship between the systems
4	FAS1> vol copy start [-S] *source_vol* fas2:*destination_vol*	Start copying the source volume (and it's SnapShots with -S) to the destination volume on a remote system
OR	FAS1> vol copy start [-S] *source_vol destination_vol*	Start copying the source volume (and it's SnapShots with -S) to the local destination volume
5	FAS1> vol copy status	Check on progress of vol copy operation
6	FAS1> options vol.copy.throttle [value]	**Optional**: Set the speed of the copy from 1 (10%) to 10 (100%) to reduce impact on network traffic
7	FAS1> vol copy abort [operation_number]	Cancel one or more volume copy operations
8	FAS1> vol options *destination_vol* online	Make the new volume useable

6.3 Snapshots

Step	Command/Action	Description
1	FAS> snap create vol1 mysnap	Create a snapshot of volume vol1
2	FAS> snap sched vol1 1 6 12@8,10,12.14,16,18	Shedule snapshots of vol1 to retain 1 weekly, 6 nightly and 12 hourly snapshots. Take the snapshots at 0800, 1000, 1200, 1400, 1600 and 1800
3	FAS> snap reserve vol1 12	set the snap reserve on vol1 to 12%
4	FAS> snap list vol1	List all snapshots for vol1
5	FAS> snap delta vol1 [snap1 snap2]	Show the amount of change between snapshots on vol1 (or between 2 snapshots)
6	FAS> snap reclaimable vol1 snap1 [snap2 …]	List amount of space freed if listed snapshot(s) were deleted

7	FAS> snap rename vol1 *old_name new_name*	Rename a snapshot in vol1
8	FAS> snap delete vol1 snap1	Delete snapshot snap1 in vol1
9	FAS> snap autodelete vol1	set/change settings to automatically delete snapshots when volume and snap reserve are nearly full

6.4 SnapRestore

Warning: All file changes and snapshots created after the snapshot used for the SnapRestore will be permanently lost

Step	Command/Action	Description
1	FAS> license add <code>	Install license code for SnapRestore
2	FAS> snap restore -t file /vol/vol1/etc/rc	SnapRestore specific file from snapshot
3	FAS> snap restore -t vol -s weekly.1 vol1	SnapRestore entire volume from a weekly Snapshot

Command syntax:

snap restore [-t file|vol] [-s snapshot_name] [-r restore_as_path] vol_name

6.5 Asynchronous SnapMirror

SnapMirror is a replication function for maintaining up-to-date copies of data in another volume or another storage controller which may be thousands of kilometres away. Refer to the Data ONTAP *Data Protection Online Backup and Recovery Guide* and *TR-3466 SnapMirror Async Best Practices* for more information:

6.5.1 Create an Asynchronous Volume SnapMirror Relationship

This section describes the procedure to set up asynchronous Volume SnapMirror replication.

Step	Command/Action	Description
1	FAS1> license add <snapmirror_code>	License snapmirror on the source and destination Storage Appliance (can be the same system for internal replication).
2	FAS1> df -k vol1 ***FAS2> df -k vol1***	Ensure destination volume is equal to or larger than source volume. FAS1 is the source and FAS2 is the destination.
3	FAS1> vol options vol1 convert_ucode on	Set the source volume to Unicode ON for source volumes that support CIFS clients
4	FAS1> vol status vol1	Verify volume status and unicode setting
5	***FAS2> vol create vol1***	Create a volume of the same size or larger on the destination system
6	***FAS2> vol restrict vol1***	Restrict the destination volume

7	***FAS2> vol status vol1***	Verify volume is now restricted
8	FAS1> options snapmirror.access host=fas2 ***FAS2> options snapmirror.access host=fas1***	Allow snapmirror access by each storage controller to the other.
9	***FAS2> wrfile -a /etc/snapmirror.conf*** fas1:vol1 fas2:vol1 - * * * * or fas1:vol1 fas2:vol1 – **0-55/5** * * * *(every 5 mins of every hour)*	Create a snapmirror schedule on the destination FAS defining when to synchronise (Min of Hr, Hr of Day, Day of Mth, Day of Wk) See section 11.6 for a sample snapmirror.conf file
9	FAS1> snapmirror on ***FAS2> snapmirror on***	Enable snapmirror on both the source and destination systems.
10	***FAS2> snapmirror initialize -S fas1:vol1 fas2:vol1***	Initialize transfer of files from source to destination system and create a baseline from which to mirror.
11	***FAS2> snapmirror status -l***	Verify status of transfer or of mirror

6.5.2 Convert a read-only SnapMirror Volume to read-write

Step	Command/Action	Description
1	FAS1> snapmirror status (if possible) ***FAS2> snapmirror status***	Verify the status of the snapmirrors
2	***FAS2> snapmirror quiesce fas1_vol1***	Finish writes to fas1_vol1
3	***FAS2> snapmirror break fas1_vol1***	Break volume fas1_vol1 from the snapmirror relationship

6.5.3 Resync a Broken Volume SnapMirror Relationship

Step	Command/Action	Description
1	***FAS2> rdfile /etc/snapmirror.conf***	Verify snapmirror schedule is still correct
2	FAS1> vol status vol1 ***FAS2> vol status fas1_vol1***	Verify both volumes are online and read-writeable.
3	FAS1> snapmirror on	Turn on SnapMirror for both systems
4	Ensure all applications and users activities to the volumes are halted	This is a recommendation to reduce the replication time and reduce changes
5	FAS1> snapmirror resync -S fas2:fas1_vol1 vol1	From the original source, perform a resync of the data from the original destination system
6	FAS1> snapmirror update -S fas2:fas1_vol1 vol1	Update any changes since the baseline snapshot of the resync

7a	FAS1> snapmirror break vol1	Break the current snapmirror relationship so it can be reversed and set to its original direction.
7b	FAS1> snapmirror quiesce fas1:/vol/vol1/mytree FAS1> snapmirror break fas1:/vol/vol1/mytree	For Qtrees, the snapmirror must be first quiesced and then broken.
8a	***FAS2> snapmirror resync -S fas1:vol1 fas1_vol1***	Perform a second resync, setting FAS1 as the source again.
8b	***FAS2> snapmirror resync -S*** fas1:/vol/vol1/mytree /vol/fas1_vol1/mymirror	Perform a second resync on a Qtree.

6.5.4 Create an Asynchronous Qtree SnapMirror

Step	Command/Action	Description
1	FAS> license add <snapmirror_code>	License snapmirror on the source and destination Storage Appliance.
2	FAS1> options snapmirror.access host=fas2 ***FAS2> options snapmirror.access host=fas1***	Allow snapmirror access by each storage controller to the other.
3	FAS1> snapmirror on ***FAS2> snapmirror on***	Enable snapmirror on both the source and destination systems
4	***FAS2> snapmirror initialize -S*** fas1:/volvol1/mydata fas2:/vol/backup_vol/mydata_copy	Initialize transfer of files from source to destination system and create a baseline from which to mirror.
5	***FAS2> snapmirror status -l***	Verify status of transfer or of mirror
6	***FAS2> wrfile /etc/snapmirror.conf*** fas1:/volvol1/mydata fas2:/vol/backup_vol/mydata_copy - 10 * * * <ctrl+c>	Create a snapmirror schedule on the destination system defining when to synchronize (Minute of Hour, Hour of Day, Day of Month, Day of Week)

6.5.5 Convert read-only Qtree SnapMirrror destination to writeable

Step	Command/Action	Description
1	***FAS2> snapmirror status***	Verify the status of the snapmirrors. SnapMirror must be on.
2	***FAS2> snapmirror quiesce /vol/vol0/mymirror***	Finishes any write activity and then disables further updates
3	***FAS2> snapmirror break fas2:/vol/vol0/mymirror***	Break the snapmirror relationship

6.5.6 Purging Asynchronous Mirrors

Step	Command/Action	Description
1	***FAS2> wrfile /etc/snapmirror.conf***	Remove redundant entries
2	***FAS2> snapmirror quiesce <dst_qtree>*** ***FAS2> snapmirror break <dst_vol_or_qtree>***	Quiesce any qtree snapmirrors and break SnapMirror relationships.
3	FAS1> snapmirror destinations	Display any snapmirror destinations
4	FAS1> snapmirror release <src_path> <dst_hostname>:<dst_path>	Release the source associated with snapmirror relationships.
5	FAS1> snap list <vol> FAS1> snap delete <vol> <snapshot>	List and delete any snapshots that are for redundant snapmirror relationships.
6	FAS> snapmirror off	Disable snapmirror on source and destination if appropriate.

6.6 SnapVault

SnapVault performs backup (versus replication like SnapMirror) of qtrees and directories from a primary storage system (source) to a secondary storage system (destination).

Step	Command/Action	Description
1	FAS1> license add <sv_primary_license>*** FAS2> license add <sv_secondary_license>***	License SnapVault on the primary and secondary systems.
2	FAS> ndmpd on	Enable the NDMP service.
3	FAS> options snapvault.enable on	Enable SnapVault.
4	FAS1> options snapvault.access host=fas2	Allow host access from the SnapVault Secondary (destination) system.
5	***FAS2> options snapvault.access host=fas1,fas3***	Allow host access from all the clients.
6	***FAS2> snapvault start -S fas1:/vol/vol1/qtree1 /vol/sv_vol/na1_qtree1***	Initialize the relationship between source qtree1 on FAS1 to a unique destination qtree in /vol/sv_vol
7	FAS1> snapvault snap sched vol1 sv_weekly 1@sat@19 FAS1> snapvault snap sched vol1 sv_nightly 6@mon-fri@19 FAS1> snapvault snap sched vol1 sv_hourly 14@mon-fri@7-18	Create a schedule of snapshots for SnapVault use on each client volume containing qtrees to backup. There are weekly, nightly and hourly snapshots. Specify number to retain, @what days to run, @what times to take snapshots

8	***FAS2> snapvault snap sched -x vol1 sv_weekly 1@sat@19*** ***FAS2> snapvault snap sched -x vol1 sv_nightly 6@mon-fri@19*** ***FAS2> snapvault snap sched -x vol1 sv_hourly 14@mon-fri@7-18***	Create a schedule of transfers from all clients containing qtrees in vol1. There are weekly, nightly and hourly snapshots. Specify number to retain, @what days to run, @what times to take snapshots
9	FAS> snapvault status [-l] [-s]	Check on the status of SnapVault transfers

6.6.1 Perform a SnapVault restore

Step	Command/Action	Description
1	FAS1> snapvault restore -S ***fas2:/vol/sv_vol/fas1_qtree1 /vol/vol1/qtree1***	Restores the data in qtree1 from FAS2 using the most recent common snapshot.
2	FAS1> snapvault release fas2:/vol/sv_vol/fas1_qtree1 /vol/vol1/qtree1 ***FAS2> snapvault release /vol/sv_vol/fas1_qtree1 fas1:/vol/vol1/qtree1***	Removes the reverse relationship created during the restore process.
3	***FAS2> snapvault start -r -S fas1:/vol/vol1/qtree1 /vol/sv_vol/fas1_qtree1***	Restart the snapvault backup relationship with qtree1 on FAS1

6.6.2 Turn SnapVault destination into SnapMirror destination.

Convert a SnapVault destination qtree into a SnapMirror qtree so clients may access it or for disaster recovery purposes.

Step	Command/Action	Description
1	***FAS2> snapmirror off***	Halt all SnapMirror operations on the secondary FAS
2	***FAS2> options snapvault.enable off***	Halt all SnapVault operations
3	***FAS2> priv set diag***	**Warning**: This enables an advanced set of commands. Consult Tech Support before using them.
4	***FAS2*> snapmirror convert /vol/sv_vol/fas1_qtree1***	Converts the SnapVault qtree into a SnapMirror qtree
5	***FAS2*> priv set***	Return to the standard command set
6	***FAS2> snapmirror on***	Enable SnapMirror
7	***FAS2> snapmirror quiesce /vol/sv_vol/fas1_qtree1***	Ensure there are no SnapMirror operations on /vol/sv_vol/fas1_qtree1
8	***FAS2> snapmirror break /vol/sv_vol/fas1_qtree1***	Make the qtree writeable

6.6.3 Release a SnapVault relationship

Step	Command/Action	Description
1	***FAS2> snapvault unsched sv_vol sv_hourly*** ***FAS2> snapvault unsched sv_vol sv_nightly*** ***FAS2> snapvault unsched sv_vol sv_weekly***	Remove all snapshot schedules for the volume sv_vol on the destination FAS
2	***FAS2> snapvault stop fas2:/vol/sv_vol/q1***	Stop the existing relationship
3	***FAS2> snapvault status***	Verify the relationship no longer exists
4	***FAS2> qtree status sv_vol***	Verify qtree q1 no longer exists
5	FAS1> snapvault unsched vol1 sv_hourly FAS1> snapvault unsched vol1 sv_nightly FAS1> snapvault unsched vol1 sv_weekly	Remove all snapshot schedules for the volume vol1 on the source FAS
6	FAS1> snapvault destinations	List the existing relationships
7	FAS1> snapvault release /vol/vol1/q1 fas2:/vol/sv_vol/q1	Release the relationship between /vol/vol1/q1 and the qtree on FAS2
8	FAS1> snapvault status	Verify the relationship no longer exists

6.7 Associated Key SnapMirror/Vault OPTIONS

Option	Default	Description
[7.3] replication.logical.reserved_transfers	0	Guarantees the specified number of qtree SnapMirrors or SnapVault source/destination transfers can always be run
replication.throttle.enable	off	Enables global network throttling of SnapMirror and SnapVault transfers
replication.throttle.incoming.max_kbs	unlimited	Specifies maximum bandwidth for all incoming (destination FAS) snapmirror/vault transfers. Requires `replication.throttle.enable on`
replication.throttle.outgoing.max_kbs	unlimited	Specifies maximum bandwidth for all outgoing (source FAS) snapmirror/vault transfers. Requires `replication.throttle.enable on`
[7.3] replication.volume.reserved_transfers	0	Guarantees specified number of volume SnapMirror source/destination transfers can always be run
snapmirror.checkip.enable	off	Enables IP address based verification of SnapMirror destination FASes by source FASes

6.8 FlexClone

This section describes how to create replicas of FlexVols using the licensed product FlexClone. A FlexClone volume saves space by using the blocks in a shared snapshot rather than duplicating the blocks. Only changes or additions to the data in the volume clone consume space.

6.8.1 Clone a flexible volume

Step	Command/Action	Description
1	FAS> license add <code>	Install license for FlexClone
2	FAS> snap list vol1	Display list of snapshots in vol1
3	FAS> vol clone create newvol -b vol1 nightly.1	Create a clone volume named newvol using the nightly.1 snapshot in vol1
4	FAS> vol status -v newvol	verify newvol was created
5	FAS> snap list vol1	Look for snapshots listed as `busy, vclone`. These are shared with flexclones of vol1 and should **not** be deleted or the clone will grow to full size
6	FAS> df -m newvol	Display space consumed by new and changed data in the flexclone volume.

6.8.2 Split a FlexClone volume from the parent volume

Step	Command/Action	Description
1	FAS> vol clone split estimate newvol	Determine amount of space required to split newvol from its parent flexvol.
2	FAS> df -A <aggr name>	Display space available in the aggregate containing the parent volume (vol1)
3	FAS> vol clone split start newvol	Begin splitting newvol from its parent volume (vol1)
4	FAS> vol clone split status newvol	Check the status of the splitting operation
5	FAS> vol clone split stop newvol	Halt split process. **NOTE**: All data copied to this point remains duplicated and snapshots of the FlexClone volume are deleted.
6	FAS> vol clone status -v newvol	Verify newvol has been split from its parent volume

6.8.3 FlexClone a file or LUN [7.3]

Rather than create a copy of a file or LUN, FlexClone can be used to make a space efficient clone and keep the clone inside the same FlexVol. Refer to the *Data ONTAP Storage Efficiency Management Guide* and *TR-3742 Using FlexClone to Clone Files and LUNs*

Step	Command/Action	Description
1	FAS> license add <code>	Install license for FlexClone
2	Obtain path of file or LUN from a CIFS or NFS client and translate to /vol/vol_name /filepath	Data ONTAP has no means to view files inside a volume, but must use the /vol/vol_name/filename syntax for cloning so the systems and storage admins must translate between the two
3	FAS> clone start /vol/raw_video/test_video.avi /vol/raw_video/test_video_clone.avi	Create a clone of the file 'test_video.avi' and call it 'test_video_clone.avi'
OR	FAS> clone start <src_path> [dest_path] <-r <src_fbn>:<dest_fbn>:<fbn_cnt> ...>	Clone a file inside a LUN by specifying the LBA addresses of the source and destination blocks
OR	FAS> clone start <src_path> <dest_path> -s <snapshot_name>	Clone a file in a snapshot
4	FAS> clone status <vol_name>	Check on the status of the clone operation
5	FAS> clone stop <vol-name> <ID>	Aborts a clone operation in progress
6	FAS> df -s raw_video	Display space savings obtained by making a file clone **Note**: Clones are treated as being full-sized for quota calculations even though physical space has not been consumed

7 Security

7.1 General Storage Controller Security

Secure Admin is included in ONTAP 7G and provides for secure network connections to a storage appliance for the CLI and FilerView. Refer to *TR-3649 Best Practices for Secure Configuration of Data ONTAP 7G* for additional security configuration settings.

7.1.1 Managing SSH

Configure SSH to provide secure connections to the CLI.

Step	Command/Action	Description
1	FAS> secureadmin setup ssh	Configures the SSH protocol
2	FAS> secureadmin enable {ssh1 | ssh2}	Turn on the SSH protocols
3	FAS> secureadmin disable {ssh1 | ssh2}	Turn off the SSH protocols

7.1.2 Managing SSL

Configure SSL to provide secure HTTP connections to FilerView.

Step	Command/Action	Description
1	FAS> secureadmin setup ssl	Configures the SSL protocol
2	FAS> secureadmin addcert ssl <directory_path>	**OPTIONAL**: Install a certificate-authority-signed certificate
3	FAS> secureadmin enable ssl	Turn on the SSL protocol
4	FAS> secureadmin disable ssl	Turn off the SSL protocol

7.1.3 Associated Key Security OPTIONS

Option	Default	Description
[7.3] interface.blocked.nfs	Off	Set to a comma-separated list of interfaces or VIFs to prevent use by NFS
[7.3] interface.blocked.iscsi	Off	Set to a comma-separated list of interfaces or VIFs to prevent use by iSCSI
[7.3] interface.blocked.ftp	Off	Set to a comma-separated list of interfaces or VIFs to prevent use by FTP
[7.3] interface.blocked.snapmirror	Off	Set to a comma-separated list of interfaces or VIFs to prevent use by SnapMirror

[7.3] interface.blocked.cifs	Off	Set to a comma-separated list of interfaces or VIFs to prevent use by CIFS
ip.fastpath.enable		Turn off to reduce ARP spoofing and session hijacking attacks
rsh.enable	On	Turn off to disable RSH access
security.passwd.rootaccess.enable	On	Turn off to disable root user access to the storage system
ssh.pubkey_auth.enable	Off	Turn on to enable SSH public key authentication
telnet.enable	On	Turn off to disable Telnet access
trusted.hosts (ignored unless telnet.access is set to 'legacy')		Set to a dash ' – ' to disable all Telnet access, insert hostnames to restrict access, set to * to allow access to all hosts

7.2 CIFS Security

The majority of security features for CIFS require SMB2 which was first implemented in Windows Vista and Server 2008 and supported in Data ONTAP 7.3.

7.2.1 Restricting CIFS access

Data ONTAP supports features in addition to ACLs to further restrict access to CIFS data.

Note: Group Policy Objects can be applied to the entire system by placing the system in a dedicated OU in Active Directory rather than placing it in the default OU=Computers.

Command/Action	Description
FAS> cifs.enable_share_browsing off	Enable Access Based Enumeration (ABE) and prevent users from seeing shares, files, and folders they do not have access permissions to
FAS> cifs shares -change Legal -accessbasedenum	Enable ABE on the Legal CIFS share. users who do not have permission to access Legal or files inside it (whether through individual or group permission restrictions) are no longer visible in Windows Explorer
FAS> cifs shares -change IT_apps -nobrowse	Temporarily disable browsing of the IT_apps share

7.2.2 Monitoring CIFS Events

Step	Command/Action	Description
1	FAS> options cifs.per_client_stats.enable on	
2	FAS> cifs top	Uses client stats to display highest users
3	FAS> options cifs.per_client_stats.enable off	Client stats collection affects performance. This will turn it off and discard any existing per-client statistics
4	FAS> cifs audit start | stop	Turn on/off auditing of all events. Auditing uses system resources and may affect performance. Refer to the documentation for more information on auditing.

7.2.3 CIFS Network Security OPTIONS

Option	Default	Description
cifs.enable_share_browsing	On	Turn off to enable Access Based Enumeration (ABE)
cifs.idle_timout <time>	30	Specify how many minutes ONTAP will wait before disconnecting an idle CIFS session
cifs.restrict_anonymous.enable	0	See below
[7.3] cifs.restrict_anonymous [0|1|2] (replaces cifs.restrict_anonymous.enable)	0	Controls the access restrictions of non-authenticated sessions. Default is no access restrictions. Set to **1** disallows enumeration of users and shares. Set to **2** to fully restrict access.
cifs.signing.enable	Off	Turn on to enable SMB signing to prevent 'man-in-the-middle' intrusions by requiring each CIFS sessions use a security signatures. Imposes a performance penalty on the client and controller.
[7.3] cifs.smb2.client.enable	Off	Turn on support for clients using SMB2
[7.3] cifs.smb2.durable_handle.enable	On	Preserves open files when a client unexpectedly disconnects and later reconnects to a share
[7.3] cifs.smb2.durable_handle.timeout	16m	Delay to allow a client to reconnect before closing their open files
[7.3] cifs.smb2.enable	off	Turn on SMB2
[7.3] cifs.smb2.signing.required	off	Turn on SMB signing for the SMB2 protocol
[7.3] interface.blocked.cifs [port | VIF]	Null	Blocks CIFS traffic from using the comma-separated list of Ethernet ports and/or VIFs.

7.3 AntiVirus

Data ONTAP is a memory-resident OS not vulnerable to viruses or other malware. The data stored on the system is not protected by Data ONTAP so external antivirus servers must screen files for viruses.

Step	Command/Action	Description
1	Install and configure a Data ONTAP compliant virus scanner on a PC server(s)	Most major AV vendors have compliant versions of their software
2	FAS> vscan scanners	Scan the network for AV servers
3	FAS> vscan scanners secondary_scanners <IP addresses>	For multiple AV scanners, designate all but one as secondary scanners
4	FAS> vscan on	Enable virus scanning. By default, Data ONTAP sends every CIFS file a client accesses to the scanner(s) for scanning
5	FAS> cifs shares -change cifs.homedir -vscan	Turn on scanning of the home directories
6	FAS> cifs shares -change App_logs -novscan	Disable virus scanning of the App_logs CIFS share
7	FAS> vscan	Display status of vscanners, file extensions being scanned, and number of files scanned
8	FAS> vscan options timeout <value>	Change scanner timeout value from the default of 10 seconds to 1 – 45 seconds. The larger the timeout, the longer the delay until a user is given file access.
9	FAS> vscan options mandatory_scan off	The default is On which prevents file access if a scan can not be performed.
10	FAS> vscan options client_msgbox on	Turn on to notify users an infected file has been found. Otherwise, users are only told “file unavailable”
11	FAS> vscan options use_host_scanners on	Enable virus scanning on a vFiler
12	FAS> vscan scanners stop <IP address>	Stop virus scanning sessions for the specified scanner server
13	FAS> vscan reset	ONTAP caches information about previously scanned files to avoid rescanning those files. When you load a new virus-scanning signature file, reset the cache to rescan files that were scanned using an old signature file.

8 System and Disk Maintenance

8.1 System Maintenance

This section contains commands to manage the storage controller and diagnose problems. Refer to the *Data ONTAP System Administration Guide* for more information.

Command/Action	Description
FAS> sysconfig -c	Check system for configuration errors
FAS> config dump Install.cfg	Backup all configuration information to a backup file in /etc/configs
FAS> config diff 25Apr2009.cfg	Compare current system configuration with a backup configuration file to see differences
FAS> config restore 25Apr2009.cfg	Restores system settings to those saved in the backup configuration file
FAS> environment	display information about a FAS's health
FAS> memerr	print history of memory errors since boot
FAS> options	display or change configurable global system options
FAS> options autosupport.doit "<subject>"	manually generate an AutoSupport
FAS> logger <free text message>	Insert administrative/informational messages into the system log
FAS> source <filename>	read and execute a text file containing ONTAP commands

8.1.1 Associated Key OPTIONS

Option	Default	Description
autosupport.cifs.verbose	Off	When on, includes CIFS session and share information in AutoSupport messages
autosupport.doit "<subject>"	N/A	Triggers an immediate AutoSupport message
autosupport.support.transport	https	Whether to use https, http or smtp to communicate with an email server
autosupport.support.proxy	N/A	Allows defining IP address of proxy server when transport is set to HTTP or HTTPS

8.2 Special Boot Menu and Maintenance Mode

The Special Boot Menu (Maintenance Mode in particular) allows you to work on a system before Data ONTAP loads. This mode loads from the flash boot device and can be run even without attached disk shelves. During a reboot/power cycle, press Ctrl+C when prompted for the Special Boot Menu.

Menu Option	Description
1. Normal Boot	Boots into Data ONTAP
2. Boot without /etc/rc	Boots into Data ONTAP but bypasses /etc/rc so networking is not configured. Used to diagnose /etc/rc issues
3. Change password	Only way to change the root password if it is forgotten
4. Initialize all disks	Reformats the disks and creates a sparse traditional volume. Install Data ONTAP after completing the Setup wizard.
4a. Initialize all disks	On software-based ownership systems, reformats the drives and creates a spares FlexVol root volume. Install Data ONTAP after completing the Setup wizard to populate the root volume
5. Maintenance Mode	A special run environment with a subset of commands for diagnosing hardware problems and manipulating disks and aggregates. No networking configured.

8.3 Disk Shelf Maintenance

8.3.1 DS14 Shelves

Step	Command/Action	Description
1	FAS> sysconfig -a	Displays disks, shelf controllers, and shelves and their firmware levels
2	FAS> fcadmin device_map	Display all shelves and disks known to the system by FC port adapter address
3	FAS> shelfchk	Interactive command to visually verify communications between disk shelves and the FAS by turning LEDs on and off.
4	FAS> storage show disk -p	Shows all paths to every disk and disk shelf. With Multipath High-Availability (MPHA) cabling each disk should show an A and B path.
5	FAS> priv set advanced FAS*> storage download shelf FAS*> priv set	Manually start installation of new shelf controller firmware written to /etc/shelf_fw folder on the root volume.

6	FAS> storage show adapter FAS> storage disable adapter 7b	Display all the FC disk adapters in the system and then disable adapter 7b in preparation to replace a shelf controller module connected to the 7b interface.

8.3.2 [7.3]SAS Shelves (DS4243 & DS2246)

Step	Command/Action	Description
1	FAS> sasadmin expander_map	Verify all SAS shelves are visible to the system. Run on both nodes of a cluster.
2	FAS> sasdmin shelf <adapter ID>	Displays a list of all shelves and their shelf IDs (or lists shelves on a specific adapter)
3	FAS> sasadmin shelf	Displays a pictorial representation of the drive population of all SAS shelves.
4	FAS> priv set advanced FAS> sasadmin adapter_online <adapter name>	SAS ports should come online when a QSFP cable is plugged in. Use this command if it does not.
5	FAS> options acp.enabled on	Turn on Alternate Control Path (ACP) functionality
6	FAS> storage show acp	Verify the ACP cabling is correct

8.3.3 Associated Key Disk Shelf OPTIONS

Option	Default	Description
shelf.atfcx.auto.reset.enable	Auto	Enables automatic shelf power-cycling for AT-FCX shelves with the required power supply and shelf firmware version 37 or higher.
shelf.esh4.auto.reset.enable	Off	Enables automatic shelf power-cycling for ESH4 shelves with the required power supply and shelf firmware version.
acp.enabled	Off	Set to on to install ACP cables on SAS shelves.

8.4 Disk Maintenance

Step	Command/Action	Description
1	FAS> aggr status -f	Lists all failed disks
2	FAS> priv set advanced FAS*> disk led_on 0a.21 FAS*> disk led_off 8c.65 FAS*> priv set	Turn on the amber led on disk 0a.21 and turn off the amber LED on disk 8c.65. If led_on doesn't work, type led_off and then led_on.

3	FAS> disk maint 0a.25	Sends disk 0a.25 to Maintenance Center for analysis. **NOTE**: This forces a disk failure
4	FAS> disk fail 0a.27	Manually fail disk 0a.27 to a spare drive. This initiates Rapid RAID recovery and will take time to copy data to the spare.
5	FAS> disk replace 0a.25	Uses Rapid RAID Recovery to swap a spare drive with drive 0a.25
6	FAS> disk remove 0a.25	Spin down spare disk 0a.25 before removing from FAS
7	FAS> disk zero spares	Convert disks from a destroyed aggregate/tradvol into spares
8	Boot into Maintenance Mode : *> disktest -v	Runs about 5 minutes to diagnose loop and disk issues. A confidence factor less than 1 indicates problems. Any disk with hard disk errors should be failed manually

8.4.1 Drive zeroing time estimates

Capacity	Type	Speed	Estimate zeroing time (hours)
300 GB	FC	15k rpm	1.5
450 GB			2.2
600 GB			2.5
300 GB	SAS	15k rpm	1.5
450 GB			2.2
600 GB			2.5
450 GB	SAS	10k rpm	2.3
600 GB			2.6
500 GB	SATA	7.2k rpm	2.5
1TB			4.3
2TB			5.6

8.4.2 Update disk firmware and disk qualification file

Step	Command/Action	Description
1	Download the 'all.zip' file and extract the files into /etc/disk_fw folder in the root volume	http://support.netapp.com/NOW/cgi-bin/diskfwmustread.cgi/download/tools/diskfw/bin/all
2	FAS> disk_fw_update	Manually install disk firmware files placed in /etc/disk_fw
Note : New models of disk drives often require updating the disk qualification list in order to be properly recognized by Data ONTAP		
1	Download the qual_devices.zip (or .tar.gz) file and extract into the /etc folder on the root volume	http://support.netapp.com/NOW/download/tools/diskqual/

2	Wait 5 minutes for ONTAP to process the file	
3	Insert new drives or attach new shelf to system	(Assuming you knew beforehand there would be an issue with the new disks)

8.4.3 Associated Key OPTIONS

Option	Default	Description
raid.background_disk_fw_update.enable	On	When off, disk firmware updates will only occur at boot time or during disk insertion. Turning this on also allows system to come back up faster.
raid.reconstruct.perf_impact	medium	Determines performance impact of RAID reconstruction. Does NOT affect reconstructions in progress – only future reconstructs.
raid.rpm.ata.enable	Off	When on, ONTAP always selects ATA disks of same RPM (5400 or 7200) when creating new aggregates or adding disks to an existing aggregate
raid.rpm.fcal.enable	On	When off, allows mixing 10K and 15K RPM drives in an aggregate

8.5 Tape Device Maintenance

8.5.1 Managing Tape Devices

Step	Command/Action	Description
1	FAS> sysconfig -m	Show attached tape media changers
2	FAS> sysconfig -t	Show attached tape devices
3	FAS> storage show tape	Display information about attached tape devices
4	FAS> ndmpd sessions	Display open/active ndmp backup sessions
5	FAS> storage stats tape nrst01	Display statistics for nrst01 tape drive
6	FAS> mt -f nrst0a offline	Rewind and eject tape

8.5.2 Associated Key Tape OPTIONS

Option	Default	Description
tape.reservations	Off	Allow reserving specific tape devices to prevent conflicts with other systems trying to backup to the tape device using NDMP

9 Controller Failover Implementation

This section covers basic cluster setup and failover. See the *Data ONTAP Active/Active Configuration Guide* and *Data ONTAP System Administration Guide* for more details. Also refer to *TR-3450 HA Pair Configuration and Best Practices*

9.1 Enable controller failover functionality

Step	Command/Action	Description
1	FAS1> license add <cluster_code> ***FAS2> license add <cluster_code>***	Add cluster license to both cluster partners (“nodes”)
2	FAS1> reboot ***FAS2> reboot***	Reboot both partners
3	FAS1> cf enable	Enable clustering
4	FAS1> cf status Cluster enabled, fas2 is up.	Check status of cluster
5	FAS1> fcstat device_map ***FAS2> fcstat device_map***	Ensure both partners can access the other partner’s disks

9.1.1 Associated Key OPTIONS

Option	Default	Description
cf.giveback.auto.enable	On	Determine if a giveback is performed when a down node is repaired and reboots
cf.takeover.on_failure	On	When off, disables automatic takeover
cf.takeover.on_network_interface_failure	off	Enable takeover on failure of all monitored NICs (NICs must be set in ifconfig statements in /etc/rc file.)
cf.takeover.on_network_interface_failure.policy	all_nics	By default, all NICs must fail to initiate failover. When set to any_nics then one NIC failure results in failover.
[7.3] cf.hw_assist.enable	On	Uses the RLM to notify partner of hardware failures, reducing delay before initiation of takeover.
[7.3] cf.hw_assist.partner.address	Null	Define partner IP address to receive Hardware-Assisted Takeover messages
[7.3] cf.hw_assist.partner port	Null	Define partner NIC port to receive Hardware-Assisted Takeover

9.2 Setup network takeover interfaces

Step	Command/Action	Description
1	Gather network information on both nodes • IP address for local and partner node • Netmask for local and partner node	Example: **Local IP/Netmask**: 10.41.72.**103**/255.255.255.0 **Partner IP/Netmask:** 10.41.72.**104**/255.255.255.0
2	FAS1> ifconfig e0 10.41.72.103 partner 10.41.72.104 ***FAS2> ifconfig e0 10.41.72.104 partner 10.41.72.103*** or FAS1> ifconfig e0 partner 10.41.72.104 ***FAS2> ifconfig e0 partner 10.41.72.103***	Setup local and partner node interfaces for partner takeover
3	Modify /etc/rc ifconfig e0 `hostname`-e0 mediatype auto flowcontrol full netmask 255.255.255.0 **partner 10.41.72.104**	Make the changes in step 2 persistent across reboots
4	FAS1> ifconfig e0 e0: flags=948043<UP,BROADCAST,RUNNING,MULTICAST,TCPCKSUM> mtu 1500 inet 10.41.72.103 netmask 0xffffff00 broadcast 10.41.72.255 **partner inet 10.41.72.104 (not in use)** ether 00:0e:0c:2e:f8:54 (auto-1000t-fd-up) flowcontrol full	Check interfaces for partner configuration

9.3 Perform cf takeover/giveback

Controller failover functionality should be tested on a regular basis. One recommendation is to perform a cf takeover/giveback (or reboot for standalone systems) prior to any maintenance requiring downtime. This ensures the system is functioning properly by discovery pre-existing issues with the system.

Step	Command/Action	Description
1	FAS1> cf status	Verify cluster is normal status
2	FAS1> cf takeover	Local node takes over partner node
3	FAS1(takeover)> cf status fas1 has taken over fas2. Takeover due to negotiated failover, reason: operator initiated cf takeover	Verify FAS1 has taken over FAS2
4	FAS1(takeover)> partner	Switch to partner's CLI context

5	FAS2/FAS1> sysconfig -v *** This system has been taken over by fas1 NetApp Release 7.1: Fri Dec 23 02:32:04 PST 2005 System ID: 9950393031 (NA-2); partner ID: 9950393390 (FAS1) System Serial Number: 9990073 (FAS2); partner Serial Number: 9990079 (FAS1) System Rev: C2 No hardware device information is available.	Check to verify FAS1 has taken over partner.
6	FAS2/FAS1> ifconfig -a FAS2/FAS1> vif status	Verify FAS2's network interfaces and VIFs have been created and are online.
7	FAS2/FAS1> partner	Switch back to FAS1 CLI
8	FAS1(takeover)> cf giveback [lots of console messages] Cluster monitor: takeover of fas2 enabled	Partner node reboots and functions normally **Note:** It is sometimes necessary to run **cf giveback -f** to terminate certain services that will prevent a giveback.
9	Verify clients can access data using all licensed protocols	
10	FAS1> cf status Cluster enabled, fas2 is up.	Verify cluster is back to normal status

10 MultiStore (vfiler) Implementation

This section will introduce a simple MultiStore implementation of a vfiler. A vfiler is logical partitioning of the resources of a storage appliance. Each vfiler has its own security domain. Refer to the *Data ONTAP MultiStore Management Guide* for more information.

10.1 MultiStore (vfiler) Configuration

Step	Command/Action	Description
1	FAS> license add <multistore_code>	License MultiStore
2	FAS> ifconfig e0 0.0.0.0 ifconfig e0 down	interfaces used with vfilers must not be assigned an ip address and must be down
3	FAS> ipspace create vfiler1-ipspace	Create an IPspace
4	FAS> ipspace assign vfiler1-ipspace e0	Assign an interface to the IPSpace
5	FAS> vol create vol1	Create storage to assign to the Vfiler
6	FAS> vfiler create vfiler1 -s vfiler1-ipspace -i 10.41.72.113 /vol/vol1	Create a Vfiler **Note**: See vfiler limits below
8	*Add the ifconfig and default route commands to /etc/rc* ifconfig e0 10.41.72.113 up netmask 255.255.255.0 mediatype 100tx-fd vfiler run vfiler1 route add default 10.41.72.1	Add the ifconfig and vfiler commands to the hosting filer's /etc/rc (ie: /vol/vol0/etc/rc) to make them persistent

10.1.1 Changing system limits on vFilers

All systems are limited to the number of vfilers they can manage. The limits include vfiler0 in the count. HA pairs do not get twice as many vfilers so must share the maximum limitation.

System Memory	Default	Max allowed (standalone or HA pair)
Less than 1GB	3	11
1Gb - 2GB	5	26
2GB or more	11	65

Step	Command/Action	Description
1	FAS> sysconfig -v	Verify system memory size
2	FAS> vfiler limit	Display current limit setting
3	FAS> vfiler limit <number>	Increase/decrease limit to number specified (using maximums above)

10.2 MultiStore (vfiler) Administration

Step	Command/Action	Description
1	FAS> vfiler status [-a|-r] vfiler1 running	Check vfiler status [-a shows Allowed protocols]
2	FAS> ipspace list	Display IPspaces configured
3	FAS> vfiler disallow vfiler1 proto=nfs	Disallow nfs protocol on a per-vfiler basis
4	FAS> vfiler context vfiler1*****	Switch CLI to run all subsequent commands on the specified vfiler.
5	vfiler1> setup	Run setup on the vfiler
6	vfiler1> cifs setup	Setup CIFS on vfiler. Be sure to give the vfiler a unique default name in the domain being configured.
7	vfiler1> qtree create eng /vol/vol1/eng	Create a qtree in the volume. Only possible if the vfiler is assigned to a volume.
8	vfiler1> cifs shares -add eng /vol/vol1/eng	Create CIFS shares in the vfiler
9	Verify clients in the same IPspace can access the share within this vfiler	Verify everything worked

To return to the root filer, type **vfiler context vfiler0**. Additionally, you may type **vfiler run** before every command to run the command on the specified vfiler's context.

10.2.1 Stop/Destroy a vfiler

Step	Command/Action	Description
1	FAS> vfiler stop vfiler1	Stops vfiler from receiving incoming packets
2	FAS> ifconfig e0 down or FAS> ifconfig -alias <alias interface>	Down the interface associated with the vfiler's IPspace -alias if the interface is an alias
3	FAS> vfiler destroy vfiler1 [...] Resources for vfiler vfiler1 moved to hosting filer.	Disassociate resources from a vfiler. This will not destroy any of the user data. All resources return to vfiler0
4	FAS> vfiler status vfiler1	Check status of vfilers

11 Configuration Files

Filename	Purpose
cifs_homedir.cfg	configuration file for CIFS home directories
cifs_nbalias.cfg	configuration file for CIFS NetBIOS aliases
exports	a list of export entries for all file system paths that Data ONTAP exports automatically when NFS starts up.
ftpusers	lists users for whom ftp login privileges are disallowed.
group	stores Unix security group membership data base
hosts	Maps IP addresses to host names and aliases.
hosts.equiv	list of hosts and users with rsh permission
netgroup	network groups data base
networks	network name data base
nsswitch.conf	Specifies the order in which Data ONTAP searches local, NIS, DNS, and LDAP files.
passwd	Unix security username and password data base
quotas	quota description file
rc	system initialization command script
registery	registry database
resolv.conf	configuration file for domain name system (DNS) resolver
snapmirror.allow	list of allowed destination filers
snapmirror.conf	volume and qtree replication schedules and configurations
symlink.translations	Enables use of NFS absolute symlinks by mapping them to CIFS-based paths
syslog.conf	configuration file for syslogd logger daemon
usermap.cfg	mappings between UNIX and Windows NT accounts and users

11.1 sample /etc/quota

#Quota	Target type	disk	files	thold	sdisk	sfiles
*	user	50M	-	-	-	-
/vol/home/user/joe	user	500M	10K	450M	-	-
21	group	750M	75K	700M	700M	-
/vol/eng/proj	tree	750M	75K	700M	-	-
writers	group@/vol/eng	300M	50K	250M	45K	-
tonyp@netapp.com	user	-	-	-	-	-
netapp\sxia	user@/vol/vol2	200M	-	150M	-	-
rsaklikar	user@/vol/vol2	200M	-	150M	-	-
“big!raj@netapp.com”	user	100M	-	50M	-	-
S-1-5-32-544	user@/vol/vol2	200M	-	150M	-	-

Note: Important quota commands:

- FAS> quota resize <vol>
- FAS> quota off <vol> / quota on <vol>

11.2 sample /etc/rc

```
#Auto-generated by setup Mon Mar 14 08:18:30 GMT 2005
hostname FAS1
vif create multi MultiTrunk1 e0 e1
ifconfig MultiTrunk1 172.25.66.10 partner MultiTrunk2
vif favor e0
ifconfig e5a `hostname`-e5a mediatype auto flowcontrol full netmask 255.255.255.0 partner 10.41.72.101
vlan create e4 10 20 30
ifconfig e4-10 172.25.66.11 netmask 255.255.255.0
route add default 10.41.72.1 1
routed on
options dns.domainname corp.acme.com
options dns.enable on
options nis.enable off
savecore
```

11.3 sample /etc/hosts

```
127.0.0.1       localhost
10.41.72.100    FAS1    FAS1-e5a
10.41.72.3      mailhost
```

11.4 sample /etc/resolv.conf

```
#Auto-generated by setup Thu May 31 23:43:09 GMT 2007
nameserver 10.41.72.5
nameserver 172.25.66.5
```

11.5 sample /etc/exports

```
#Auto-generated by setup Mon Mar 14 08:18:30 GMT 2005
/vol/vol0               -sec=sys,ro,rw=fbsun1,root=fbsun1,nosuid
/vol/vol0/home          -sec=sys,rw,root=fbsun1,nosuid
/vol/perf               -sec=sys,rw,root=fbsun1,nosuid
/vol/perf/qtree         -sec=sys,rw=Adminhost:fbsun1
/vol/vol0/unix_tree     -sec=sys,rw=Adminhost:fbsun1,root=fbsun1
/vol/vol0/mktg          -sec=sys,ro
/vol/perf/subnet        -sec=sys,rw=10.41.72.0/24,root=10.41.72.0/24
/vol/perf/netgroup      -sec=sys,rw=trusted-hosts
/vol/cifsvol1           -sec=sys,rw,root=fbsun1,nosuid
/vol/flex1              -sec=sys,rw,root=fbsun1,nosuid
/vol/flex2              -sec=sys,rw,root=fbsun1,nosuid
```

11.6 sample /etc/snapmirror.conf

The snapmirror.conf file uses the same syntax as the Unix crontab file. Because SnapMirror is a pull technology, you should edit the snapmirror.conf file on the destination. The following examples show different ways to set up snapmirror schedules.

The following entry indicates that fridge's qtree **home**, in volume **vol2** will mirror qtree **home**, in volume **vol1** from toaster. Transfer speed is set at a maximum rate of 2,000 kilobytes per second. The four asterisks mean transfers to the mirror are initiated every minute, (assuming a previous transfer has completed. If not, a new transfer will be initiated the first minute after the current transfer has completed.)

```
toaster:/vol/vol1/home fridge:/vol/vol2/home kbs=2000 * * * *
```

This entry, between the **db** volumes on fridge-gig dev and icebox, is kicked off every five minutes, starting at 0. (Note fridge-gig is just a network interface name. In this case, a gigabit ethernet link on fridge.)

```
fridge-gig:db icebox:db - 0-55/5 * * *
```

The entry below makes transfers every half hour, with the first at 8:15 a.m., and the last at 6:45 p.m. The asterisks mean the replication schedule is not affected by the day of month or week; so occurs every day.

```
filer1:build filer2:backup - 15,45 8,9,10,11,12,13,14,15,16,17,18 * *
```

Data ONTAP 7.3 introduced compression which makes significant changes to the config file. Each relationship now requires a 'connection' definition line at the top of the file that defines the network path(s) to connect a source and destination together using the following syntax:

connection_name=mode (source_IP, destination_IP) (source_IP, dest_IP)

```
fas1_DR=multi(10.10.10.50,10.10.10.200) (192.168.1.52,192.168.1.202)
fas1_DR:user_vol fas2:user_vol_dr compression=enable 15,45 ***
```

In this example 10.10.10.50 is the 10Gb/E interface for FAS1 and .200 is the 10Gb/E interface on FAS2. In the second parentheses, 192.168.1.52 is a 1Gb VIF on FAS1 and .202 is the 1Gb VIF on FAS2. The 'multi' says to use the 10Gb/E interfaces first and if they fail to use the 1Gb VIF connections. The next line is the standard schedule but with the compression option included.

Note: SnapMirror compression will NOT work if you use hostnames instead of IP addresses (requires an /etc/hosts entry – which defeats the purpose of DNS). Old snapmirror.conf files may need to be changed to use IP addresses in order to work with compression.

```
# minute hour dayofmonth dayofweek(0-Sunday to 6-Sat)
####define snapmirror compression relationships
na01-na02=multi (192.168.1.107,192.168.1.112)
fas1=multi(10.10.10.50,10.10.10.200) (192.168.1.52,192.168.1.202)
###end
##Start snapmirror
fridge-gig:db icebox:db - 0-55/5 * * *
filer1:build filer2:backup - 15,45 8,9,10,11,12,13,14,15,16 * *
fas1_DR:user_vol fas2:user_vol_dr compression=enable 15,45 * * *
na01-na02:vmware013 na02:sm_vmware013 compression=enable - - - -
```

12 Troubleshooting Commands

12.1 General Troubleshooting

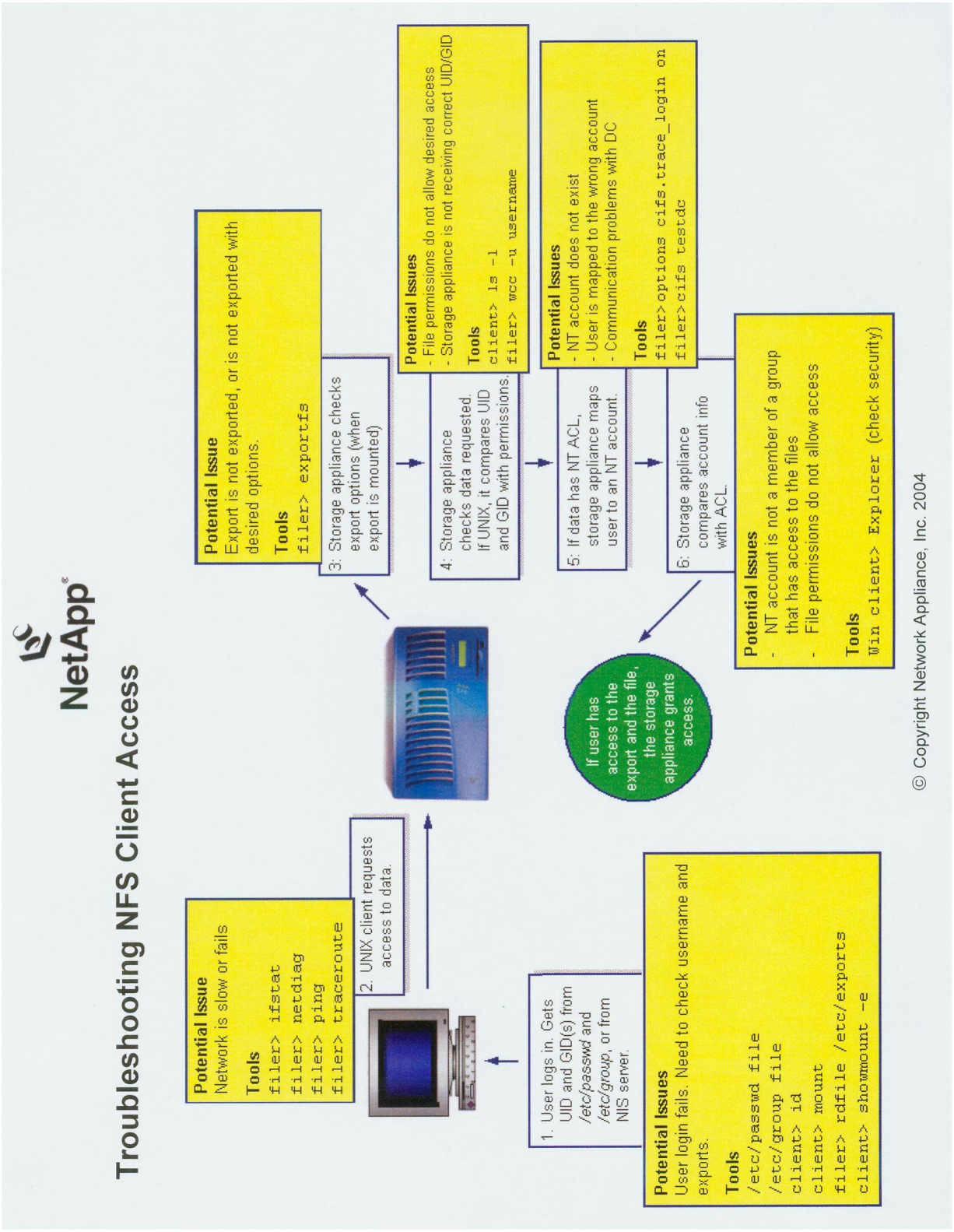
1. Define the problem.
2. Gather facts related to the problem.
3. Identify potential cause of problem.
4. Create an action plan.
5. Test the plan.
6. Implement the plan.
7. Observe results.
8. Document the solution.

Command	Description
FAS> sysstat -x 1	Display total system statistics every second
FAS> statit -b, statit -e	Storage Appliance statistics printout (a priv set advanced command)
FAS> stats	Collects statistical data
FAS> wafl_susp -w	Display WAFL Statistics
FAS> perfstat	Collects performance statistics (**Note**: May increase load on system)
FAS> sysconfig -v	System hardware configuration information
FAS> sysconfig -r	System raid group information
FAS> sysconfig -c	Checks config levels of hardware against DOT software requirement.
FAS> environment status	Display power and temperature conditions
FAS> memerr	print history of memory errors since boot
FAS> disk shm_stats	Display I/O statistics per disk
FAS> aggr status -f	List failed disks
FAS> aggr show_space <aggr name>	Display usage of space by volumes, snapshots and WAFL overhead
FAS> fcstat device_map	Display shelves and drives attached to FC ports

12.2 NFS Troubleshooting

The following section describes NFS specific troubleshooting commands.

Command	Description
FAS> options cifs.nfs_root_ignore_acl on	If this is off, NFS can mount NTFS volumes but not read or write to them (permissions error)
FAS> qtree security	Ensure the volume or qtree isn't using NTFS security
FAS> nfsstat	Display NFS statistics
FAS> exportfs	Display currently exported volumes or qtrees
FAS> rdfile /etc/exports	Display persistent volume or qtree exports
FAS> showmount -e <FAS_ip>	Run from Unix server to display a list of currently available exported volumes or qtrees


NetApp
Troubleshooting NFS Client Access
Potential Issue
Network is slow or fails
Tools
filer> ifstat
filer> netdiag
filer> ping
filer> traceroute
2. UNIX client requests access to data.
1. User logs in. Gets UID and GID(s) from /etc/passwd and /etc/group, or from NIS server.
Potential Issues
User login fails. Need to check username and exports.
Tools
/etc/passwd file
/etc/group file
client> id
client> mount
filer> rdfile /etc/exports
client> showmount -e
Potential Issue
Export is not exported, or is not exported with desired options.
Tools
filer> exportfs
3: Storage appliance checks export options (when export is mounted)
4: Storage appliance checks data requested. If UNIX, it compares UID and GID with permissions.
Potential Issues
- File permissions do not allow desired access
- Storage appliance is not receiving correct UID/GID
Tools
client> ls -l
filer> wcc -u username
5: If data has NT ACL, storage appliance maps user to an NT account.
Potential Issues
- NT account does not exist
- User is mapped to the wrong account
- Communication problems with DC
Tools
filer>options cifs.trace_login on
filer>cifs testdc
6: Storage appliance compares account info with ACL.
If user has access to the export and the file, the storage appliance grants access.
Potential Issues
- NT account is not a member of a group that has access to the files
- File permissions do not allow access
Tools
Win client> Explorer (check security)
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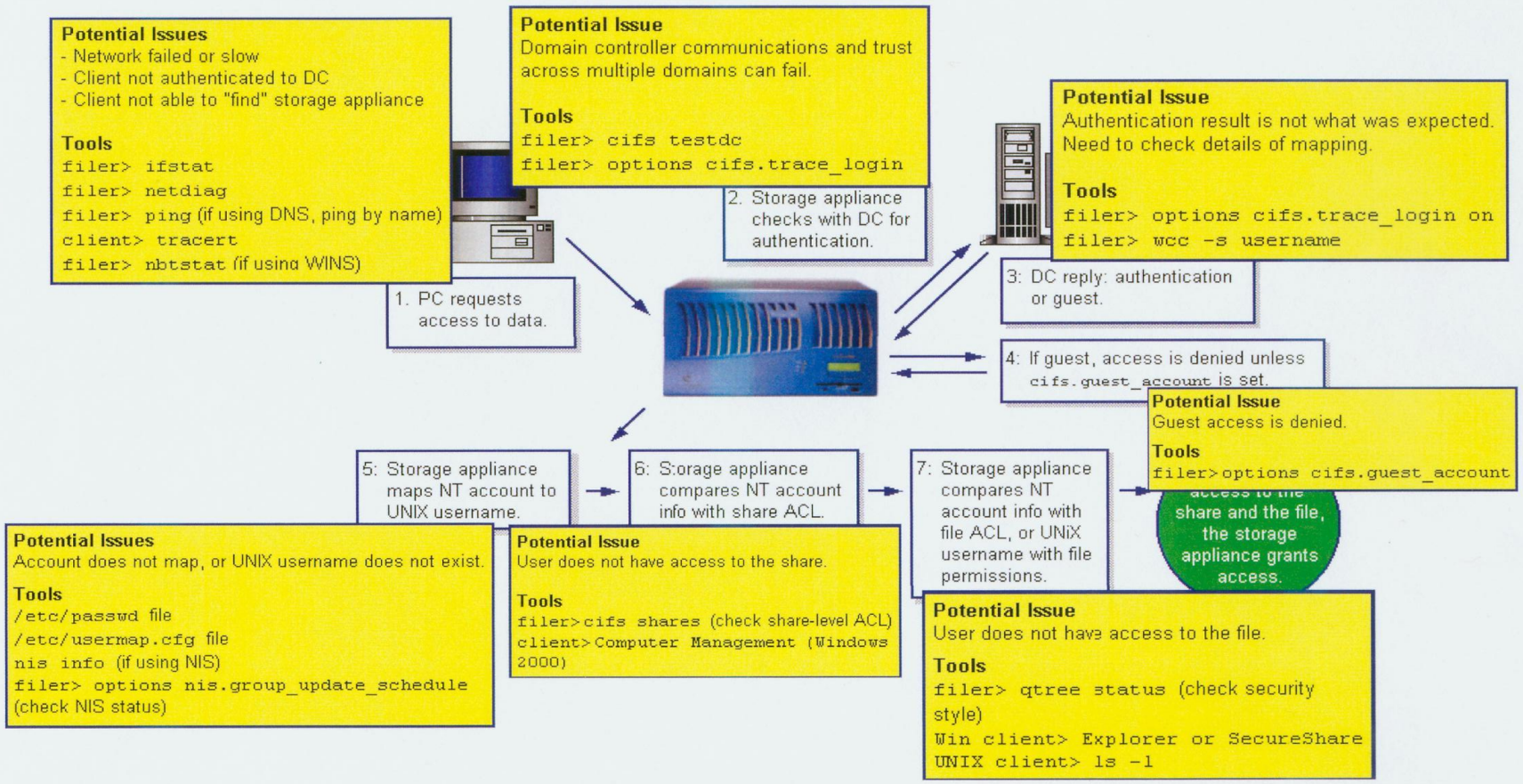
NetApp

Troubleshooting CIFS Client Access



12.3 CIFS Troubleshooting

Command	Description
FAS> cifs domaininfo	Display Domain Controller information
FAS> cifs stat	Display CIFS statistics
FAS> cifs stat -h <Domain_Controller_IP> OR FAS> cifs stat -f <Workstation_IP>	Review CIFS per client statistics
FAS> options cifs.per_client_stats.enable on	Enable per client CIFS statistics
FAS> wcc {**-u** *uname* | **-s** *ntname*}	Diagnose security checking for both UNIX-style (uname) and NT-style security (ntname)
FAS> options cifs.trace_login on	Monitor CIFS login attempts.
FAS> cifs testdc	Test domain controller communications
C:\Windows\Program Files\ssaccess.exe	SecureShare Access application for windows. Shows UNIX/NTFS ACLs

12.4 Network Troubleshooting

The following sections describes IP network issue troubleshooting commands

Command	Description
FAS> ifconfig -a	Display all ethernet interfaces, configuration and status
FAS> netstat -rn	Display Routing Table
FAS> routed status	Display route daemon status, default route info and routing protocols
FAS> netstat -s	Packet statistics per protocol
FAS> netstat -i	Packet statistics per Ethernet port
FAS> netstat -m	Network interface memory buffer utilisation
FAS> ping <hostname | IP >	Node accessibility check over IP network
FAS> netstat -p icmp	Determine if the ping throttling threshold has been exceeded
FAS> netdiag	Network Diagnostics command
FAS> ifinfo	Print interface driver information
FAS> ifstat	Print interface driver statistics
C:\net use	From Windows server - displays network connections
pktt	Gathers network traffic information
Wireshark	Analyze pktt output

12.5 NDMP Troubleshooting

Command	Description
FAS> ndmpd debug 50	Increase the debug level to view connection attempts and NDMP communications with the FAS
FAS> ndmpd status	View the status of connections
FAS> ndmpd probe	
FAS> ndmpd kill	
FAS> pktt	Packet tracing on the FAS

12.6 SAN Troubleshooting

12.6.1 FAS SAN Utilities

Command	Description
FAS> fcp nodename	If returns all zeros, then this adapter is not a target but an initiator
FAS> fcp show adapter	Display the WWPN for the HBA adapter on the FAS
FAS> fcp show initiator	Display FCP initiators connected to FAS
FAS> iscsi initiator show	Display ISCSI initiators connected to FAS
FAS> lun show -m	Display information about lun_path to initiator_group mappings
FAS> igroup show	Check for correct WWPN -> Initiator name mappings
FAS> iswt interface	Check appropriate interfaces are enabled for ISCSI (7.0 and below)
Data ONTAP 7.1+> iscsi interface	Check appropriate interfaces are enabled for ISCSI (7.1+)
FAS> iscsi security	Check and reconfigure initiator security settings

12.6.2 Solaris SAN Utilities

Command	Description
solaris# lputil	Configure/view/verify HBA bindings
solaris# sanlun fcp show adapters -v	Display information about host HBAs
solaris# sanlun lun show	Display LUNs that are mapped to host
solaris# reboot -- -r	Reboot reconfigure option. Used after changes to /kernel/drv files.
solaris# devfsadm	Discovery of new LUNs

solaris# solaris_info/filer_info/brocade_info	Utilities installed as part of the FCP attach kit. Used to collect all config info on the respective devices.
solaris# modinfo | grep lpfc	Check if lpfc driver is loaded

12.6.3 Windows SAN Utilities

Command	Description
SnapDriveDC	Gathers Windows and FAS information
C:\>lputilnt	Light Pulse Utility used to view Revision/Firmware, Persistent Bindings, configuration data (WWNN, WWPN), status of adapters
Control Panel->ISCSI	ISCSI Control Panel used to set/verify persistent bindings, login and logoff from targets

12.6.4 Finding and fixing LUN alignment issues

Refer to *TR-3747 Best Practices for File System Alignment in Virtual Environments* for the steps to fix misaligned LUNs.

Operating System	Tool	Description
Windows	diskpart.exe	Disk partition utility
Linux	fdisk	Disk partition utility
ESX	mbrscan	Identifies misalignment. Included in ESX Host Utilities Kit
ESX	mbralign	Fixed misalignment. Included in ESX Host Utilities Kit

12.6.5 Configuring Cisco EtherChannels

From the Catalyst 3750 Switch Software Configuration Guide:

This example shows how to configure an EtherChannel on a single switch in the stack. It assigns two ports as static-access ports in VLAN 10 to channel 5 with the PAgP mode **desirable**:

Switch# **configure terminal**
Switch(config)# **interface range gigabitethernet2/0/1 -2**
Switch(config-if-range)# **switchport mode access**
Switch(config-if-range)# **switchport access vlan 10**
Switch(config-if-range)# **channel-group 5 mode desirable non-silent**
Switch(config-if-range)# **end**

This example shows how to configure an EtherChannel on a single switch in the stack. It assigns two ports as static-access ports in VLAN 10 to channel 5 with the LACP mode **active**:

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet2/0/1 -2
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 10
Switch(config-if-range)# channel-group 5 mode active
Switch(config-if-range)# end
```

This example shows how to configure cross-stack EtherChannel. It assigns two ports on stack member 2 and one port on stack member 3 as static-access ports in VLAN 10 to channel 5 with the PAgP and LACP modes disabled (**on**):

```
Switch# configure terminal
Switch(config)# interface range gigabitethernet2/0/3 -4
Switch(config-if-range)# switchport mode access
Switch(config-if-range)# switchport access vlan 10
Switch(config-if-range)# channel-group 5 mode on
Switch(config-if-range)# exit
Switch(config)# interface gigabitethernet3/0/3
Switch(config-if)# switchport mode access
Switch(config-if)# switchport access vlan 10
Switch(config-if)# channel-group 5 mode on
Switch(config-if)# exit
```

12.6.6 Common Brocade SAN Switch Commands

Command	Description
Brocade> switchshow	Displays switch and port status information
Brocade> cfgshow	Displays all zone configuration information
Brocade> portperfshow	Displays port throughput numbers for all ports on the switch
Brocade> portdisable/portenable	Used to test storage controller port response
Brocade> portshow <port number>	Show port information

12.7 Test & Simulation Tools

Tool	Description
sio_ntap_win32	Simulated I/O tool for Windows
sio_ntap_sol	Simulated I/O tool for Unix
perfstat.sh	Performance Statistics
Ontap Simulator	A utility downloadable from the tool chest on the NOW website which can be run on a Linux system or in a Linux virtual machine. Fully functional except for hardware commands.

Credits

Name	Email	Date	Description
David Thiessen Australia PSE		Mar 2005	Original author
Eli Rodriguez RTP – TSE		May 2006	Added Clustering, MultiStore, SAN Troubleshooting Most information was taken from NHTT v2.1 training guides and Data ONTAP docs.
Michael Cope San Diego PSE/ Services SE	mcope@netapp.com	Jun 2006 – Present	Expanded to include all installation and implementation procedures. Upkeep with new versions of ONTAP