Managing Serviceguard NFS for Linux

invent

Manufacturing Part Number : T1442-90015

July 2007

Legal Notices

The information contained herein is subject to change without notice. The only warranties for HP products and services are set forth in the express warranty statements accompanying such products and services. Nothing herein should be construed as constituting an additional warranty. HP shall not be liable for technical or editorial errors or omissions contained herein.

Contents

1. Serviceguard NFS for LINUX Introduction

2. Installing and Configuring Serviceguard NFS for Linux

3. Sample Configurations

1 Serviceguard NFS for LINUX Introduction

This manual describes how to install and configure an Serviceguard NFS toolkit on a Linux system. Serviceguard NFS® is a toolkit that allows you to use Serviceguard to set up highly available NFS servers.

The information presented in this manual assumes you are familiar with Serviceguard and NFS operations. Refer to your Serviceguard and/or NFS documentation for additional information.

NOTE

You must set up a Serviceguard cluster before you can set up Highly Available NFS. For instructions on setting up an Serviceguard Linux cluster, see the *Managing Serviceguard for Linux* manual.

The NFS server programs must also be installed on your Linux system before you install, configure, and test your NFS package.

Overview of Serviceguard NFS

An NFS server is a host that “exports” its local directories (makes them available for client hosts to mount using NFS). On the NFS client, these mounted directories look to users like part of the client’s local file system.

Serviceguard allows you to create high availability clusters of HP Linux computers (nodes). A high availability computer system allows applications to continue in spite of a hardware or software failure. Serviceguard systems protect users from software failures as well as from failure of a system processing unit (SPU) or local area network (LAN) component. In the event that one component fails, the redundant component takes over, and Serviceguard coordinates the transfer between components.

Serviceguard NFS is a separate set of shell scripts, and a binary file. One shell script (NFS control script) is provided as a template for an NFS server package. Customize this script to meet your specific needs.

In the event of failure, the NFS server package containing the exported file systems moves to a different node in the Serviceguard cluster. After Serviceguard starts the NFS package on the adoptive node, the NFS file systems are re-exported from the adoptive node with minimum disruption of service to users. The client side “hangs” until the NFS server package comes up on the adoptive node. When the service returns, the user can continue access to the file. You do not need to restart the client.

Limitations of Serviceguard NFS

The following limitations apply to Serviceguard NFS:

- File locks are not maintained when an NFS server package moves to an adoptive node. Any applications that use file locking must reclaim their locks after an NFS server package fails over. An application that loses its file lock as a result of an NFS package failover will not be notified. If the server is also an NFS client, any file locks it holds will be lost.
- A system administrator may need to manually maintain or remove persistent file-lock states for the failed node. The previous file-lock states may remain available on the failed node.

NOTE

Starting with version A.02.00 of the NFS toolkit, you can eliminate the above limitations by enabling the File Lock Migration feature. (For details, see the “Overview of the NFS File Lock Migration Feature” section below).

Overview of the NFS File Lock Migration Feature

The following describes the File Lock Migration feature, which is part of the NFS toolkit starting with version A.02.00:

- Designate a unique holding directory as part of the NFS package located on a shared filesystem. In other words, an empty directory is created on a shared filesystem that moves between servers as part of the package. This holding directory is a user configurable parameter (`NFS_FLM_HOLDING_DIR` in `hanfs.conf`) and must be dedicated to hold the Status Monitor(SM) entries only.

- The script, `nfs.flm`, periodically copies the Status Monitor entries from the `/var/lib/nfs/sm` directory on SLES and `/var/lib/nfs/statd/sm` directory on RedHat into the package holding directory. The default for `nfs.flm` is to copy every five seconds. This value can be changed by modifying the `PROPAGATE_INTERVAL` parameter in `hanfs.conf`.

- Since the holding directory resides on a shared filesystem, on failover, it transitions from the primary node to the adoptive node defined by the NFS package. Once the holding directory is made available on the adoptive node, the SM entries residing in the holding directory are copied to the SM directory on the adoptive node (`/var/lib/nfs/sm` on SLES and `/var/lib/nfs/statd/sm` on RedHat). This sequence of actions sync the adoptive server's SM directory with that of the primary server. Two NFS packages cannot run on the same node when lock migration is used. See the limitations in the next section.

- After failover, the NFS package IP address is configured on the adoptive node, and `sm-notify` on SLES and `rpc.statd` on RedHat is restarted using package IP. Restarting this daemon triggers a crash recovery notification event, whereby `sm-notify/rpc.statd` sends crash notification messages to all clients listed in the sm directory.

- Any client that holds NFS file locks against files exported by the NFS package sends reclaim requests to the adoptive node (where the exported filesystems currently reside) and reclaims its locks.

- After `sm-notify/rpc.statd` sends the crash recovery notification messages, the SM entries in the package holding directory are removed, and the `nfs.flm` script is started on the adoptive node. The script once again copies each file in sm directory (`/var/lib/nfs/sm` on SLES and `/var/lib/nfs/statd/sm` on RedHat) of the NFS server into the holding directory periodically. The entries that now appear in the sm directory on the adoptive node following the package migration represent either a client that has reclaimed its locks or a client that has established new locks after failover.

Limitations of the NFS File Lock Migration Feature

The following describes limitations of the NFS File Lock Migration feature:

- **Multiple NFS packages are *not* supported on the same node**

  The file lock migration feature will not work for multiple NFS packages running on the same node. So, if file lock migration feature is enabled then any node configured for NFS package in a cluster, cannot be configured to run multiple NFS packages. This limitation is because `statd/sm-notify` on Linux does not deal with multi-homed hosts. It does not support multiple IP addresses in sending server reboot notification.

- **Multiple Package IPs are *not* supported with NFS**

  A Serviceguard package can support multiple relocatable IP addresses associated with it. But, if lock migration feature is enabled then only one IP should be specified for NFS in the package control script as the NFS server reboot/failover notification can be sent using only one relocatable IP.

- **NFS Defect**

  The NFS File Lock Migration feature is only supported in SLES10, SLES9 SP1, and RedHat 4 Update 4. This is due to a defect in NFS, the file lock migration feature does not work on base SLES9, RH4 U1, RH4 U2 and RH4 U3.

- **Do not use NFS Server as an NFS Client**

  During package halt, SIGKILL signal is sent to the lockd kernel thread to release file locks so that the filesystem can be unmounted successfully. If the server is also an NFS client, it loses the NFS file locks obtained by client-side processes when SIGKILL signal is sent to the lockd kernel thread with an intention to release server side locks. So, if the client applications use NFS file locking, it is suggested not to use the clustered nodes configured for the NFS package as an NFS client for any server.

- **SERVICE_FAIL_FAST_ENABLED should be set to "YES"**

`SERVICE_FAIL_FAST_ENABLED` should be set to “YES” for the NFS monitoring service in order to have lock migration feature work consistently. (See the “Configuring Lock Migration Feature” section in Chapter 2 for more details)

Supported Configurations

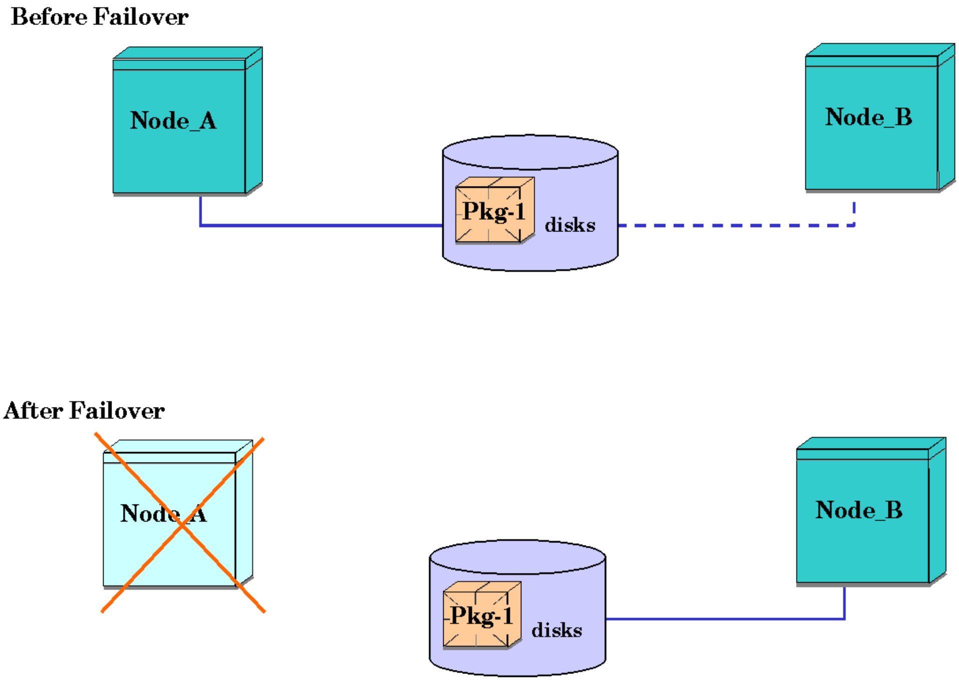
Serviceguard NFS supports the following configurations and are illustrated in the following sections:

- Simple failover from an active NFS server node to an idle NFS server node.
- Failover from one active NFS server node to another active NFS server node, where the adoptive node supports more than one NFS package after the failover.
- A host configured as an adoptive node for more than one NFS package. The host may also be prevented from adopting more than one failed package at a time.
- Cascading failover, where a package my have up to several adoptive nodes.

Failover to an Idle Node

Figure 1-1 shows a simple failover from an active NFS server node to an idle NFS server node.

Figure 1-1 Simple Failover to an Idle NFS Server

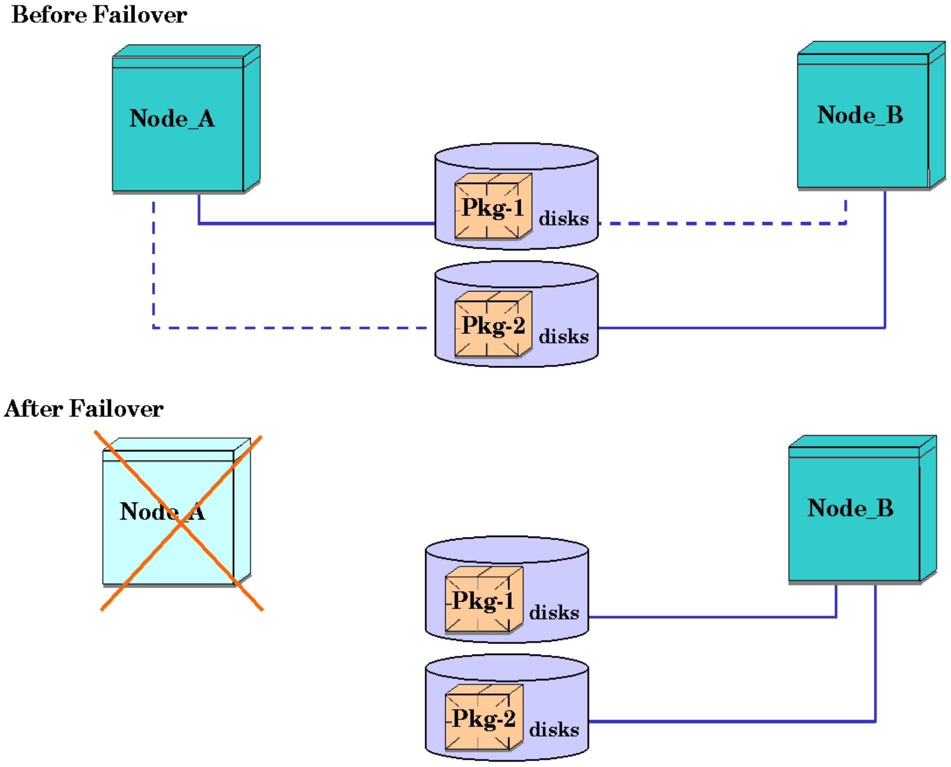


Node_A is the primary node for NFS server package Pkg_1. When Node_A fails, Node_B adopts Pkg_1. This means that Node_B locally mounts the file systems associated with Pkg_1 and exports them. Both Node_A and Node_B must have access to the disks that hold the file systems for Pkg_1.

Failover between Active Nodes

Figure 1-2 shows a failover from one active NFS server node to another active NFS server node. In Figure 1-2, Node_A is the primary node for Pkg_1, and Node_B is the primary node for Pkg_2. When Node_A fails, Node_B adopts Pkg_1 and becomes the server for both Pkg_1 and Pkg_2.

Figure 1-2 Failover from One Active NFS Server to Another



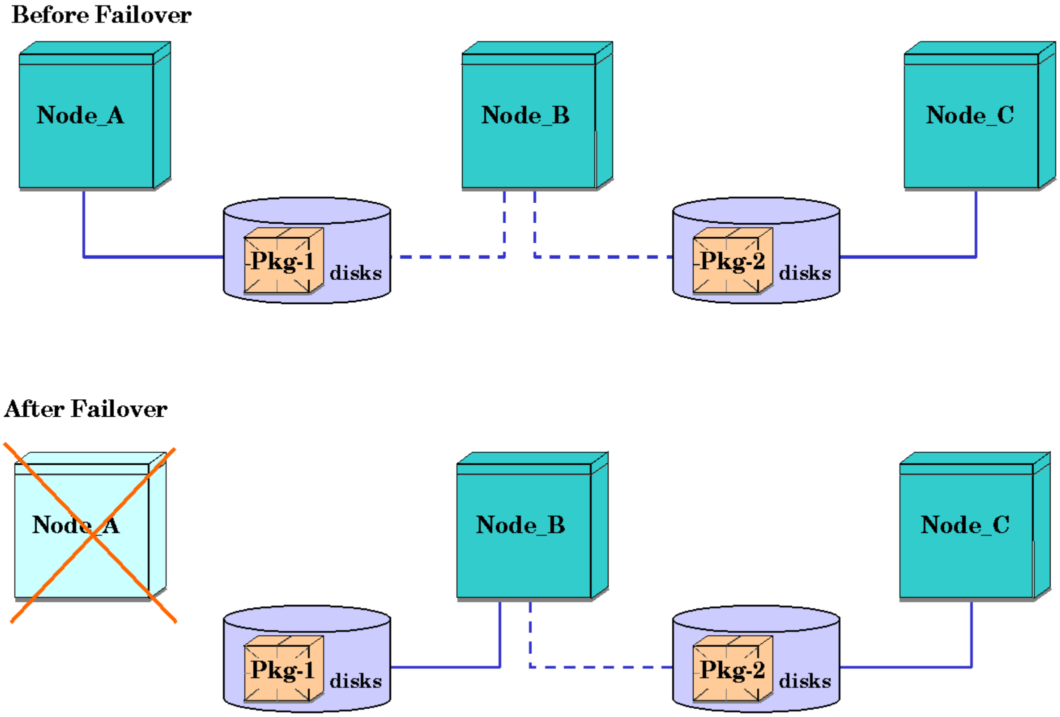
NOTE

During a package failover, the NFS server may receive a status information messages such as: `Input/output error`, `Stale NFS file handle`, or `Write error: Stale NFS file handle`. The result is a retry. If the package fails over during a user file access, the client may experience a momentary hang. Access continues as soon as the package has completed failover to the other node.

Failover with an Adoptive Node for Multiple Packages

Figure 1-3 shows a three-node configuration where one node is the adoptive node for packages on both of the other nodes. If either Node_A or Node_C fails, Node_B adopts the NFS server package from that node. When Node_A fails, Node_B becomes the server for Pkg_1. If Node_C fails, Node_B will become the server for Pkg_2.

Figure 1-3 A Host Configured as Adoptive Node for Multiple Packages

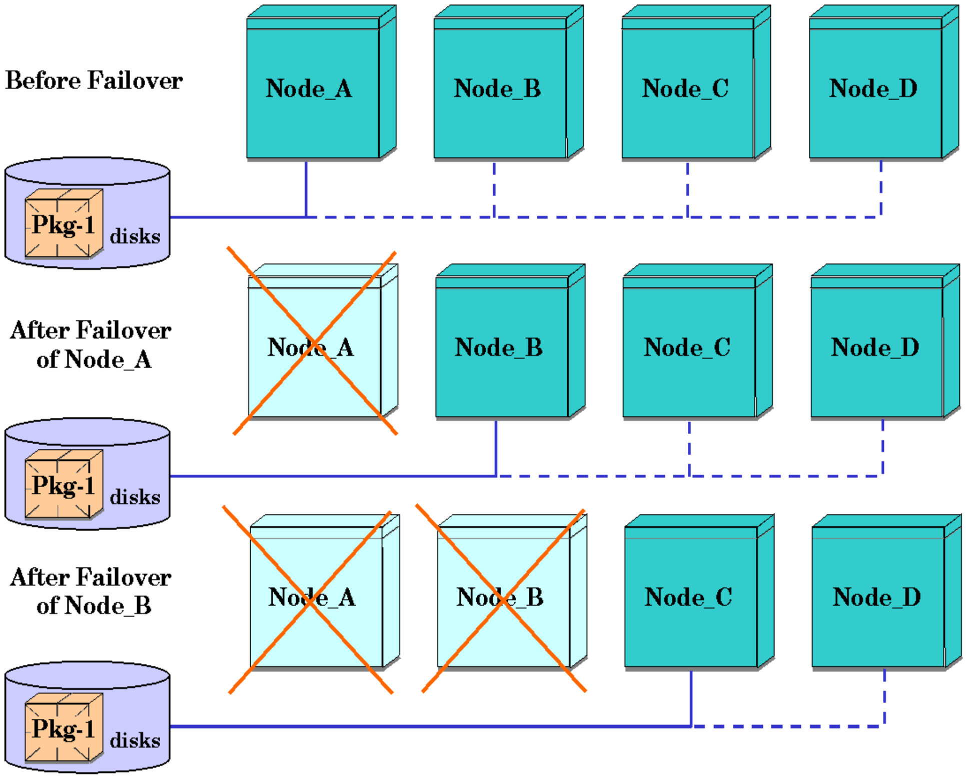


Alternatively, you can prevent Node_B from adopting more than one package at a time by setting a package control function in the package control script. With the package control function set, Node_B may adopt the package of the first node that fails, but if the second node fails, Node_B will not adopt its package. The package control function prevents a node from becoming overloaded by adopting too many packages. If an adoptive node becomes overloaded, it can fail. Refer to “Package Control Script for pkg02” on page 48 for function usage.

Cascading Failover with Multiple Adoptive Nodes

Consider a package that is configured up to three adoptive nodes. Figure 1-4 shows this configuration. If `Node_A` fails, `Pkg_1` is adopted by `Node_B`. However, if `Node_B` is down, `Pkg_1` is adopted by `Node_C`, and if `Node_C` is down, `Pkg_1` is adopted by `Node_D`. The adoptive nodes are listed in the package configuration file, which was generated by using `cmmakepkg -p file` command (see *Managing Serviceguard for Linux,* Chapter 6) in the order in which they will be tried. Note that all four nodes must have access to the disks for the `Pkg_1` file systems.

Figure 1-4 Cascading Failover, with Three Adoptive Nodes



Understanding the Serviceguard NFS Files

Serviceguard NFS uses files similar and typical to Serviceguard. These include configuration files, control scripts, monitoring scripts, and templates. As is true for all Serviceguard packages, you configure and view a small number of files. The following is a brief description of the files:

- Files that apply to the whole cluster:
  - — cluster configuration file, `cluster.conf`

    Defines the cluster nodes, shared networks, and max # of packages.
- Files that apply to each NFS package (`<pkg>`):
  - — package configuration file, `<pkg>.conf`

    The master package configuration file. It defines the package's nodes and failover behavior, and points to the package's control script, `pkg.cntl`.
  - — package control script, `<pkg>.cntl`

    This defines the start and stop behavior, especially the activation and de-activation of the HA storage, and calls the `toolkit.sh` file.
  - — Toolkit configuration script, `hanfs.conf`
  - — NFS control script, `hanfs.sh`

    This exports the HA file system managed by this package. If specified, it also starts monitoring the NFS services.
  - — `<pkg.cntl>.log` and `hanfs.sh.log` files

    These are generated automatically.
  - — NFS monitoring script, `nfs.mon`
  - — NFS file lock migration script, `nfs.flm`
  - — Toolkit interface script, `toolkit.sh`

    This script is invoked by `<pkg>.cntl,`which invokes the `hanfs.sh`.

How the Control and Monitor Scripts Work

As with all Serviceguard packages, the package control scripts start and stop the NFS package and determine how the package will operate once it becomes available on a particular node. Each control script contains two sets of code that operate depending on whether the script is called with the `start` parameter or the `stop` parameter.

A template package control script `pkg.cntl` can be generated by using `cmmakepkg -s pkg.cntl`. The template script `hanfs.sh` is provided in `/usr/local/cmcluster/nfstoolkit` directory for RedHat environments, and `/opt/cmcluster/nfstoolkit` for SLES environments.

Refer to the *Managing Serviceguard for Linux*-Chapter 6 for additional information on creating the files. Refer to "Editing the Package Control Scripts (pkg.cntl)" on page 32 and "Editing the NFS Configuration File (hanfs.conf)" on page 34 for information on how to modify this package control script template file for your own packages.

Starting the NFS Services

When called with the `start` parameter, the package control script does the following:

- Activates the volume group or volume groups associated with the package.
- Mounts each file system associated with the package.
- Invoke `toolkit.sh` to run the NFS start script.
- The NFS script `hanfs.sh`, exports each file system associated with the package so that it can later be NFS-mounted by clients.
- The NFS script initiates the NFS monitor script to check periodically on the health of NFS services, if you have configured your NFS package to use the monitor script.
- Assigns a package IP address to the LAN card on the current node.

After this sequence, the NFS server is active, and clients can NFS-mount the exported file systems associated with the package.

Starting File Lock Migration

If you call the NFS control script with the `lock_migration:<IP_address>` parameter after enabling the File Lock Migration feature, the control script does the following:

- Populates the `/var/lib/nfs/sm` directory on SLES and `/var/lib/nfs/statd/sm` directory on RedHat with the Status Monitor entries from the configured holding directory of the package, and subsequently removes the entries from the holding directory.
- Kills any running copy of the NFS File Lock Migration synchronization script, `nfs.flm`.
- Restarts the `lockd` and `sm-notify` on SLES and `rpc.statd` on RedHat using package IP. Restarting this daemon triggers a crash recovery notification event, whereby `sm-notify/rpc.statd` sends crash notification messages to all clients listed in the `/var/lib/nfs/statd/sm` directory on RedHat and `/var/lib/nfs/sm` directory on SLES.
- Starts the File Lock Migration synchronization script, which periodically copies the `sm` directory entries to the holding directory.

Halting the NFS Services

When called with the `stop` parameter, the control script does the following:

- Removes the package IP address from the LAN card on the current node.
- The package control script invokes the toolkit.sh to run the NFS script and to halt the NFS related process.
- The NFS script un-exports all file systems associated with the package so that they can no longer be NFS-mounted by clients.
- The NFS script halts the monitor process.
- The NFS script halts the File Lock Migration synchronization script if you enable the File Lock Migration feature. The NFS daemons are also halted to unmount the filesystem.
- Unmounts each file system associated with the package.
- Deactivates each volume group associated with the package.

After this sequence, the NFS package is inactive on the current node and may start up on an alternate node or be restarted later on the same node.

Monitoring the NFS Services

The monitor script `nfs.mon`, located in the file `/usr/local/cmcluster/nfstoolkit` for RedHat environments, and `/opt/cmcluster/nfstoolkit` for SLES environments), works by periodically checking the status of NFS services using the `rpcinfo` command. If any service fails to respond, the script exits, causing a switch to an adoptive node.

The monitor script monitors NFS services including:

- `portmap`
- `rpc.statd`
- `nfsd`
- `rpc.mountd`
- `rpc.rquotad`, if `QUOTO_MON` is set to “YES” in `hanfs.conf`
- `lockd`
- `nfs.flm, if LOCK_MIGRATION and NFS_FLM_MONITOR are set to “YES” in hanfs.conf`

If any of the services are dead or hangs, the `nfs.mon`. will cause the package to fail.

NOTE

To configure NFS for maximal availability, you must do the following:

- Specify `AUTO_RUN=YES` in the package configuration file. This allow the NFS package to start automatically when the cluster starts up, and to start on an adoptive node after a failure.
- Invoke the NFS Monitoring script, `nfs.mon`. The default NFS control script does not invoke the NFS monitoring script, `nfs.mon`. To invoke this script (see Chapter 3, “Sample Configurations,”) trigger a failover if one of the package’s NFS services goes down while the node and network remain up.

Whenever the monitor script detects an event, it logs information to a file using the same name as your NFS control script adding a .log extension. Each NFS package has its own log file. For example, if your control script is called pkg1.cntl, the package log file is called pkg1.cntl.log. The NFS monitor log file, which is on the same directory as the NFS control script, is always called hanfs.sh.log.

Remote mount table synchronization

With NFS toolkit, a remote mount table synchronization binary code is installed in /usr/bin/sync_rmtab. This program is provided for synchronizing the client current mount table, /var/lib/nfs/rmtab, in the case of a NFS package failover. This synchronization process ensures NFS clients access NFS seamlessly in the case of the NFS package failover. The NFS control script, hanfs.sh, calls the synchronization program when the remote mount table needs to be synchronized.

On the Client Side

The client should NFS-mount a file system using the package name in the mount command. The package name is associated with the package's relocatable IP address. On client systems, be sure to use a hard mount. For auto-mounter, the timeout should be greater than the total end-to-end recovery time for the Serviceguard NFS package—that is, failover time, running fsck, mounting file systems, and exporting file systems on the new node. The default value of the timeout is five minutes. Setting the timeout to zero disables unmounts completely.

2 Installing and Configuring Serviceguard NFS for Linux

This chapter explains how to configure Serviceguard NFS.

NOTE You must set up your Serviceguard cluster and make sure NFS server is installed before configuring Serviceguard NFS.

For instructions on setting up an Serviceguard cluster, see Chapters 5 and 6 of the *Managing Serviceguard for Linux* user’s guide.

This chapter contains the following sections:

- Installing Serviceguard NFS for Linux
- Before Creating an Serviceguard NFS Package
- Configuring a Serviceguard NFS Package

Installing Serviceguard NFS for Linux

The following describes the Serviceguard NFS Toolkit for Linux installation process.

1. Check for and remove any previous version of Serviceguard NFS for Linux:

   Query the rpm database for the NFS Toolkit:

   ```
   # rpm -qa |grep nfstoolkit
   ```

   If any part of the NFS Toolkit is installed, the grep returns the version number.

   Remove older versions of the NFS Toolkit, if needed:

   ```
   # rpm -e nfstoolkit<release_version>
   ```

2. Use the Redhat and SuSE Package Management `rpm` command to install the Serviceguard NFS file set. Change to your RPM file directory, then issue the following commands:

   RedHat:

   Proliant Servers (running the 32 bit version of the distribution):

   ```
   # rpm -i nfs-toolkit-A.02.00-0.product.redhat.i386.rpm
   ```

   Proliant Servers (running the x86_64 bit version of the distribution):

   ```
   # rpm -i nfs-toolkit-A.02.00-0.product.redhat.x86_64.rpm
   ```

   Integrity Servers:

   ```
   #  rpm -i nfs-toolkit-A.02.00-0.product.redhat.ia64.rpm
   ```

   SUSE LINUX Enterprise Server:

   Proliant Servers (running the 32 bit version of the distribution):

   ```
   # rpm -i nfs-toolkit-A.02.00-0.product.suse.i386.rpm
   ```

   Proliant Servers (running the x86_64 bit version of the distribution):

   ```
   # rpm -i nfs-toolkit-A.02.00-0.product.suse.x86_64.rpm
   ```

   Integrity Servers:

   ```
   # rpm -i nfs-toolkit-A.02.00-0.product.suse.ia64.rpm
   ```

The files will be installed in the following directories: `/usr/bin` and `/usr/local/cmcluster/nfstoolkit` for RedHat and `/opt/cmcluster/nfstoolkit` for SLES. The following files are part of the toolkit:

NOTE The following procedures assume your environment is RedHat. If your environment is SLES, replace all occurrences of "`/usr/local`" with "`/opt`".

- `/usr/local/cmcluster/nfstoolkit/README`. Description of the toolkit contents.
- `/usr/local/cmcluster/nfstoolkit/hanfs.conf`. The NFS configuration file to set user configuration parameters.
- `/usr/local/cmcluster/nfstoolkit/hanfs.sh`. The NFS control script template that starts and stops NFS daemons and exports and unexports file systems.
- `/usr/local/cmcluster/nfstoolkit/nfs.mon`. The NFS monitor script.
- `/usr/local/cmcluster/nfstoolkit/nfs.flm`. The NFS File Lock Migration synchronization script
- `/usr/bin/sync_rmtab`. Remote mount table synchronization binary code.
- `/usr/local/cmcluster/nfstoolkit/toolkit.sh`. The interface script between the package control script and hanfs.sh.

3. Run `cmmakepkg` command to generate a package configuration file and package control script template to the `/usr/local/cmcluster/nfstoolkit` directory with the following command:

```
# cd /usr/local/cmcluster/nfstoolkit
```

```
# cmmakepkg -p pkg.conf
```

```
# cmmakepkg -s pkg.cntl
```

4. Create a directory for your package files, for example:

```
# mkdir /usr/local/cmcluster/<pkg_name>
```

5. Issue the following command to copy the Serviceguard NFS template files to the newly created package directory:

```
# cp /usr/local/cmcluster/nfstoolkit/* \
/usr/local/cmcluster/<pkg_name>
```

Copying the Template Files

If you will run only one Serviceguard NFS package in your Serviceguard cluster, technically you do not have to copy the template files. Though, it is recommended that you keep your template file in its original form for future use. If you will run multiple Serviceguard NFS packages, each package *must* have its own package directory, package configuration file and control scripts.

For each Serviceguard NFS package you plan to run, make a copy of all the package files including the package configuration file (`pkg.conf`), package control script (`pkg.cntl`), toolkit interface script (`toolkit.sh`), NFS Control Script (`hanfs.sh`), NFS configuration file (`hanfs.conf`), NFS monitor script (`nfs.mon`) and NFS file lock migration synchronization script (`nfs.flm`). You can rename the package control script with a package specific identification, such as `pkg1.conf` and `pkg1.cntl`.

NOTE

`pkg.cntl`, `toolkit.sh` , `hanfs.conf`, `nfs.mon`, `nfs.flm`, and `hanfs.sh` should be in the same directory. Do not rename `hanfs.conf`, `hanfs.sh`, `toolkit.sh`, `nfs.flm`, and `nfs.mon`. These files are hard coded in the control scripts.

Before Creating an Serviceguard NFS Package

Before creating a Serviceguard NFS package, perform the following tasks:

NOTE The following procedures assume your environment is RedHat. If your environment is SLES, replace all occurrences of "`/usr/local`" with "`/opt`".

1. Select the NFS Server package during Red Hat Linux installation and verify that the NFS is properly installed.

   After RedHat installation is complete, check for the NFS utility to verify NFS installation:

   - Verify the NFS utility, run the command:

     ```
     # rpm -qa | grep nfs
     ```

     If the output contains `nfs-utils-`*`<release_version>`* , the utility is installed.

2. Set up your Serviceguard cluster according to the instructions in the *Managing Serviceguard for Linux* user's guide.

3. Configure the disk hardware for high availability. Data disks associated with Serviceguard NFS must be external disks. All the nodes that support the Serviceguard NFS package must have access to the external disks. For most disks this means they must be attached to a shared bus that is connected to all nodes which support the package. The disk on which NFS volume is configured can be either a single lun or a split site `raid1` array, which provides a level of disaster tolerance to the NFS volume. This can be achieved by setting up a Serviceguard Extended Distance Cluster which uses the linux software RAID as the basic building block. For information on setting up the Extended Distance Cluster, see the HP Serviceguard Extended Distance Cluster for Linux Deployment Guide.

4. Use LVM commands to set up volume groups, logical volumes, and file systems as needed for the data that will be exported to clients. Refer to the *Managing Serviceguard* manual.

   a. Create a directory for each NFS package. For example:

      `/usr/local/cmcluster/nfs1`

   b. The names of the volume groups must be unique within the cluster, and the major and minor numbers associated with the volume groups must be the same on all nodes. In addition, the mounting points and exported file system names must be the same on all nodes.

      The preceding requirements exist because NFS uses the major number, minor number, inode number, and exported directory as part of a file handle to uniquely identify each NFS file. If differences exist between the primary and adoptive nodes, the client's file handle would no longer point to the correct file location after movement of the package to a different node.

5. Make sure the user IDs and group IDs of those who access the Serviceguard NFS file system are the same on all nodes that can run the package.

   Make sure the user IDs and group IDs in the `/etc/passwd` and `/etc/group` files are the same on the primary node and all adoptive nodes, or use NIS to manage the `passwd` and `group` databases.

6. Create an entry for the name of the package in the DNS or NIS name resolution files, or in `/etc/hosts`, so that users will mount the exported file systems from the correct node. This entry maps the package name to the package's relocatable IP address.

7. Decide whether to place executables locally on each client or on the NFS server. There are a number of trade-offs to be aware of regarding the location of executables with Serviceguard NFS.

   The advantages of keeping executables local to each client are as follows:

   - No failover time. If the executables are local to the client, there is no delay if the NFS server fails.
   - Faster access to the executables than accessing them through the network.

   The advantage of putting the executables on the NFS server is as follows:

   - Ease of management. If the executables are located in one centralized location, the administrator must update only one copy when changes are made.

Configuring a Serviceguard NFS Package

To configure a Serviceguard NFS package, complete the following tasks, described in this section:

- Editing the Package Configuration File (pkg.conf)
- Editing the Package Control Scripts (pkg.cntl)
- Editing the NFS Configuration File (hanfs.conf)
- Creating the Serviceguard Binary Configuration File

NOTE Repeat the configuration process for each NFS package.

Editing the Package Configuration File (`pkg.conf`)

The following steps describe the required modifications to the Package Configuration File. Make one Package Configuration file for each package.

1. Except for the variables listed below, use the default values for the variables in the package configuration file, or change them as needed.

   For instructions on modifying the default values, see the *Managing Serviceguard* manual, or read the comments in the package configuration file.

2. Set the PACKAGE_NAME variable. For example:

   ```
   PACKAGE_NAME pkg01
   ```

   You can use the default package name if you are planning to run only one Serviceguard NFS package on your Serviceguard cluster. Each package must have a unique name.

3. Create a NODE_NAME variable for each node that will run the package. The first NODE_NAME should specify the primary node. All the NODE_NAME variables following the primary node should specify the adoptive nodes, in the order in which they will be tried. For example:

```
NODE_NAME thyme
NODE_NAME basil
NODE_NAME sage
```

4. Set the RUN_SCRIPT and HALT_SCRIPT variables to the full path name of the control script. You do not have to specify a timeout for either script. For example:

   ```
   RUN_SCRIPT /usr/local/cmcluster/pkg1/pkg1.cntl
   RUN_SCRIPT_TIMEOUT NO_TIMEOUT
   HALT_SCRIPT /usr/local/cmcluster/pkg1/pkg1.cntl
   HALT_SCRIPT_TIMEOUT NO_TIMEOUT
   ```

5. If you want to run the NFS monitor script, set the SERVICE_NAME variable. For example:

   ```
   SERVICE_NAME nfs1.monitor
   ```

   Each package must have a unique service name. The SERVICE_NAME variable in the package configuration file must match the NFS_SERVICE_NAME variable in the NFS control script.

   If you do not wish to run the NFS monitor script, comment out the SERVICE_NAME variable. For example:

   ```
   SERVICE_NAME nfs1.monitor
   ```

   If your NFS package configuration file specifies AUTO_RUN YES, the package switches to the next adoptive node in the event of a node or package failure. The NFS monitor script causes the package to fail over if any of the monitored NFS services fails.

6. Set the SUBNET variable to the subnet that is monitored for the package. For example:

   ```
   SUBNET 192.100.112.0
   ```

Editing the Package Control Scripts (`pkg.cntl`)

The following steps describe the required modifications to the Package Control Scripts. Make one Package Control Script for each package.

NOTE The following procedures assume your environment is RedHat. If your environment is SLES, replace all occurrences of "`/usr/local`" with "`/opt`".

1. Create a separate `VG[n]` variable for each volume group. For example:

   ```
   VG[0]=vg01
   VG[1]=vg02
   ```

2. Create a separate `LV[n]`, `FS[n]`, `FS_TYPE[n]`, and `FS_MOUNT_OPT[n]` variable for each volume group and file system that will be mounted on the server. For example:

   ```
   LV[0]=/dev/vg01/lvol1;FS[0]=/ha_root;
   FS_TYPE[0]=ext2;FS_MOUNT_OPT[0]="-o rw"
   LV[1]=/dev/vg01/lvol2;FS[1]=/users/scaf;
   FS_TYPE[1]=ext2;FS_MOUNT_OPT[1]="-o rw"
   LV[2]=/dev/vg02/lvol1;FS[2]=/ha_data;
   FS_TYPE[2]=ext2;FS_MOUNT_OPT[2]="-o rw"
   ```

   This example defines the variable for three NFS mounted file systems, `ha_root`, `users/scaf`, and `ha_data`.

3. Specify the IP address for the package and the address of the subnet to which the IP address belongs. For example:

   ```
   IP[0]=15.13.114.243
   SUBNET[0]=192.100.112.0
   ```

   The IP address you specify is the relocatable IP address for the package. NFS clients that mount the file systems in the package will use this IP address to identify the server. You should configure a name for this address in the DNS or NIS database, or in the `/etc/hosts` file.

4. Specify that this package uses the high availability NFS server by uncommenting the `HA_APP_SERVER` variable. Uncomment the following line:

```
HA_APP_SERVER="pre-IP"
```

5. If two packages have the same adoptive node, *and* you want to prevent a shared adoptive node from adopting both packages at once, specify the cmmodpkg command with the package control option (-d) in the customer_defined_run_cmds. For example:

```
function customer_defined_run_cmds
{
    cmmodpkg -d -n 'hostname' pkg02 &
}
```

   This package control function can prevent an adoptive node from becoming overloaded when multiple packages fail over. If an adoptive node becomes overloaded, it can fail.

   In this example, if a host is an adoptive node for both pkg01 and pkg02, the above cmmodpkg -d command, in the control script for pkg01, would prevent the host that is running pkg01 from adopting pkg02. If pkg02 fails, it will failover to another adoptive node (if configured) where pkg01 is not running.

   Add a similar line in the control script for pkg02 to prevent the host that is running pkg02 from adopting pkg01.

   The ampersand (&) causes the cmmodpkg command to run in the background. The cmmodpkg command in the background allows the control script to complete and finish bringing up the package.

NOTE There is a small window of time, during which if one package has begun to fail over but the cmmodpkg command has not executed, the other package can fail over and the host will adopt it. In other words, if two packages fail over at approximately the same time, a host may adopt both packages, even though the package control option is specified.

See "Configuring One Adoptive Node to Support Failover of Multiple Packages" on page 51 for a sample configuration using the package control option.

6. Use the default values for the rest of the variables in the control script, or change them as needed. For instructions on modifying the default values, see the *Managing Serviceguard for Linux* manual, or read the comments in the `/usr/local/cmcluster/nfstoolkit/pkg.cntl` template file.

Editing the NFS Configuration File (`hanfs.conf`)

The following steps describe the required modifications to the NFS Configuration file:

NOTE The following procedures assume your environment is RedHat. If your environment is SLES, replace all occurrences of `/usr/local with /opt`.

1. Create a separate `XFS[n]` variable for each NFS directory to be exported. Specify the directory name and any export options. For example:

   ```
   XFS[0]=”*:/ha_root”
   ```

   ```
   XFS[1]="*:/users/scaf"
   ```

   ```
   XFS[2]="-o ro *:/ha_data"
   ```

   ```
   XFS[3]="-o fsid=23,rw *:/pkg3"
   ```

   Do not configure these exported directories in the `/etc/exports` file. When an NFS server boots up, it attempts to export all file systems in its `/etc/exports` file. If those file systems are not currently present on the NFS server node, the node cannot boot properly. This happens if the server is an adoptive node for a file system, and the file system is available on the server only after failover of the primary node.

2. If you want to run the NFS monitor script:

   a. Set the `NFS_SERVICE_NAME` variable to the value of the `SERVICE_NAME` variable in the package configuration file. Each package must have a unique service name. For example:

      ```
      NFS_SERVICE_NAME[0]=nfs1.monitor
      ```

   b. Set the `NFS_SERVICE_CMD` variable to the full path name of the NFS monitor script. For example:

```
NFS_SERVICE_CMD[0]=/usr/local/cmcluster/pkg1/nfs.mon
```

Multiple instances of the monitor script can run on the same node without any problems, and if a package fails over, only the instance associated with that package is terminated.

If you do not want to run the NFS monitor script:

Comment out the NFS_SERVICE_NAME and NFS_SERVICE_CMD variables. For example:

```
# NFS_SERVICE_NAME[0]=nfs1.monitor
```

3. If you want to start and monitor rpc.quotad daemon, set QUOTA_MON to YES. For example:

```
QUOTA_MON=YES
```

If you do not want to start and monitor rpc.quotad daemon, set QUOTA_MON to NO. For example:

```
QUOTA_MON=NO
```

Configuring Lock Migration Feature

The following steps need to be completed to use of the lock migration feature:

1. In the package configuration file, set the SERVICE_FAIL_FAST_ENABLED to "YES" for the NFS monitoring service. Example:

```
SERVICE_NAME      nfs1.monitor

SERVICE_FAIL_FAST_ENABLED        YES

SERVICE_HALT_TIMEOUT    300
```

NOTE

In RedHat, there are times when sending SIGKILL to the kernel 'lockd' thread might not release all the file locks and cause the failure of the unmounting of filesystem. To force unmount of the filesystem, the machine has to be rebooted. In such cases, it is recommended to set SERVICE_FAIL_FAST_ENABLED to "YES" which reboots the machine upon service failure.

In SLES, the sm directory does not consistenty update with the client entries. This is due to the client entry being made for the first time only after the system has booted. After a fail back of the package, the

NFS fails to create `sm` directory entries. After a fail back, if the client attempts to reclaim his locks, fresh entries for the clients will not be made in the `/var/lib/nfs/sm` directory of the server. For SLES, it is mandatory to set `SERVICE_FAIL_FAST_ENABLED` to “YES”, so the server reboots in order to have lock migration feature work consistently.

If you halt the package manually on any node configured for an NFS package, you must reboot the machine before the package is run again on the same node.

2. In the Package Control Script, edit the `customer_defined_run_cmds` function to execute the `toolkit.sh` script for file lock migration. In the example below, the following line was added, `$HA_APP_SCRIPT lock_migration:<Package IP>`.

NOTE `HA_APP_SCRIPT` is initialized to the `toolkit.sh` path in the package control script.

Example:

```
function customer_defined_run_cmds

             {

$HA_APP_SCRIPT lock_migration:${IP[0]}

test_return 51
```

NOTE The argument to be passed to the `HA_APP_SCRIPT` for lock migration should contain the same name or IP address used by the clients while mounting the exported file system.

Example: If client mounts the NFS file system using the package name, specify the same in customer_defined_run_cmds as shown below:

```
function customer_defined_run_cmds

             {

$HA_APP_SCRIPT lock_migration:<package name>
```

```
test_return 51
```

NOTE

A Serviceguard package can support multiple relocatable IP addresses associated with it. However, if lock migration feature is enabled then only one IP is allowed to be specified in the NFS package control script since the NFS limits server reboot/failover notification is sent using only a single IP. In the package control script, only one IP/Subnet address pair is allowed to be specified under `IP ADDRESS` section.

3. Configure the following variables in `hanfs.conf`:

   a. `LOCK_MIGRATION`:

      To enable File Lock Migration, set the `LOCK_MIGRATION` variable to “YES”. By default the variable is set to “NO”.

      An example for this parameter is as follows:
      `LOCK_MIGRATION="YES"`

   b. `NFS_FLM_HOLDING_DIR`:

      Name of a unique directory created in one of the shared volumes associated with this package. This directory holds copies of the `/var/lib/nfs/sm` files on SLES and `/var/lib/nfs/statd/sm` files on RedHat for this package. You must create this directory in one of the shared volumes associated with this package so that it can migrate with the package (from the primary server to the adoptive server).

      You must dedicate this directory for holding SM entries only. In addition, you must not add any files as this directory is maintained by the toolkit. This directory should not have other files or subdirectories when starting the cluster. All files in this directory are deleted after a failover.

      An example for this parameter is as follows:
      `NFS_FLM_HOLDING_DIR="/pkg1a/sm"`

      The above directory should be present in one of the file systems specified in the package control script.

   c. `PROPAGATE_INTERVAL`:

Number of seconds between the attempts of the script to copy files from the `/var/lib/nfs/sm` directory on SLES and `/var/lib/nfs/statd/sm` on RedHat into the holding directory, specified by `NFS_FLM_HOLDING_DIR`. The default value of this parameter is five seconds.

An example for this parameter is as follows:

```
PROPAGATE_INTERVAL=5
```

NOTE

The NFS client may not receive a crash notification if it sends an initial lock request to the NFS server and during the interim, the NFS package failsover to an adoptive node before the FLM script copies the `/var/lib/nfs/statd/sm` entry on RedHat and `/var/lib/nfs/sm` entry on SLES for this client to the package holding directory. Hence the client may not reclaim the lock once the NFS package failsover to the adoptive node.

The probability of this occurring within the default time interval between copies is extremely low as the SM file copy interval is very short (by default, five seconds). You can reduce the probability further by configuring the time interval to a value lower than the default.

d. `NFS_FLM_MONITOR`:

   To monitor the file lock migration script (`nfs.flm`) by the NFS monitor script (`nfs.mon`), set the `NFS_FLM_MONITOR` variable to “YES”. The default value is NO. Setting this parameter to “YES” ensures that the file lock state files are being copied into holding directory successfully.

e. `NFS_FLM_RESTART`:

   Number of times the monitoring script should attempt to restart the file lock migration script (`nfs.flm`) if it fails. The default value is 4.

NOTE

To use the lock migration feature, the user has to do all the configurations specified above and also consider all the limitations of the lock migration feature mentioned in the section on See "Limitations of the NFS File Lock Migration Feature" on page 10.

Creating the Serviceguard Binary Configuration File

1. Use the cmapplyconf command to verify the content of your cluster and package configuration and to copy the binary configuration file to all the nodes in the cluster. In the following example, the cluster configuration file is /usr/local/cmcluster/cluster.conf. On your system, use the names of your own cluster configuration and package configuration files.

```
# cmapplyconf -v -C /usr/local/cmcluster/cluster.conf \

  -P /usr/local/cmcluster/pkg1/pkg1.conf
```

2. Use your favorite copy utility (for example, scp) to copy the package control, NFS control, and monitor scripts to the same path names on all the nodes in the cluster. For example, to copy the files from host thyme to host basil, issue the following command from host thyme:

```
# scp /usr/local/cmcluster/cluster/pkg1/* \

  basil:/usr/local/cmcluster/cluster/pkg1
```

Housekeeping Suggestions

After the shell scripts are installed they are located in /usr/local/cmcluster/nfstoolkit and the binary file is located in /usr/bin on your Linux platforms. It is recommended that you set up directories to keep your various package and script files grouped for organization. Set up one directory for each package and keep the associated control and monitoring scripts in that directory.

3 Sample Configurations

This chapter gives sample cluster configuration files, package configuration files, package control script, and NFS control script for configurations supporting the following failover options:

- Failover between multiple active nodes. The sample configuration has three servers and three Serviceguard NFS packages and supports a three-server mutual takeover. Each server is the primary node for one package and an adoptive node for the other two packages.
- One adoptive node for two packages. The sample configuration has two packages, each owned by a different server. A third server is the adoptive node for both packages. This sample configuration uses the package control option, which prevents the adoptive node from adopting more than one package at a time.
- Multiple node cascading failover. The sample configuration has three servers and two packages. One server is the primary node for both packages, and the other two servers are adoptive nodes for both packages.
- One adoptive node for an NFS package with File Lock Migration. The sample configuration has two servers and one Serviceguard NFS package. One server is the primary node and the other server is the adoptive node for the NFS package. This sample configuration enables the File Lock Migration Feature.

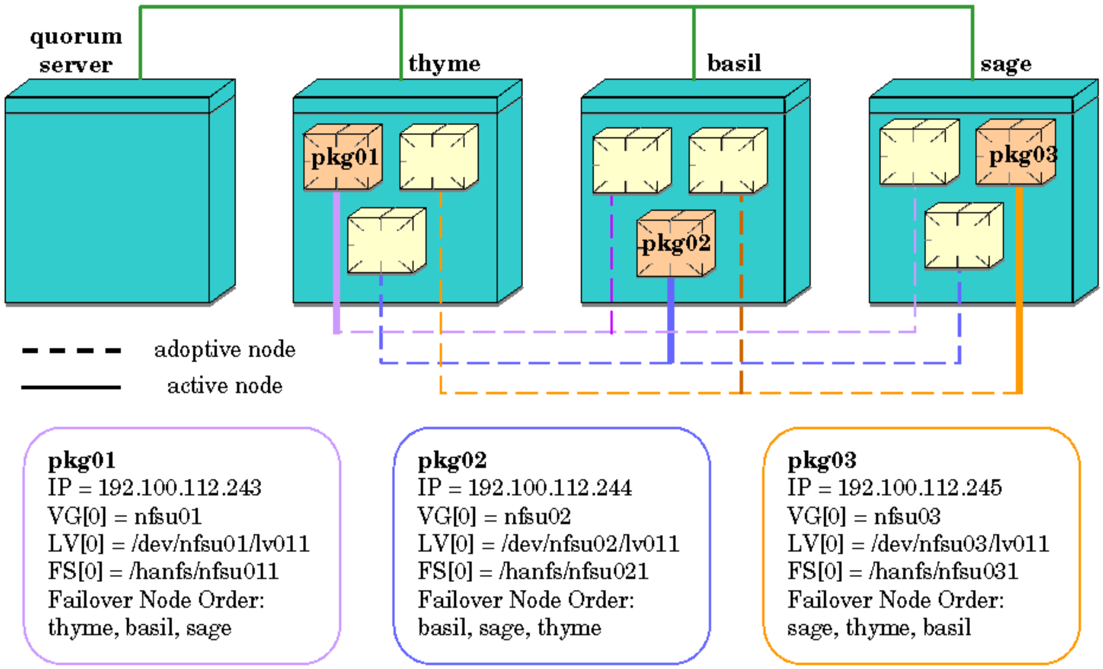
NOTE Examples in this chapter are RedHat specific.

The sample configuration files in this chapter show only the configured values. Most of the comments have been omitted.

Configuring Multiple Nodes to Support Failover of Multiple Packages

This configuration has three servers and three Serviceguard NFS packages. Each server is the primary node for one package and an adoptive node for the other two packages. Figure 3-1 illustrates this configuration. Dotted lines indicate which servers are adoptive nodes for the packages. Figure 3-2 illustrates the configuration after host `basil` fails.

Figure 3-1 **Three-Server Mutual Takeover**



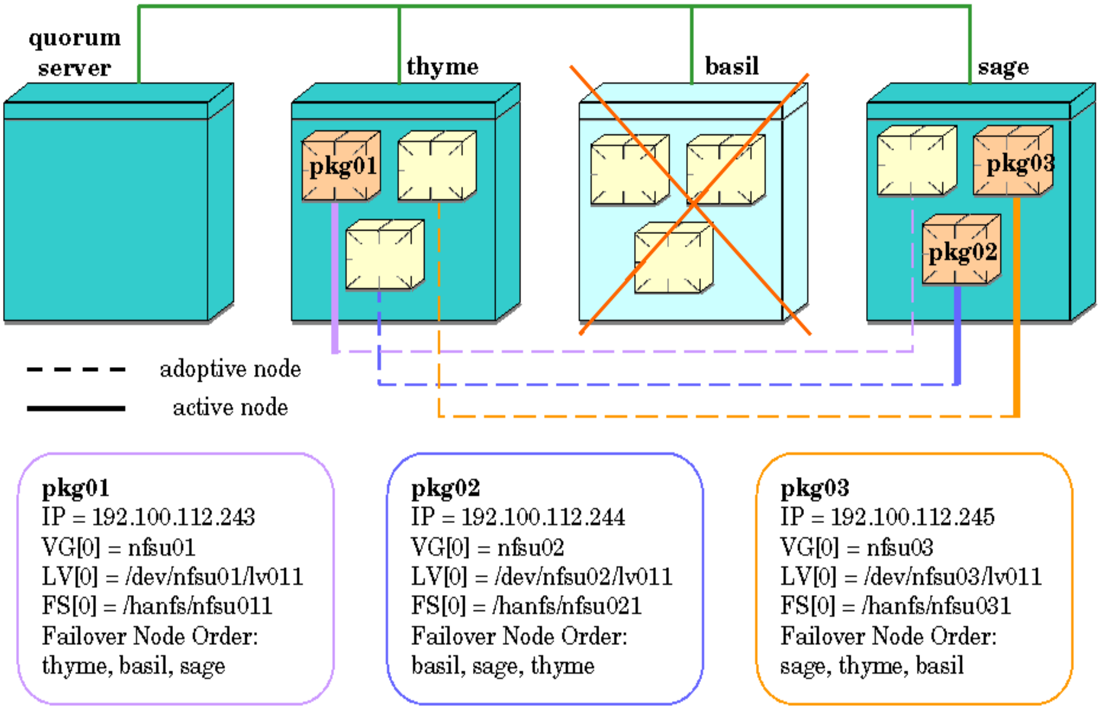
pkg01
IP = 192.100.112.243
VG[0] = nfsu01
LV[0] = /dev/nfsu01/lv011
FS[0] = /hanfs/nfsu011
Failover Node Order:
thyme, basil, sage

pkg02
IP = 192.100.112.244
VG[0] = nfsu02
LV[0] = /dev/nfsu02/lv011
FS[0] = /hanfs/nfsu021
Failover Node Order:
basil, sage, thyme

pkg03
IP = 192.100.112.245
VG[0] = nfsu03
LV[0] = /dev/nfsu03/lv011
FS[0] = /hanfs/nfsu031
Failover Node Order:
sage, thyme, basil

Figure 3-2 shows the three-server mutual takeover configuration after host basil has failed and host sage has adopted pkg02. Dotted lines indicate which servers are adoptive nodes for the packages.

Figure 3-2 Three-Server Mutual Takeover After One Server Fails



Cluster Configuration File for Three-Server Mutual Takeover

This section shows the cluster configuration file (`cluster.conf`) for this configuration example. The comments are not shown.

```
CLUSTER_NAME                 MutTakOvr

QS_HOST                      qs
QS_POLLING_INTERVAL          300000000

NODE_NAME                    thyme
  NETWORK_INTERFACE          eth0
    HEARTBEAT_IP             192.100.112.146
  NETWORK_INTERFACE          eth1

NODE_NAME                    basil
  NETWORK_INTERFACE          eth0
    HEARTBEAT_IP             192.100.112.168

NODE_NAME                    sage
  NETWORK_INTERFACE          eth0
    HEARTBEAT_IP             192.100.112.184
  NETWORK_INTERFACE          eth1
  NETWORK_INTERFACE          eth2

HEARTBEAT_INTERVAL           1000000
NODE_TIMEOUT                 5000000

AUTO_START_TIMEOUT           600000000
NETWORK_POLLING_INTERVAL     2000000

MAX_CONFIGURED_PACKAGES      4
```

Package Configuration File for pkg01

This section shows the package configuration file (pkg1.conf) for the package pkg01 in this sample configuration. The comments are not shown.

```
PACKAGE_NAME                pkg01
PACKAGE_TYPE                FAILOVER
FAILOVER_POLICY             CONFIGURED_NODE
FAILBACK_POLICY             MANUAL
NODE_NAME                   thyme
NODE_NAME                   basil
NODE_NAME                   sage
AUTO_RUN                    YES
NODE_FAIL_FAST_ENABLED      NO
RUN_SCRIPT                 /usr/local/cmcluster/pkg1/pkg1.cntl
RUN_SCRIPT_TIMEOUT          NO_TIMEOUT
HALT_SCRIPT                /usr/local/cmcluster/pgk1/pkg1.cntl
HALT_SCRIPT_TIMEOUT         NO_TIMEOUT
SERVICE_NAME                nfs1.monitor
SERVICE_FAIL_FAST_ENABLED   NO
SERVICE_HALT_TIMEOUT        300
SUBNET                      192.100.112.0
```

Package Control Script for pkg01

This section shows the package control script (pkg1.cntl) for the package pkg01 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                # Default
VG[0]="nfsu01"
LV[0]=/dev/nfsu01/lvol1;
FS[0]=/hanfs/nfsu011;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.243"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

NFS Toolkit Configuration File for pkg01

This section shows the NFS Toolkit configuration file (hanfs.conf) for the package pkg01 on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu011"
NFS_SERVICE_NAME[0]="nfs1.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg1/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Package Configuration File for pkg02

This section shows the package configuration file (pkg2.conf) for the package pkg02 in this sample configuration. The comments are not shown.

```
PACKAGE_NAME               pkg02
PACKAGE_TYPE               FAILOVER
FAILOVER_POLICY            CONFIGURED_NODE
FAILBACK_POLICY            MANUAL
NODE_NAME                  basil
NODE_NAME                  sage
NODE_NAME                  thyme
AUTO_RUN                   YES
NODE_FAIL_FAST_ENABLED     NO
RUN_SCRIPT                 /usr/local/cmcluster/pkg2/pkg2.cntl
RUN_SCRIPT_TIMEOUT         NO_TIMEOUT
HALT_SCRIPT                /usr/local/cmcluster/pgk2/pkg2.cntl
HALT_SCRIPT_TIMEOUT        NO_TIMEOUT
SERVICE_NAME               nfs2.monitor
SERVICE_FAIL_FAST_ENABLED  NO
SERVICE_HALT_TIMEOUT       300
SUBNET                     192.100.112.0
```

Package Control Script for pkg02

This section shows the package control script (pkg2.cntl) for the package pkg02 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"            # Default
VG[0]="nfsu02"
LV[0]=/dev/nfsu02/lvol1;
FS[0]=/hanfs/nfsu021;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.244"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

NFS Toolkit Configuration File for pkg02

This section shows the NFS Toolkit configuration file (hanfs.sh) for the package pkg02 on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu021"
NFS_SERVICE_NAME[0]="nfs2.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg2/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Package Configuration File for pkg03

This section shows the package configuration file (`pkg3.conf`) for the package `pkg03` in this sample configuration. The comments are not shown.

```
PACKAGE_NAME              pkg03
PACKAGE_TYPE              FAILOVER
FAILOVER_POLICY           CONFIGURED_NODE
FAILBACK_POLICY           MANUAL
NODE_NAME                 sage
NODE_NAME                 thyme
NODE_NAME                 basil
AUTO_RUN                  YES
NODE_FAIL_FAST_ENABLED    NO
RUN_SCRIPT                /usr/local/cmcluster/pkg3/pkg3.cntl
RUN_SCRIPT_TIMEOUT        NO_TIMEOUT
HALT_SCRIPT               /usr/local/cmcluster/pgk3/pkg3.cntl
HALT_SCRIPT_TIMEOUT       NO_TIMEOUT
SERVICE_NAME              nfs3.monitor
SERVICE_FAIL_FAST_ENABLED NO
SERVICE_HALT_TIMEOUT      300
SUBNET                    192.100.112.0
```

Package Control Script for pkg03

This section shows the NFS control script (pkg3.cntl) for the package pkg03 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                 # Default
VG[0]="nfsu03"
LV[0]=/dev/nfsu03/lvol1;
FS[0]=/hanfs/nfsu031;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.245"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

NFS Toolkit Configuration File for pkg03

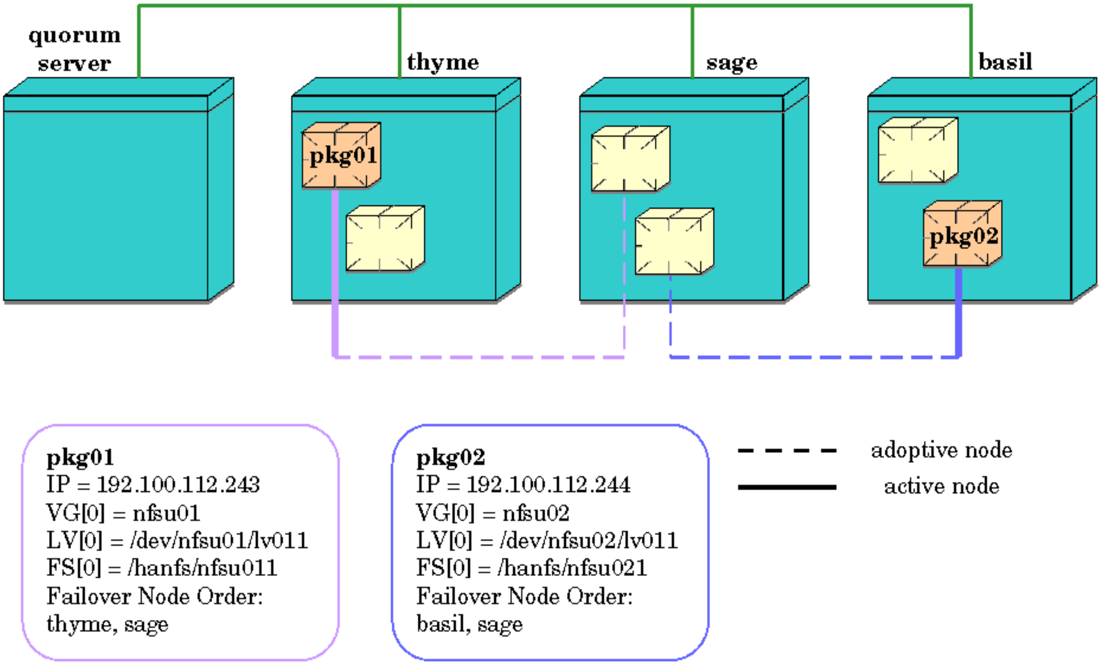
This section shows the NFS Toolkit configuration file (hanfs.conf) for the package pkg03 on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu031"
NFS_SERVICE_NAME[0]="nfs3.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg3/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Configuring One Adoptive Node to Support Failover of Multiple Packages

This configuration has two packages, each owned by a different server. The adoptive node for both packages is the same host. This sample configuration uses the package control option, which prevents the adoptive node from adopting another package if it has already adopted one. Figure 3-3 illustrates this configuration. Figure 3-4 shows the same configuration after one primary server has failed.

Figure 3-3 One Adoptive Node for Two Packages



pkg01
IP = 192.100.112.243
VG[0] = nfsu01
LV[0] = /dev/nfsu01/lv011
FS[0] = /hanfs/nfsu011
Failover Node Order:
thyme, sage

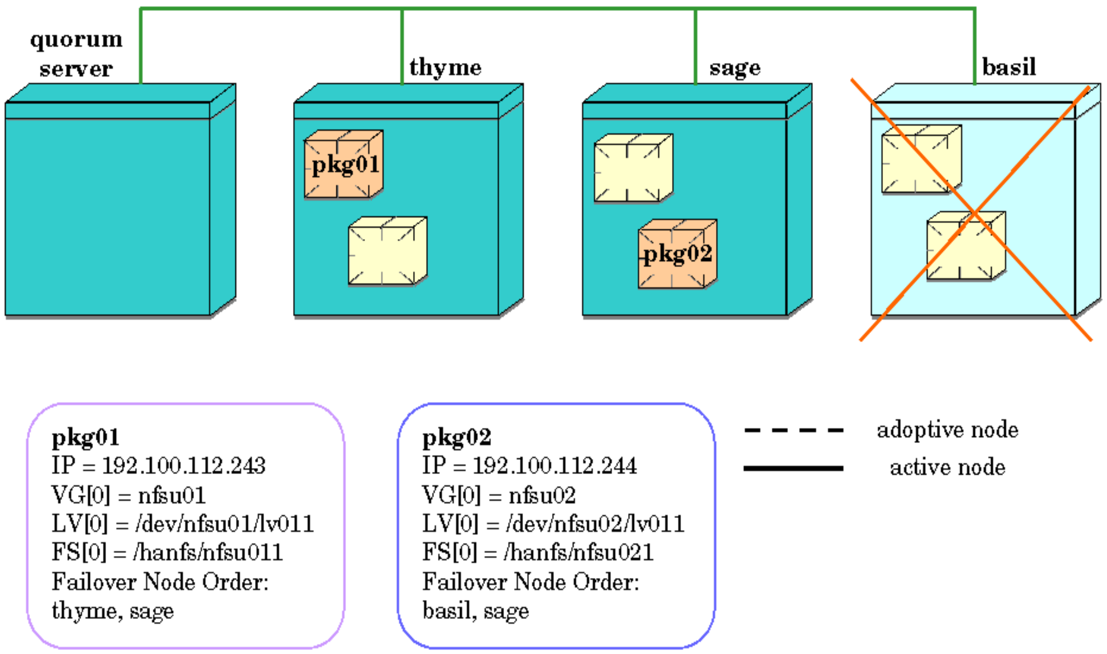
pkg02
IP = 192.100.112.244
VG[0] = nfsu02
LV[0] = /dev/nfsu02/lv011
FS[0] = /hanfs/nfsu021
Failover Node Order:
basil, sage

Figure 3-4 shows this sample configuration after host basil has failed. Host sage has adopted pkg02.

NOTE

Setting the package control option (-d) of the cmmodpkg command, prevents host sage from adopting another package, so host sage is no longer an adoptive node for pkg01. This prevent the adoptive node (sage) from becoming overloaded when multiple packages failover.

Figure 3-4 **One Adoptive Node for Two Packages After One Server Fails**



Cluster Configuration File for Adoptive Node for Two Packages

This section shows the cluster configuration file (`cluster.conf`) for this configuration example. The comments are not shown.

```
CLUSTER_NAME                      PkgCtrl

QS_HOST                           qs
QS_POLLING_INTERVAL               300000000

NODE_NAME                         thyme
  NETWORK_INTERFACE               eth0
    HEARTBEAT_IP                  192.100.112.146
  NETWORK_INTERFACE               eth1

NODE_NAME                         basil
  NETWORK_INTERFACE               eth0
    HEARTBEAT_IP                  192.100.112.168

NODE_NAME                         sage
  NETWORK_INTERFACE               eth0
    HEARTBEAT_IP                  192.100.112.184
  NETWORK_INTERFACE               eth1
  NETWORK_INTERFACE               eth2

HEARTBEAT_INTERVAL                1000000
NODE_TIMEOUT                      5000000

AUTO_START_TIMEOUT                600000000
NETWORK_POLLING_INTERVAL          2000000

MAX_CONFIGURED_PACKAGES           4
```

Package Configuration File for pkg01

This section shows the package configuration file (`pkg1.conf`) for the package `pkg01` in this sample configuration. The comments are not shown.

```
PACKAGE_NAME                pkg01
PACKAGE_TYPE                FAILOVER
FAILOVER_POLICY             CONFIGURED_NODE
FAILBACK_POLICY             MANUAL
NODE_NAME                   thyme
NODE_NAME                   sage
AUTO_RUN                    YES
NODE_FAIL_FAST_ENABLED      NO
RUN_SCRIPT                  /usr/local/cmcluster/pkg1/pkg1.cntl
RUN_SCRIPT_TIMEOUT          NO_TIMEOUT
HALT_SCRIPT                 /usr/local/cmcluster/pgk1/pkg1.cntl
HALT_SCRIPT_TIMEOUT         NO_TIMEOUT
SERVICE_NAME                nfs1.monitor
SERVICE_FAIL_FAST_ENABLED   NO
SERVICE_HALT_TIMEOUT        300
SUBNET                      192.100.112.0
```

Package Control Script for pkg01

This section shows the package control script (pkg1.cntl) for the package pkg01 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                # Default
VG[0]="nfsu01"
LV[0]=/dev/nfsu01/lvol1;
FS[0]=/hanfs/nfsu011;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.243"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

The function customer_defined_run_cmds calls the cmmodpkg command with the package control option (-d). This command prevents the host that is running pkg01 from adopting pkg02. The ampersand (&) causes the cmmodpkg command to run in the background. It must run in the background to allow the control script to complete.

There is a short time, after one primary node has failed but before the cmmodpkg command has executed, when the other primary node can fail and the adoptive node will adopt its package. In other words, if both thyme and basil fail at approximately the same time, host sage may adopt two packages, even though the package control option is specified.

If you omit the cmmodpkg -d command from the NFS control script, host sage can adopt both pkg01 and pkg02 if their primary nodes fail.

NFS Toolkit Configuration File for pkg01

This section shows the NFS Toolkit configuration file (`hanfs.conf`) for the package `pkg01` on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu011"
NFS_SERVICE_NAME[0]="nfs1.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg1/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Package Configuration File for pkg02

This section shows the package configuration file (pkg2.conf) for the package pkg02 in this sample configuration. The comments are not shown.

```
PACKAGE_NAME               pkg02
PACKAGE_TYPE               FAILOVER
FAILOVER_POLICY            CONFIGURED_NODE
FAILBACK_POLICY            MANUAL
NODE_NAME                  basil
NODE_NAME                  sage
AUTO_RUN                   YES
NODE_FAIL_FAST_ENABLED     NO
RUN_SCRIPT                 /usr/local/cmcluster/pkg2/pkg2.cntl
RUN_SCRIPT_TIMEOUT         NO_TIMEOUT
HALT_SCRIPT                /usr/local/cmcluster/pgk2/pkg2.cntl
HALT_SCRIPT_TIMEOUT        NO_TIMEOUT
SERVICE_NAME               nfs2.monitor
SERVICE_FAIL_FAST_ENABLED  NO
SERVICE_HALT_TIMEOUT       300
SUBNET                     192.100.112.0
```

Package Control Script for pkg02

This section shows the package control script (pkg2.cntl) for the package pkg02 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                # Default
VG[0]="nfsu02"
LV[0]=/dev/nfsu02/lvol1;
FS[0]=/hanfs/nfsu021;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.244"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

The function customer_defined_run_cmds calls the cmmodpkg command with the package control option (-d). This command prevents the host that is running pkg02 from adopting pkg01. The ampersand (&) causes the cmmodpkg command to run in the background. It must run in the background to allow the control script to complete.

There is a short time, after one primary node has failed but before the cmmodpkg command has executed, when the other primary node can fail and the adoptive node will adopt its package. In other words, if both thyme and basil fail at approximately the same time, host sage may adopt two packages, even though the package control option is specified.

If you omit the cmmodpkg -d command from the NFS control script, host sage can adopt both pkg01 and pkg02 if their primary nodes fail.

NFS Toolkit Configuration File for pkg02

This section shows the NFS Toolkit configuration file (`hanfs.conf`) for the package `pkg02` on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu021"
NFS_SERVICE_NAME[0]="nfs2.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg2/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Configuring Multiple Adoptive Nodes for Cascading Failover

This configuration has two packages and three servers. One server is the primary node for both packages. The other servers are adoptive nodes for the two packages. Figure 3-5 illustrates this configuration. Dotted lines indicate which servers are adoptive nodes for the packages. Figure 3-6 illustrates the configuration after host `thyme` fails.

Figure 3-5 **Cascading Failover with Three Servers**

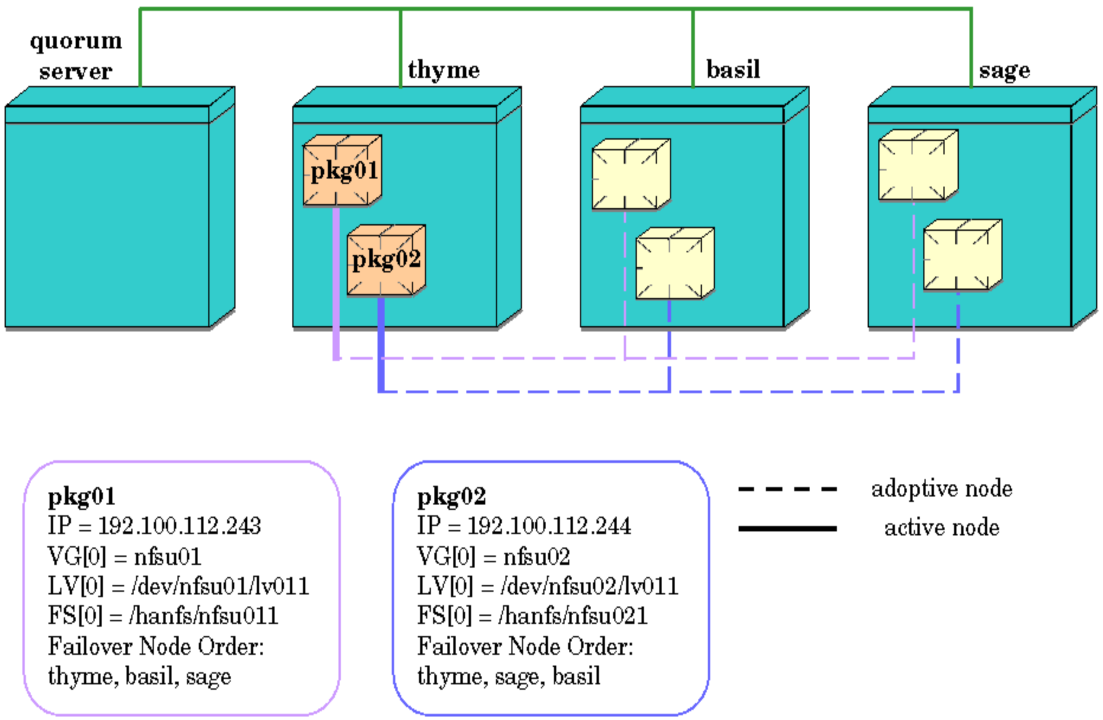
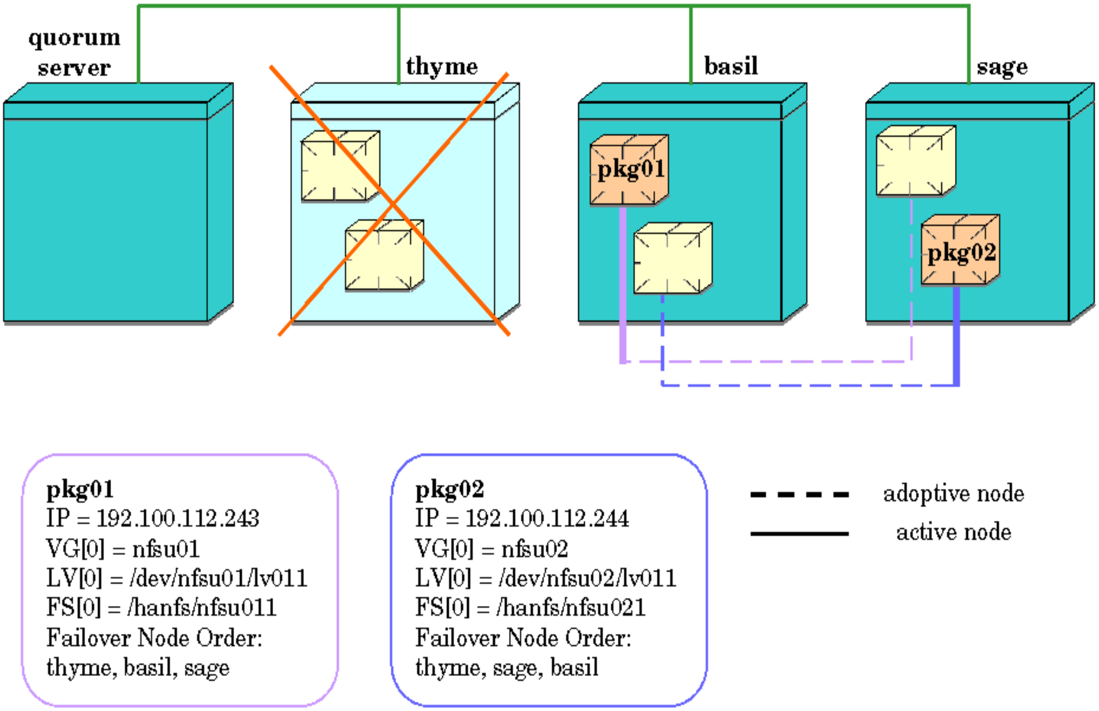


Figure 3-6 shows the cascading failover configuration after host thyme has failed. Host basil is the first adoptive node configured for pkg01, and host sage is the first adoptive node configured for pkg02.

Figure 3-6 **Cascading Failover with Three Servers After One Server Fails**



Cluster Configuration File for Three-Server Cascading Failover

This section shows the cluster configuration file (`cluster.conf`) for this configuration example. The comments are not shown.

```
CLUSTER_NAME                Cascading

QS_HOST                     qs
QS_POLLING_INTERVAL         300000000

NODE_NAME                   thyme
  NETWORK_INTERFACE         eth0
    HEARTBEAT_IP            192.100.112.146
  NETWORK_INTERFACE         eth1

NODE_NAME                   basil
  NETWORK_INTERFACE         eth0
    HEARTBEAT_IP            192.100.112.168

NODE_NAME                   sage
  NETWORK_INTERFACE         eth0
    HEARTBEAT_IP            192.100.112.184
  NETWORK_INTERFACE         eth1
  NETWORK_INTERFACE         eth2

HEARTBEAT_INTERVAL          1000000
NODE_TIMEOUT                5000000

AUTO_START_TIMEOUT          600000000
NETWORK_POLLING_INTERVAL    2000000

MAX_CONFIGURED_PACKAGES     4
```

Package Configuration File for pkg01

This section shows the package configuration file (pkg1.conf) for the package pkg01 in this sample configuration. The comments are not shown.

```
PACKAGE_NAME               pkg01
PACKAGE_TYPE               FAILOVER
FAILOVER_POLICY            CONFIGURED_NODE
FAILBACK_POLICY            MANUAL
NODE_NAME                  thyme
NODE_NAME                  basil
NODE_NAME                  sage
AUTO_RUN                   YES
NODE_FAIL_FAST_ENABLED     NO
RUN_SCRIPT                 /usr/local/cmcluster/pkg1/pkg1.cntl
RUN_SCRIPT_TIMEOUT         NO_TIMEOUT
HALT_SCRIPT                /usr/local/cmcluster/pgk1/pkg1.cntl
HALT_SCRIPT_TIMEOUT        NO_TIMEOUT
SERVICE_NAME               nfs1.monitor
SERVICE_FAIL_FAST_ENABLED  NO
SERVICE_HALT_TIMEOUT       300
SUBNET                     192.100.112.0
```

Package Control Script for pkg01

This section shows the package control script (pkg1.cntl) for the package pkg01 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                # Default
VG[0]="nfsu01"
LV[0]=/dev/nfsu01/lvol1;
FS[0]=/hanfs/nfsu011;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.243"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

NFS Toolkit Configuration File for pkg01

This section shows the NFS Toolkit configuration file (hanfs.conf) for the package pkg01 on this sample configuration:

```
XFS[0]="-o rw *:/hanfs/nfsu011"
NFS_SERVICE_NAME[0]="nfs1.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg1/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Package Configuration File for pkg02

This section shows the package configuration file (pkg2.conf) for the package pkg02 in this sample configuration. The comments are not shown.

```
PACKAGE_NAME                pkg02
PACKAGE_TYPE                FAILOVER
FAILOVER_POLICY             CONFIGURED_NODE
FAILBACK_POLICY             MANUAL
NODE_NAME                   thyme
NODE_NAME                   sage
NODE_NAME                   basil
AUTO_RUN                    YES
NODE_FAIL_FAST_ENABLED      NO
RUN_SCRIPT                  /usr/local/cmcluster/pkg2/pkg2.cntl
RUN_SCRIPT_TIMEOUT          NO_TIMEOUT
HALT_SCRIPT                 /usr/local/cmcluster/pgk2/pkg2.cntl
HALT_SCRIPT_TIMEOUT         NO_TIMEOUT
SERVICE_NAME                nfs2.monitor
SERVICE_FAIL_FAST_ENABLED   NO
SERVICE_HALT_TIMEOUT        300
SUBNET                      192.100.112.0
```

Package Control Script for pkg02

This section shows the package control script (pkg2.cntl) for the package pkg02 in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/
cmcluster/bin
VGCHANGE="vgchange -a y"                # Default
VG[0]="nfsu02"
LV[0]=/dev/nfsu02/lvol1;
FS[0]=/hanfs/nfsu021;
FS_TYPE[0]="ext2";
FS_MOUNT_OPT[0]="-o rw"
# FS_UMOUNT_COUNT=""
# FS_MOUNT_RETRY_COUNT=""
IP[0]="192.100.112.244"
SUBNET[0]="192.100.112.0"
HA_APP_SERVER="pre-IP"
#SERVICE_NAME[0]=""
#SERVICE_CMD[0]=""
#SERVICE_RESTART[0]=""
```

NFS Control Script for pkg02

This section shows the NFS control script (hanfs.sh) for the package pkg02 on this sample configuration on the user-configured part of the script is shown:

```
XFS[0]="-o rw *:/hanfs/nfsu021"
NFS_SERVICE_NAME[0]="nfs2.monitor"
NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg2/nfs.mon"
NFS_SERVICE_RESTART[0]="-r 0"

QUOTA_MON=YES

LOCK_MIGRATION=NO
```

Configuring One Adoptive Node for an NFS package with File Lock Migration

This configuration has two NFS servers and one NFS package, One server is the primary node and the other server is the adoptive node for the NFS package. As shown in Figure 3-7 this sample configuration enables the File Lock Migration Feature.

Figure 3-7 One Adoptive Node for an NFS Package

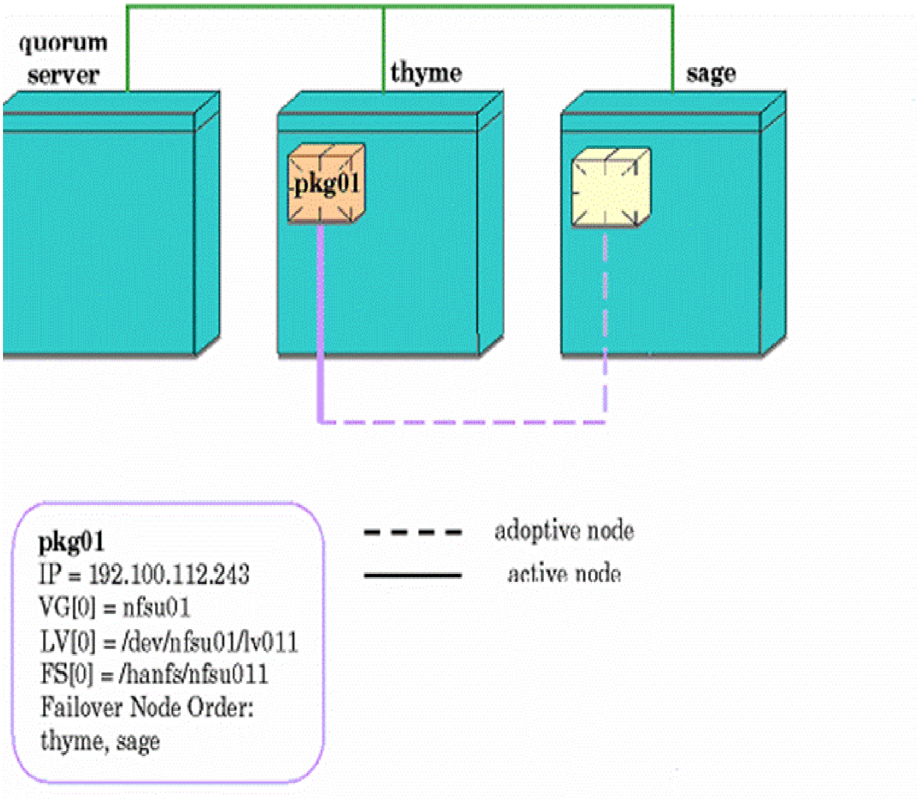
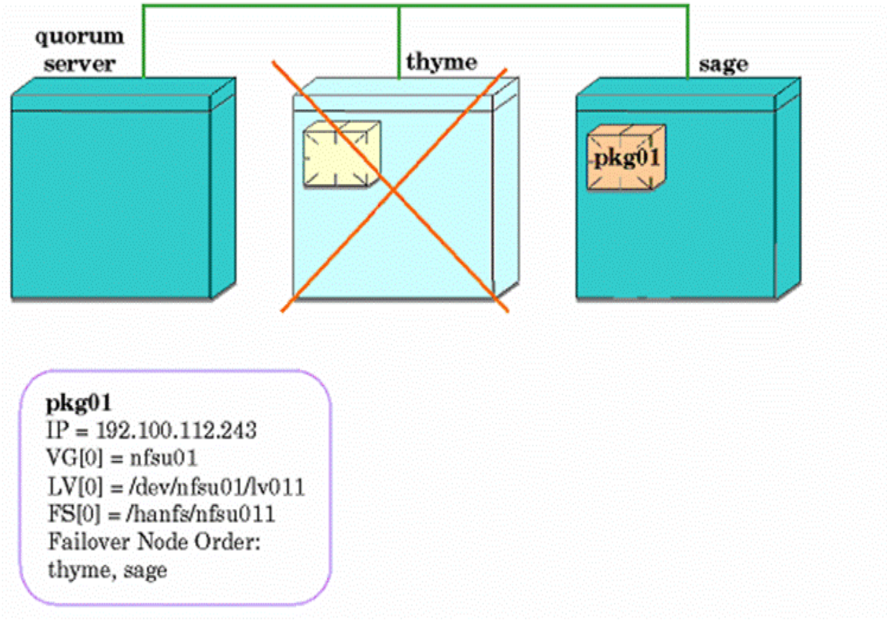


Figure 3-8 shows the same configuration after one primary server has failed. Figure 3-6 shows this sample configuration after host basil has failed. Host sage has adopted pkg02.

Figure 3-8 NFS Package on Adoptive Node After One Server Fails



Cluster Configuration File for Adoptive Node for NFS package with File Lock Migration

This section shows an example of the cluster configuration file (cluster.conf) for NFS package with File Lock Migration. The comments are not shown.

```
CLUSTER_NAME                      PkgCtrl


QS_HOST                           qs

QS_POLLING_INTERVAL               300000000


NODE_NAME                         thyme

  NETWORK_INTERFACE               eth0

    HEARTBEAT_IP                  192.100.112.146

  NETWORK_INTERFACE               eth1


NODE_NAME                         sage

  NETWORK_INTERFACE               eth0

    HEARTBEAT_IP                  192.100.112.184

  NETWORK_INTERFACE               eth1

  NETWORK_INTERFACE               eth2


HEARTBEAT_INTERVAL                1000000

NODE_TIMEOUT                      5000000


AUTO_START_TIMEOUT                600000000

NETWORK_POLLING_INTERVAL          2000000


MAX_CONFIGURED_PACKAGES           4
```

Package Configuration File for pkg01

This section shows an example of the package configuration file (`pkg1.conf`) for the package `pkg01` in this sample configuration. The comments are not shown.

```
PACKAGE_NAME                pkg01

PACKAGE_TYPE                FAILOVER

FAILOVER_POLICY             CONFIGURED_NODE

FAILBACK_POLICY             MANUAL

NODE_NAME                   thyme

NODE_NAME                   sage

AUTO_RUN                    YES

NODE_FAIL_FAST_ENABLED      NO

RUN_SCRIPT                  /usr/local/cmcluster/pkg1/pkg1.cntl

RUN_SCRIPT_TIMEOUT          NO_TIMEOUT

HALT_SCRIPT                 /usr/local/cmcluster/pgk1/pkg1.cntl

HALT_SCRIPT_TIMEOUT         NO_TIMEOUT

SERVICE_NAME                nfs1.monitor

SERVICE_FAIL_FAST_ENABLED   YES

SERVICE_HALT_TIMEOUT        300

SUBNET                      192.100.112.0
```

Package Control Script for pkg01

This section shows the package control script (`pkg1.cntl`) for the package `pkg01` in this sample configuration. Only the user-configured part of the script is shown; the executable part of the script and most of the comments have been omitted.

```
PATH=/sbin:/usr/bin:/usr/sbin:/etc:/bin:usr/local/cmcluster/bi
n

VGCHANGE="vgchange -a y"                # Default

VG[0]="nfsu01"

LV[0]=/dev/nfsu01/lvol1;

FS[0]=/hanfs/nfsu011;
```

```
FS_TYPE[0]="ext2";

FS_MOUNT_OPT[0]="-o rw"

# FS_UMOUNT_COUNT=""

# FS_MOUNT_RETRY_COUNT=""

IP[0]="192.100.112.243"

SUBNET[0]="192.100.112.0"

HA_APP_SERVER="pre-IP"

#SERVICE_NAME[0]=""

#SERVICE_CMD[0]=""

#SERVICE_RESTART[0]=""


function customer_defined_run_cmds

{

$HA_APP_SCRIPT lock_migration:${IP[0]}

test_return 51

}
```

The function `customer_defined_run_cmds` calls the `toolkit.sh` script with `lock_migration:<IP_address>` parameter for file lock migration.

The argument to be passed to the `HA_APP_SCRIPT` for lock migration should contain the same name or IP address used by the clients while mounting the exported file system.

NFS Toolkit Configuration File for pkg01(hanfs.conf)

This section shows the NFS toolkit configuration file (`hanfs.conf`) for the package `pkg01` on this sample configuration. This example enables the File Lock Migration feature.

```
XFS[0]="-o rw *:/hanfs/nfsu011"

NFS_SERVICE_NAME[0]="nfs1.monitor"

NFS_SERVICE_CMD[0]="/usr/local/cmcluster/pkg1/nfs.mon"

NFS_SERVICE_RESTART[0]="-r 0"

LOCK_MIGRATION=YES
```

```
NFS_FLM_HOLDING_DIR="/hanfs/nfsu011/sm"

PROPAGATE_INTERVAL=5

NFS_FLM_MONITOR=YES

NFS_FLM_RESTART=4
```

Index