SGI® InfiniteStorage Cluster Manager for Linux® Administrator's Guide

007–3800–003

CONTRIBUTORS

Written by Lori Johnson

Engineering contributions by Derek Guy Barnes, Dale Brantly, Jeff Cech, Susheel Gokhale, Ron Kerry, LaNet Merrill, Nate Pearlstein, Kevan Rehm, Paddy Sreenivasan

Illustrated by Chrystie Danzer

COPYRIGHT

LIMITED RIGHTS LEGEND

TRADEMARKS AND ATTRIBUTIONS

New Features in this Guide

This release includes the following changes:

- Support for the following hardware and software:
  - SUSE LINUX Enterprise Server 9 (SLES9)
  - SGI Altix 3700 Bx2 servers
  - SGI TP9300 and SGI TP9500 RAID as shared storage
  - 10-Gigabit Ethernet interfaces.
- Changed names for the following commands and directories:
  - `sgicm-config-cluster` graphical user interface (GUI)
  - `sgicm-config-cluster-cmd` command-line interface (CLI)
  - `/usr/share/sgicm-config-cluster`

  For more information, see "Cluster Configuration Tools" on page 27.
- Support for block device filenames rather than XSCSI or raw device filenames.
- Support for the `Check as client` monitor level. See "Step 8: Configure the Service" on page 42.
- "Failed State for a Service" on page 106
- Examples of the Samba Druid and NFS Druid. See "Step 11: Add a Samba Share *(Optional)*" on page 46 and "Step 12: Define the NFS Information *(Optional)*" on page 46.

Record of Revision

Version	Description
001	May 2004 Original publication to support SGI Cluster Manager 3.0 for Linux
002	August 2004 Supports SGI Cluster Manager 3.1 for Linux
003	April 2005 Supports SGI Cluster Manager 4.0 for Linux

Contents

Figures

Tables

About This Guide

This guide provides information about SGI Cluster Manager for Linux, which provides highly available services for SGI Altix servers. An optional product provides high-availability services for CXFS clustered filesystems, local XVM logical volumes, the Data Migration Facility (DMF), and the Tape Management Facility (TMF).

Related Publications

The following publications contain additional information that may be helpful:

- SGI ProPack for Linux and SGI Altix documentation:
  - *NIS Administrator's Guide*
  - *Personal System Administration Guide*
  - *SGI ProPack for Linux Start Here*
  - *SUSE LINUX Enterprise Server for SGI Altix Systems*
  - *SGI Altix 350 System User's Guide*
  - *SGI Altix 3000 User's Guide*
  - *SGI Altix 3700 Bx2 User's Guide*
  - *Performance Co-Pilot for IA-64 Linux User's and Administrator's Guide*
  - *SGI L1 and L2 Controller Software User's Guide*
  - *SGI Altix Systems Dual-Port Gigabit Ethernet Board User's Guide*
- *CXFS Administration Guide for SGI InfiniteStorage*
- *DMF Administrator's Guide for SGI InfiniteStorage*
- *TMF Administrator's Guide*
- *XVM Volume Manager Administrator's Guide*
- *TPM Installation Instructions and User's Guide for SGI TP9100*
- *SGI InfiniteStorage TP9300 and TP9300S RAID User's Guide*

- *SGI® InfiniteStorage TP9400 and SGI® InfiniteStorage TP9500 and TP9500S RAID User's Guide*
- *SGI InfiniteStorage TP9500 and TP9700 RAID User's Guide*
- *SGI TPSSM Administration Guide*

SGI Cluster Manager man pages:

- `clulockd`(8)
- `clumembd`(8)
- `cluquorumd`(8)
- `clurmtabd`(8)
- `clusvcmgrd`(8)
- `sgicm-config-cluster`(8)
- `sgicm-config-cluster-cmd`(8)

Obtaining Publications

You can obtain SGI documentation as follows:

- See the SGI Technical Publications Library at http://docs.sgi.com. Various formats are available. This library contains the most recent and most comprehensive set of online books, release notes, man pages, and other information.
- View release notes on your system by accessing the README file(s) for the product. This is usually located in the `/usr/share/doc/`*productname* directory, although file locations may vary.
- View man pages by typing `man` *title* at a command line.

Conventions

The following conventions are used throughout this document:

Convention	**Meaning**
`command`	This fixed-space font denotes literal items such as commands, files, routines, path names, signals, messages, and programming language structures.
variable	Italic typeface denotes variable entries and words or concepts being defined.
`user input`	This bold, fixed-space font denotes literal items that the user enters in interactive sessions. (Output is shown in nonbold, fixed-space font.)
[ ]	Brackets enclose optional portions of a command or directive line.
...	Ellipses indicate that a preceding element can be repeated.
GUI	This font denotes the names of graphical user interface (GUI) elements such as windows, screens, dialog boxes, menus, toolbars, icons, buttons, boxes, fields, and lists.

Reader Comments

If you have comments about the technical accuracy, content, or organization of this publication, contact SGI. Be sure to include the title and document number of the publication with your comments. (Online, the document number is located in the front matter of the publication. In printed publications, the document number is located at the bottom of each page.)

You can contact SGI in any of the following ways:

- Send e-mail to the following address:

  techpubs@sgi.com

- Use the Feedback option on the Technical Publications Library Web page:

  http://docs.sgi.com

- Contact your customer service representative and ask that an incident be filed in the SGI incident tracking system.
- Send mail to the following address:

  Technical Publications
  SGI
  1500 Crittenden Lane, M/S 535
  Mountain View, California 94043–1351

SGI values your comments and will respond to them promptly.

Chapter 1

Introduction

The SGI Cluster Manager for Linux provides *highly available services* that survive a single point of failure. It uses redundant components and special software to provide services for a cluster that contains two machines or system partitions, known as *members*.

All highly available services are owned by one member at a time. Highly available services are monitored by the SGI Cluster Manager software. If one member fails, the other member restarts the highly available applications of the failed member, known as the *failover process*.

To clients, the services on the backup member are indistinguishable from the original services before failure occurred. It appears as if the original member has crashed and rebooted quickly. Clients that use User Datagram Protocol (UDP) for communication with the server will notice a brief interruption in the highly available service. Clients that use Transmission Control Protocol (TCP) for communication may have to reconnect to the server in case of failure.

Although SGI Cluster Manager for Linux provides similar functionality to IRIX FailSafe, there are differences; see Appendix A, "FailSafe and SGI Cluster Manager" on page 109.

This chapter discusses the following:

- "Base Product" on page 2
- "Optional SGI Software Storage Plug-In Product" on page 2
- "Highly Available Services" on page 3
- "Hardware Requirements" on page 3
- "Software Requirements" on page 6
- "Failover Domains" on page 6
- "Cluster Daemons" on page 8

Base Product

The SGI Cluster Manager base product provides failover support for the following:

- Filesystems (including XFS)
- NFS
- Samba
- IP addresses
- User-defined applications (that is, applications that are not provided by the SGI Cluster Manager product)

Optional SGI Software Storage Plug-In Product

A *plug-in* is the set of software that allows a service to be highly available without modifying the application itself. An optional value-add product supplies plug-ins for the following:

- CXFS clustered filesystems
- Data Migration Facility (DMF)
- XVM volume manager in local mode

This optional product also provides a failover script for the Tape Management Facility (TMF). You can modify your application to use this script to provide highly available services for TMF.

Highly Available Services

A highly available service consists of the following:

- Disks
- IP address
- Filesystem (such as XFS or CXFS)
- NFS (if used)
- Samba (if used)
- User applications (if used)

Hardware Requirements

SGI Cluster manager requires a cluster of exactly two members. The following SGI Altix servers are supported:

- An Altix 350 with an IO10 PCI card, which may use either of the following for remote resets:
  - Serial connection (`l2`), which requires the following:
    - *Multiport serial adapter cable* (a device that provides four DB9 serial ports from a 36-pin connector), must be purchased (part number `CBL-SATA-SERIAL`)
    - Hardware L2 system controller (which must be purchased)
  - Network connection (`l2network`), which requires an additional PCI network interface card must be purchased.
- An Altix 350 with an IO9 PCI card, which must use the L2 Ethernet reset configuration (`l2network`) for remote resets. This requires a hardware L2 system controller that must be separately purchased.

  Note: Customers cannot replace the IO9 PCI card in the Altix 350 with the IO10 PCI card. This procedure requires a new interface board and cables as well as a drive swap from SCSI to SATA. This procedure can only be done by SGI service personnel.

- An Altix 3700 server, which can use either the L2 Ethernet reset configuration (`l2network`) or the L2 serial reset configuration (`l2`). These servers may be partitioned; each system partition is an individual member.
- An Altix 3700 Bx2 server, which must use the L2 Ethernet reset configuration (`l2network`). See "`l2network` Ethernet Connection" on page 16.

SGI Cluster Manager also requires the following:

- Shared quorum partitions without filesystems where configuration, cluster, and service status information is kept by SGI Cluster Manager. For more information, see "Shared Quorum Partitions" on page 11.
- Network cabling: you can connect private network or cross-over cables between members. You have a choice between an Ethernet cable from server to hub or a 20-ft cross-over Ethernet cable.

Note: To use cross-over cabling for a private network, you must purchase another PCI Ethernet card.

Figure 1-1 shows an example configuration using CXFS. A private network is recommended for SGI Cluster Manager. The SGI Cluster Manager members should be able to communicate with the SGI Cluster Manager tiebreaker via the network. The tiebreaker can be a machine or a router or any device that can be connected via the network. (For more information about tiebreakers, see "Step 6: Set the Tiebreakers" on page 39.)

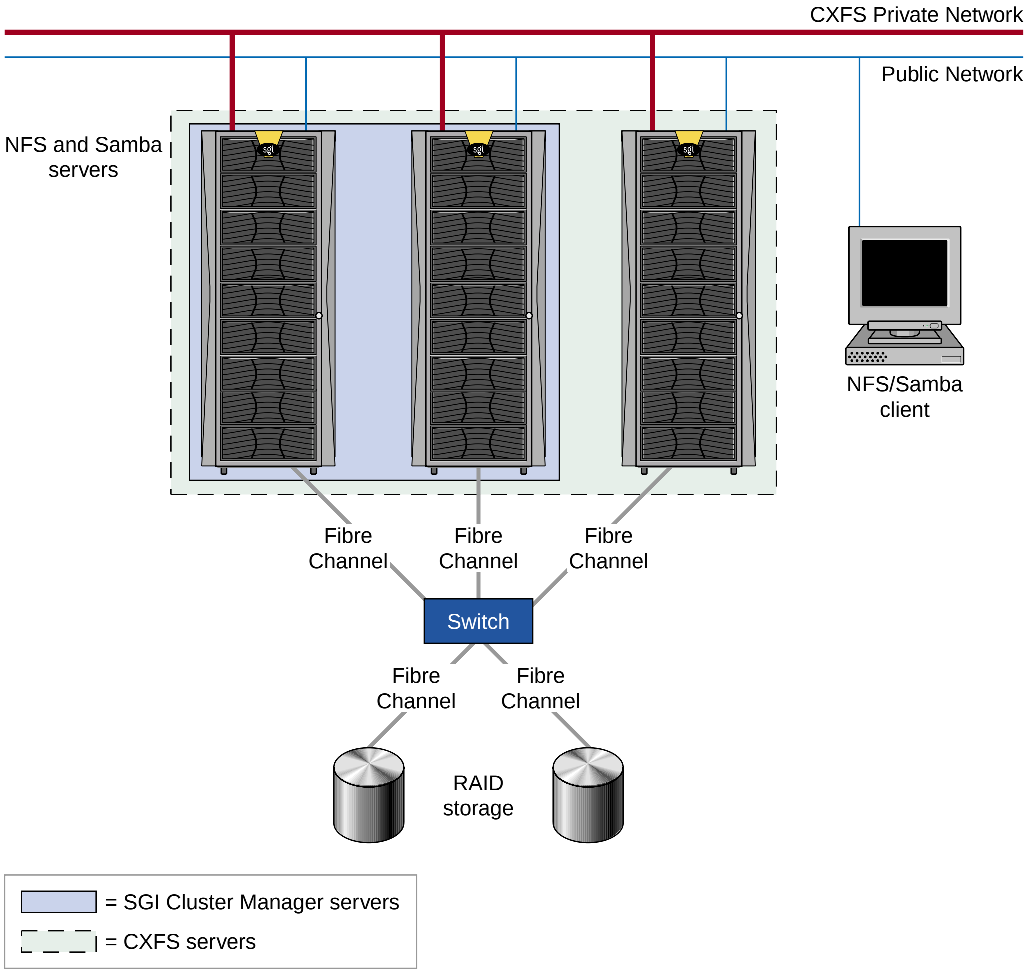


Figure 1-1 An Example CXFS and SGI Cluster Manager Configuration

Software Requirements

SGI Cluster Manager requires the following:

- SGI ProPack 4 for Linux
- SUSE LINUX Enterprise Server 9 (SLES9)

This release also supports the following releases:

- Samba 3.0 as shipped with SLES9 Service Pack 1
- The CXFS Altix server/client release that supports the SGI ProPack 4 base

  Note: Use of clustered XVM volumes with SGI Cluster Manager requires the CXFS plug-in. The SGI Cluster Manager base product supports local XVM volumes.

- DMF for SGI ProPack 4
- TMF for SGI ProPack 4

See "Software Packages" on page 21 and the `README` file for a list of the RPMs included on CDs.

Failover Domains

The *failover domain* is the list of members in the cluster where a service can be online.

Each failover domain has two *failover options* that are considered when a new membership is formed or a failure occurs and a new target member for the service must be determined:

- *Restricted failover* permits failover only to the members listed. If all of the members in the domain are unavailable, the service will stop.

  If a domain is not restricted, a service can run on the member that is not in domain if there is a failure and the member that is in the domain is unavailable. (However, administrative commands cannot relocate the service to a member that is not in the domain, whether or not this option is used.)

- *Ordered failover* causes the service to start on the first member defined (the lowest-ordered) if it is available; if that member is unavailable, the other member will be used. If controlled failback is not set, the service will automatically failback from the second member to the original member when the original member is rebooted after a failure or maintenance period.

Note: *Lowest-ordered* means a higher preference for a service to be started on that member.

Each failover domain also has a *failback option*, which is considered when a member rejoins the cluster. The *controlled failback* option says that a service will not be moved back to the original member when it rejoins the cluster even if it is the preferred member in the list (when ordered failover is used). The system administrator must manually relocate the service in order for it to run on the original member without an intervening failure. Only a new failure will cause a service to be automatically moved.

Suppose you have a cluster members A and B. Table 1-1 describes some of the possible results from using various options under different circumstances for the `nfs` service.

Table 1-1 Failover Domain and Option Results

Failover Domain	Options	Circumstance	Results
(none)	(none)	Newly formed membership	The service will be started on either A or B, randomly chosen
B	(none)	Newly formed membership	The service will be started on B if it is available. If B is not available, the service will be started on A.
B, A	(none)	Newly formed membership	The service will be started on either A or B, randomly chosen. If that member is unavailable, the other will be used. This situation is similar to having no failover domain.
B	(none)	The service is running on B and then B fails	The service will be started on A. The service will remain on A even after B restarts.
B, A	Ordered	Newly formed membership	The service will be started on B if it is available. If B is not available, the service will be started on A.

Failover Domain	Options	Circumstance	Results
B, A	Restricted failover and controlled failback	Newly formed membership	The service will be started on either A or B, randomly chosen. If that member fails, the service will be restarted on the other member and will remain there until the system administrator manually intervenes.
B	Restricted	The service is running on B and then B fails	The service will stop.
B, A	Ordered	The service is running on B and then B fails	The service will be started on A. The service will be moved back to B as soon as it restarts.
B, A	Ordered failover and controlled failback	The service is running on B and then B fails	The service will be started on A. The service will remain on A even after B restarts. To go back to B, the system administrator must manually move the service.

Cluster Daemons

Following is an overview of the cluster daemons:

- `clumembd`(8) is the cluster membership daemon. It performs network heartbeats and checks the liveliness of other members in the cluster.
- `cluquorumd`(8) is the cluster quorum daemon. It computes new membership and implements quorum. It also implements I/O fencing by resetting members that are in failed state and reads/writes membership information to the shared quorum partitions.
- `clurmtabd`(8) is the cluster remote NFS mount table daemon. It synchronizes NFS mount point entries by polling the `/var/lib/nfs/rmtab` file.
- (8)`clusvcmgrd` is the cluster service manager daemon. It starts/stops and checks the status of services running in the cluster.
- `clulockd`(8) is the cluster global lock manager daemon. The locks are stored on the shared quorum partitions.

For more information, see the man pages.

Hardware Installation

This chapter discusses the following:

- "Shared Quorum Partitions" on page 11
- "Heartbeat Network" on page 12
- "Power Controllers" on page 12

For more information about storage configuration, see the following:

- *TPM Installation Instructions and User's Guide for SGI TP9100*
- *SGI InfiniteStorage TP9300 and TP9300S RAID User's Guide*
- *SGI® InfiniteStorage TP9400 and SGI® InfiniteStorage TP9500 and TP9500S RAID User's Guide*
- *SGI InfiniteStorage TP9500 and TP9700 RAID User's Guide*
- *SGI TPSSM Administration Guide*

Shared Quorum Partitions

SGI Cluster Manager for Linux **requires** two 10–MB disk partitions to keep membership quorum: the *primary partition* and the *shadow partition* (used for backup purposes). You should use the block device to access these partitions.

To provide maximum redundancy, the primary partition and the shadow partition should be in different storage devices connected to the members using different Fibre Channel (FC) cards. The two partitions should have independent I/O paths.

SGI Cluster Manager supports SAN configurations using the TP9100, TP9300, and TP9500 RAIDs. Each member in the cluster should be connected to storage using multiple paths so that service failovers are minimized. Ideally, the two shared quorum partitions should be on separate FC controllers at the front end, separate HBAs on the Altix, and on separate RAID logical units (LUNs) or RAID arrays if possible. They should be at least 10 MB in size and the partition type must be `linux`.

The device names for the shared quorum partitions must be identical on all cluster members. Use the /usr/lib/clumanager/create_device_links script to create the same device name on each member.

For more information, see the books listed at the beginning of this chapter.

Heartbeat Network

SGI Cluster Manager uses hostnames for sending heartbeat and control messages to indicate that a member is up and running and to request operations or distribute information. Ethernet cables are provided that will allow the members to be connected directly or connected using a network hub.

You can use 10/100baseT or 1–Gb ports in the system for heartbeat communication. For more information, see *SGI Altix Systems Dual-Port Gigabit Ethernet Board User's Guide*.

Heartbeats are either broadcast on all networks or multicast on the network interface that hostname configured.

Power Controllers

You must use SGI L2 system controllers for power control. Multiple members within a partitioned system may share a single L2 as long as the system serial number on each L1 is the same.

The L2 hardware is an optional product for the Altix 350 and must be purchased. An L2 is standard for each Altix 3700 rack.

Network-based and serial-based power controllers are not supported for SGI Cluster Manager on SGI Altix servers. (However, network-based power controllers should not be confused with the l2network L2 Ethernet connection.)

For information about configuring the power controller, see "Step 4: Add Power Controller Configuration" on page 33.

L2 Connections

Use one of the following for L2 power controllers:

- "`l2` Serial Connection" on page 13
- "`l2network` Ethernet Connection" on page 16

If you have an Altix 3700 Bx2 or run CXFS with SGI Cluster Manger, you must use the `l2network` Ethernet option. See "`l2network` Ethernet Connection" on page 16.

`l2` Serial Connection

A serial connection requires the following:

- Altix 350: serial ports on Altix 350 with IO10 and a `IO10 CBL-SATA-SERIAL` multiport serial adapter cable. You must also order the `LS-BASE-IO` serial ATA (SATA) drive option.

  Figure 2-1 shows the rear panel for an Altix 350. For information about using an Altix 350 with an IO9 PCI card, see "Hardware Requirements" on page 3.

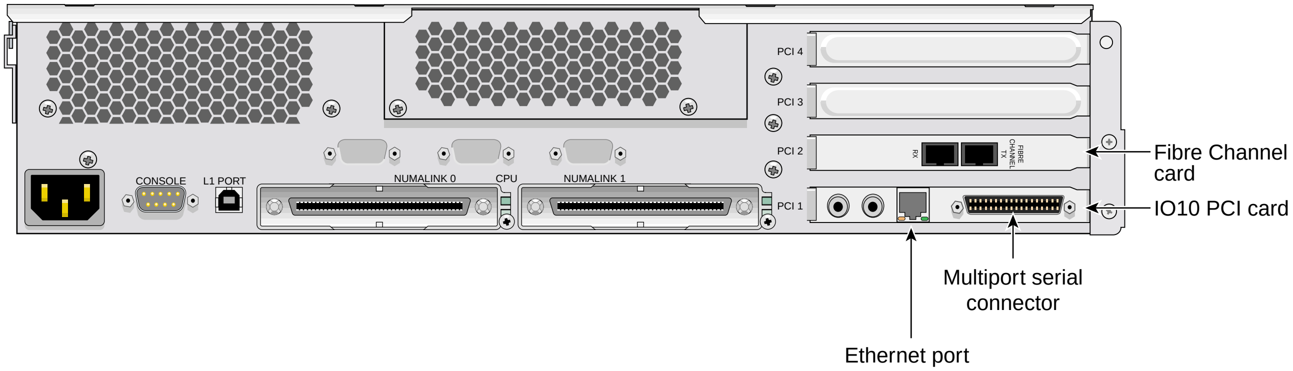


Figure 2-1 Altix 350 Rear Panel

- Altix 3700: DB9 serial ports on an IX-brick.
- Serial cables should use the remote modem port on the L2 system controller. Connect the serial cable to the remote modem port on one end and the `tty` port on the other end.

- The `l2` designation in the cluster database

Figure 2-2 and Figure 2-3 show the serial connections.

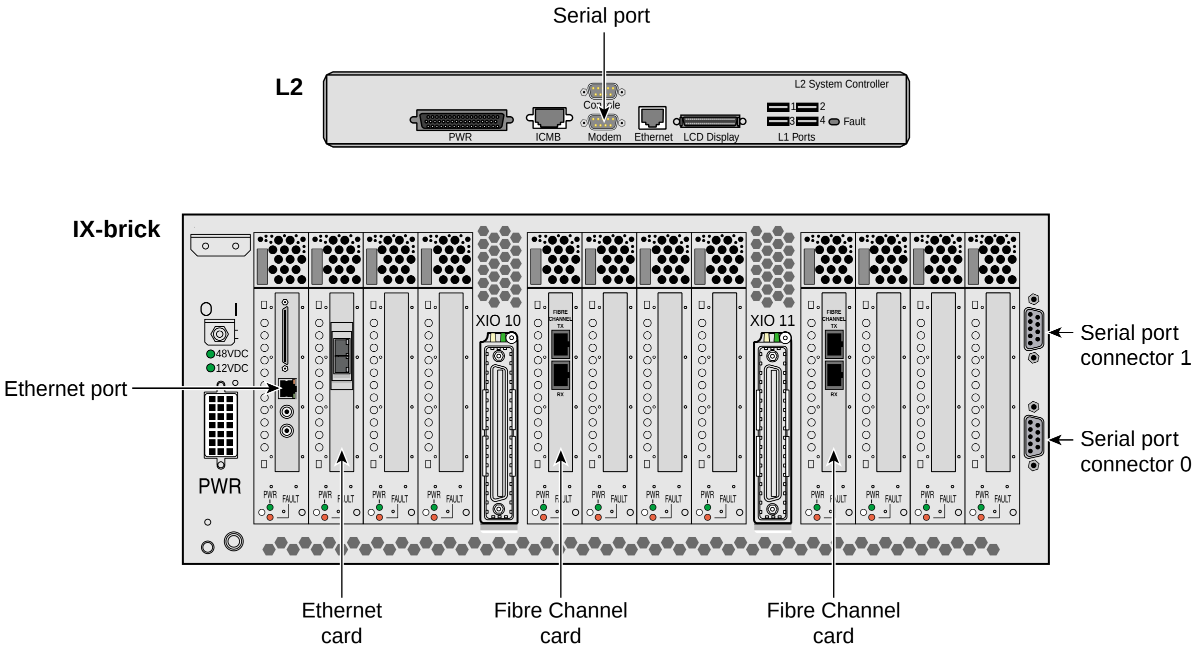


Figure 2-2 Altix 3700 Rear Panel

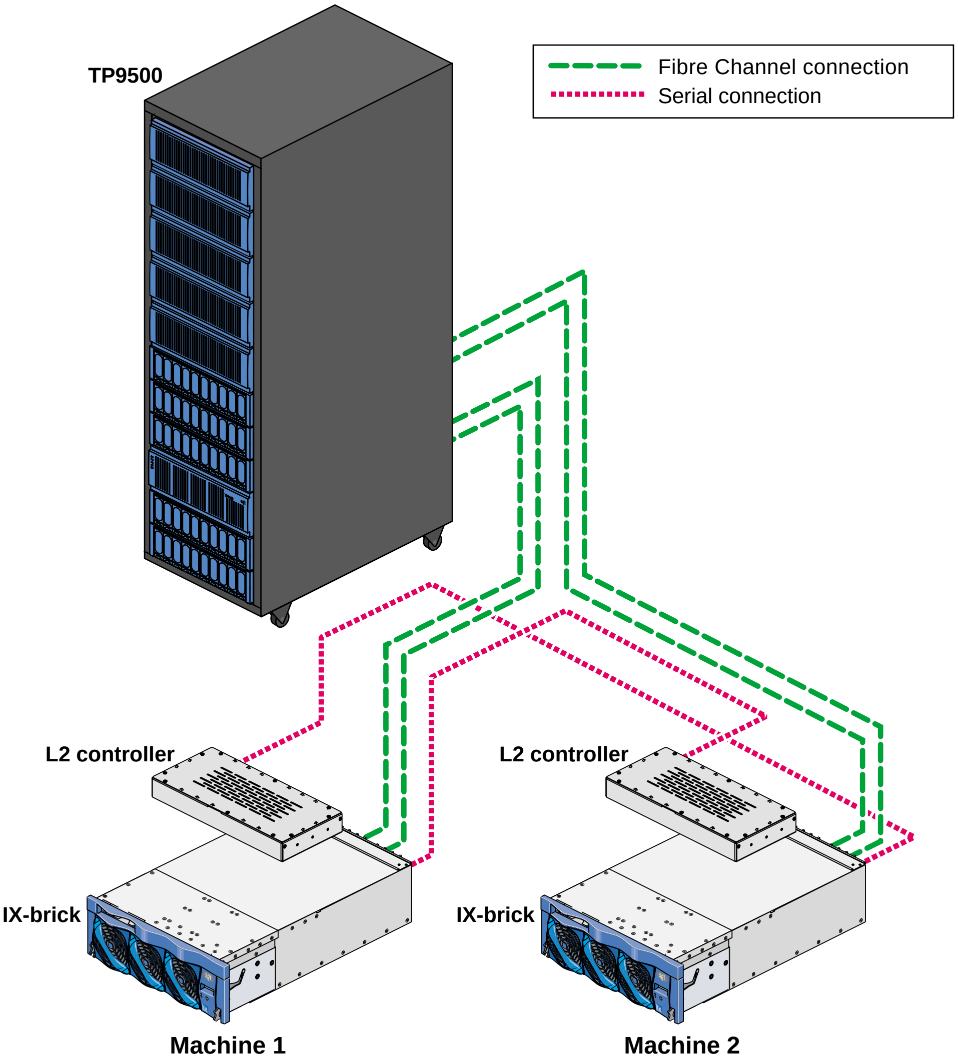


Figure 2-3 Altix 3700 L2 with Serial Cable Connection

`l2network` Ethernet Connection

Ethernet connection requires the following:

- An Ethernet port on each member.
- All members in the cluster and the L2 must be connected to the same network. For reliability reasons, SGI recommends a private network if the Ethernet method is used. (This private network must be separate from the CXFS private network.) If a private network is used, a PCI Ethernet card is required for each member.
- Multiple members within a partitioned system may share a single L2 as long as the system serial number on each L1 is the same.
- The `l2network` designation in the cluster database
- The IP address to be entered for a given node's power controller is the IP address of that node's L2. For example, to specify the power controller for MachineA, enter the IP address for MachineA's L2.

Figure 2-4 shows the L2 Ethernet connection for an Altix 3700.

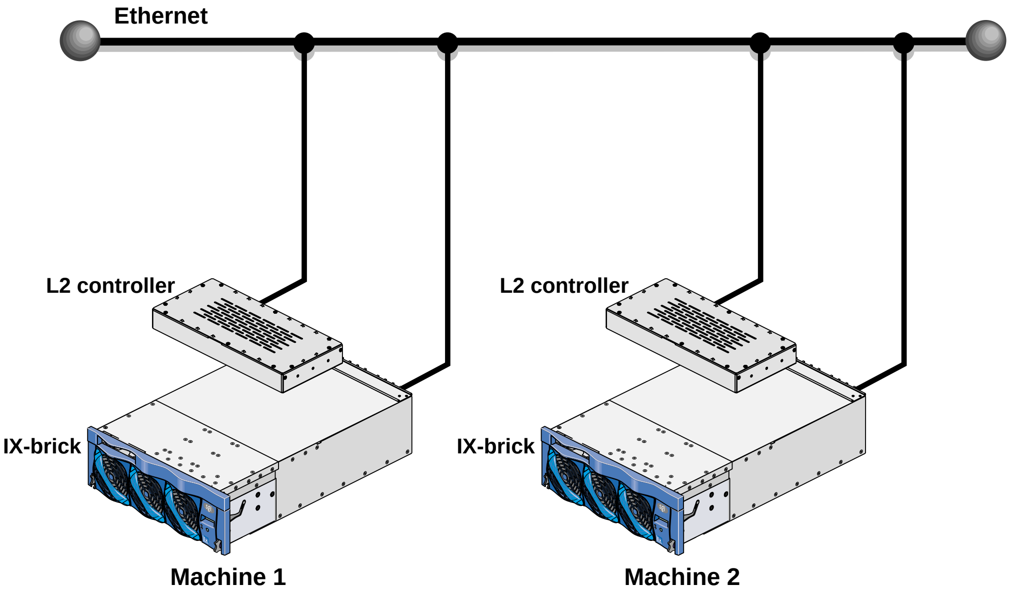


Figure 2-4 Altix 3700 L2 with an Ethernet Connection

Figure 2-5 shows the L1 USB port on an Altix 3700 Bx2 CR brick. Use a USB cable to connect the L1 USB port to the USB/network adapter mounted on the rack. The USB/network adapter should be connected to the network and must be accessible from the other SGI Cluster Manager member via the network.

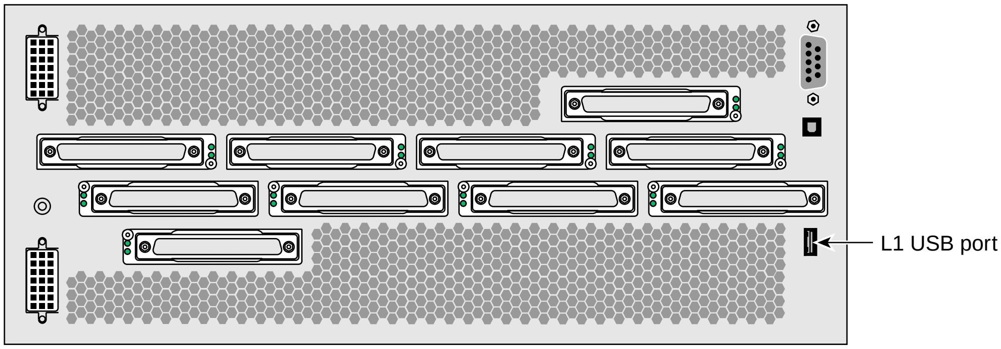


Figure 2-5 Altix 3700 Bx2 CR-brick Rear Panel

Testing Serial Connectivity for the L2

Use the `cu`(1) command to test the serial reset lines.

Note: The `cu` command requires that the `tty` device filenames be in the following format:

`/dev/tty`*XXX*

The command also requires that the device files be accessible by the user `uucp`.

Perform the following steps:

1. Create symlinks to the serial device. For example:

```
# ln -s /dev/ttyIOC1 /dev/ttyI0
```

2. Change the ownership of the device file to `uucp`. For example:

```
# chown uucp.uucp /dev/ttyIOC1
```

3. Use `cu` to define power controllers in SGI Cluster Manager.

Note: You must use parity=even.

For example:

```
# cu -l /dev/ttyI0 -s 38400 --parity=even
Connected.

Jackhammer-001-L2>cfg
L2 192.0.1.133: - 001 (LOCAL)
L1 192.0.1.133:0:0    - 001c04.1
L1 192.0.1.133:0:1    - 001i13.1
L1 192.0.1.133:0:5    - 001c07.2
L1 192.0.1.133:0:6    - 001i02.2
```

For more information, see the cu(1) man page.

You can also use the clufence(8) command to test serial connectivity.

Testing Ethernet Connectivity for the L2

To determine an L2's IP address or to configure an IP address for an L2, connect to the L2 using the serial port and use the L2 ip command.

For example, to show the current IP setting:

```
l2-foo-001-L2>ip
addr: 192.0.2.70   netmask: 255.255.255.0   broadcast addr: 192.0.2.255
```

Note: If you are using DHCP to assign the IP addresses of the L2s dynamically, you will see the following message:

```
l2-foo-001-L2>ip
static IP address not currently set
```

This is not an error, it just indicates that static IP addresses are not in use. To determine the IP address, use the cfg command from the L2 to show each brick and each L2 in the configuration.

To change the IP setting to 63.154.16.7:

```
l2-foo-001-L2> ip 63.154.16.7 255.255.255.0 63.154.16.255
```

You can use the ping command to test connectivity to an L2. You can also use the L2 l2find command to find other L2s in the same subnet. For example:

```
[root@altix root]$ telnet l2-server.acme.com
Trying 192.0.1.98...
Connected to l2-server.acme.com.
Escape character is ’^]’.

Linux 2.4.7-sgil2 (192.0.1.98) (ttyp2)

SGI SN1 L2 Controller

INFO: connection established to localhost, to quit enter <ctrl-]> <>
server-001-L2>help l2find
l2find
        print list of L2’s on the same subnet as this one
server-001-L2>l2find
6 L2’s discovered:

IP              SSN      NAME            RACK FIRMWARE
--------------- -------- --------------- ---- ------------
[ L2’s with different System Serial Numbers ]
  192.0.1.67  R2000016                    000 L3 controlle
  192.0.1.132 L1000487                    001 1.3.61
  192.0.1.96  N0000005  bar               002 1.24.2
  192.0.1.100 N0000005  bar2              003 1.24.2
  192.0.1.94  N0000005  bar3              004 1.24.2
  192.0.1.105 N0000005  bar_l2_2          001 1.22.0
server-001-L2>
```

Chapter 3

Software Installation

This chapter describes how to install the SGI Cluster Manager for Linux software.

This chapter includes the following sections:

- "Software Packages" on page 21
- "Installing the Software" on page 22
- "Upgrading" on page 23
- "Uninstalling the Software" on page 24

Software Packages

The following packages are required:

- Required base product packages from the SGI Cluster Manager base product CD:
  - `clumanager-2.0.0-sles9sgi400r3.ia64.rpm`
  - `sgi-cluster-manager-docs-4.0-1.noarch.rpm`
  - `sgicm-config-cluster-2.0.0-sles9sgi400r3.noarch.rpm`

  Note: The `sgicm-config-cluster` RPM is dependent upon the `clumanager` RPM. You must install the `clumanager-2.0.0` RPM first.

- Required GUI infrastructure packages from the SGI Cluster Manager base product CD:

  ```
  python-gnome-2.0.3-2.ia64.rpm
  python-orbit-2.0.0-177.ia64.rpm
  ```

- Required GUI infrastructure packages from the SUSE LINUX Enterprise Server 9 (SLES9) CDs (some of these may be already installed depending on the installation options selected):

  ```
  control-center2-2.4.0-166.1.ia64.rpm
  eel-2.4.2-72.1.ia64.rpm
  ```

```
gdk-pixbuf-0.22.0-62.1.ia64.rpm
gnome-desktop-2.4.1.1-132.1.ia64.rpm
gnome-panel-2.4.2-63.1.ia64.rpm
libglade-0.17-230.1.ia64.rpm
libgnomeprint-2.5.3-43.1.ia64.rpm
libgnomeprintui-2.5.3-46.1.ia64.rpm
libwnck-2.4.0.1-125.1.ia64.rpm
libzvt-2.0.1-54.1.ia64.rpm
metacity-2.6.3-71.1.ia64.rpm
nautilus-2.4.2-50.1.ia64.rpm
python-gtk-2.0.0-215.1.ia64.rpm
python-xml-2.3.3-88.1.ia64.rpm
pyxml-0.8.3-185.1.ia64.rpm
startup-notification-0.5-319.1.ia64.rpm
```

- Optional high-availability plug-ins for CXFS, DMF, TMF, and local XVM from the SGI Cluster Manager storage software plug-ins CD:

  ```
  clumanager-sgi-2.0.0-sles9sgi400r3.ia64.rpm
  ```

Installing the Software

Do the following:

1. If necessary, upgrade to the supported level of SGI ProPack according to the directions in *SGI ProPack for Linux Start Here*. See "Software Requirements" on page 6.

2. Insert the *SGI Cluster Manager x.x for Linux — Base Product* CD and do the following to mount the CD and see its contents:

```
# mount /dev/cdrom /mnt/cdrom
# cd /mnt/cdrom
# ls
COPYING  README  RPM_MD5_SUMS  SGI  TRANS.TBL
```

   Read the `README` file to learn about any late-breaking changes in the installation procedure.

3. Install the software from the CD using the `rpm`(8) command:

```
# rpm -Uvh clumanager-2.0.0-sles9sgi400r3.ia64.rpm \
sgi-cluster-manager-docs-3.1-1.noarch.rpm \
sgicm-config-cluster-2.0.0-sles9sgi400r3.noarch.rpm

Preparing...                ########################################### [100%]
    1:clumanager             ########################################### [ 33%]
    2:sgi-cluster-manager-doc########################################### [ 67%]
    3:sgicm-config-cluster   ########################################### [100%]
```

   For more information, see the `rpm`(8) man page.

4. If you have purchased the optional high-availability product for CXFS, DMF, TMF, and local XVM, insert the *SGI Cluster Manager x.x for Linux — Storage Software Plug-ins* CD. Do the following to mount the CD and see its contents:

```
# mount /dev/cdrom /mnt/cdrom
# cd /mnt/cdrom
# ls
COPYING  README  RPM_MD5_SUMS  SGI  TRANS.TBL
```

   Read the `README` file to learn about any late-breaking changes in the installation procedure.

5. Install the software from the CD:

```
# rpm -Uvh clumanager-sgi-2.0.0-sles9sgi400r3.ia64.rpm
Preparing...                ########################################### [100%]
    1:clumanager-sgi         ########################################### [100%]
```

Upgrading

To upgrade from the previous release, do the following:

1. Relocate all services to one member. For example:

   ```
   # clusvcadm -r service -m member
   ```

   For more information, see "Service Administration" on page 66.

2. Stop cluster daemons on the member to be upgraded. For example:

   ```
   # /etc/init.d/clumanager stop
   ```

   For more information, see "Stopping Cluster Processes" on page 66.

3. Install the new software as described in "Installing the Software" on page 22.

4. Start the cluster daemons on the member. For example:

   ```
   # /etc/init.d/clumanager start
   ```

   For more information, see "Starting Cluster Processes" on page 65.

5. Relocate the services to the upgraded member if needed. For example:

   ```
   # clusvcadm -r service -m member
   ```

   For more information, see "Service Administration" on page 66.

6. If you modified `/usr/lib/clumanager/create_device_links`, restore your modifications by copying the backup file that is automatically made:

```
# cp /usr/lib/clumanager/create_device_links.rpmsave /usr/lib/clumanager/create_device_links
```

> **Note:** When you install the SGI Cluster Manager software, a new `/usr/lib/clumanager/create_device_links` file is installed. If the `create_device_links` file was modified, the changed file will be will be saved as `/usr/lib/clumanager/create_device_links.rpmsave`.

7. Repeat steps 1 through 6 for the other member.

Uninstalling the Software

To uninstall the software, use the following command:

```
rpm -e rpm_name
```

Uninstalling the `clumanager` RPM will attempt to stop cluster daemons in the local node.

For example:

```
# rpm -e clumanager-2.0.0-sles9sgi400r3 sgi-cluster-manager-docs-4.0-1 \
   clumanager-sgi-2.0.0-sles9sgi400r3
```

For more information, see the rpm(8) man page.

Chapter 4

Configuration

This chapter provides an overview of the cluster configuration tools and the basic configuration process.

Cluster Configuration Tools

SGI Cluster Manager supports the following tools to configure the cluster:

- Graphical user interface (GUI): `sgicm-config-cluster`(8)
- Command-line interface (CLI): `sgicm-config-cluster-cmd`(8)

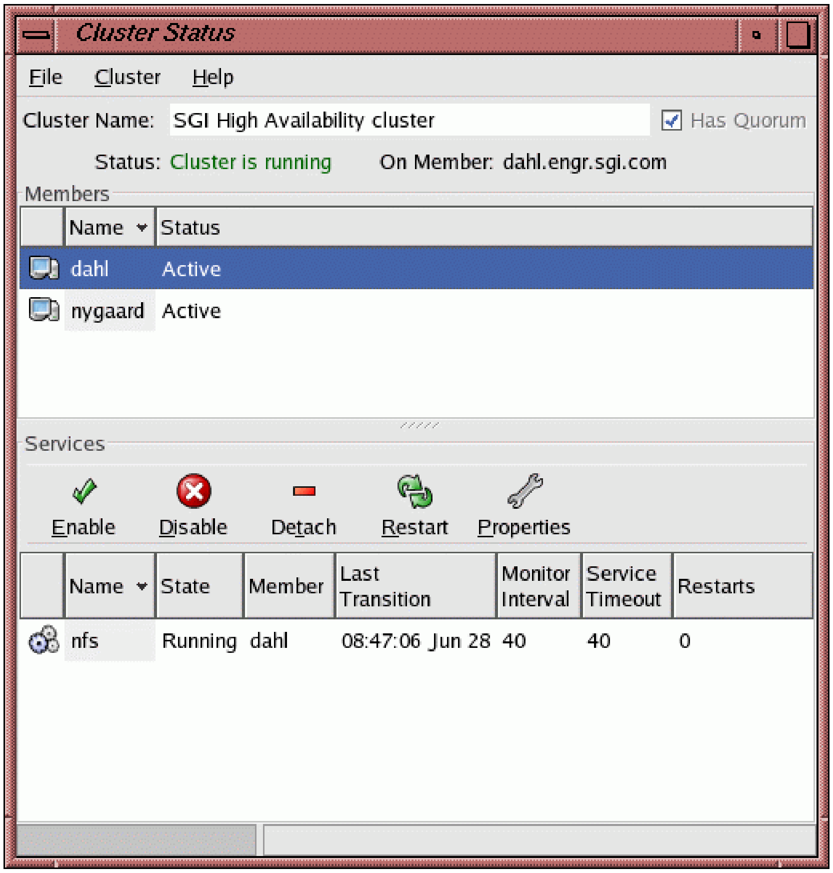
At any given time, you must use only one of these tools to perform configuration tasks. The GUI and the CLI supply similar functionality, although there are a few exceptions.

Note: If you are going to access the GUI remotely, SGI recommends that you use a virtual X server method such as Virtual Network Computing (VNC) for better performance. For more information, see the following RealVNC website:

http://www.realvnc.com/download.html

Displaying Configuration Status

The GUI displays the current status of the cluster. To display more details about an item, select the item and click **Properties**. Figure 4-1 shows an example of the GUI.



Cluster Name: SGI High Availability cluster ☑ Has Quorum

Status: Cluster is running On Member: dahl.engr.sgi.com

Name	Status
dahl	Active
nygaard	Active

Name	State	Member	Last Transition	Monitor Interval	Service Timeout	Restarts
nfs	Running	dahl	08:47:06 Jun 28	40	40	0

Figure 4-1 Cluster Status GUI

In the CLI, enter an argument with =*value* to assign a value or alone (without a =*value*) to display the current setting. For example, the following displays the name of the cluster and the number of times the configuration has been changed:

```
# sgicm-config-cluster-cmd --cluster

cluster:
  name = SGI High Availability cluster
  config_viewnumber = 14
```

Saving Changes

Caution: After making modifications to the configuration using the GUI, you should save the information using the following selections:

File
> Save

The information is written to a local `/etc/cluster.xml` file as well as to the shared quorum partitions.

Configuration Steps

This section discusses the configuration steps:

- "Step 1: Define the Shared Quorum Partitions" on page 30
- "Step 2: Create the Cluster" on page 32
- "Step 3: Define the Members" on page 32
- "Step 4: Add Power Controller Configuration" on page 33
- "Step 5: Change the Heartbeat Interval, Timeout, and Failover Speed" on page 36
- "Step 6: Set the Tiebreakers" on page 39
- "Step 7: Create the Failover Domain" on page 40
- "Step 8: Configure the Service" on page 42
- "Step 9: Add a Service IP Address" on page 44
- "Step 10: Add the Disk and Filesystem Information to the Service *(Optional)*" on page 45
- "Step 11: Add a Samba Share *(Optional)*" on page 46
- "Step 12: Define the NFS Information *(Optional)*" on page 46
- "Step 13: Save the Cluster Configuration *(GUI only)*" on page 47
- "Step 14: Synchronize Configuration Changes Across the Cluster" on page 47

- "Step 15: Verify that Configuration Changes are Synchronized" on page 47
- "Step 16: Start the Cluster Daemons" on page 49

Step 1: Define the Shared Quorum Partitions

The names of the device files for filesystems to store quorum information must be the same on all cluster members. You must do one of the following:

- Ensure that the members have their disks attached identically.
- Create symbolic links (*symlinks*) so that the names of shared quorum partitions are the same on all cluster members . You must re-create the symlinks every time the machine reboots because `/dev` files are re-created. Therefore, you should modify the `/usr/lib/clumanager/create_device_links` script to add the device symlinks that are required.

  For example:

```
#
# Create device links for shared quorum partitions:
# if [ ! -h device_link ]; then
#       ln -s /dev/....  /dev/shared ....
# fi
#

if [ ! -h /dev/shared1 ]; then
         ln -s /dev/sdb1  /dev/shared1
fi

if [ ! -h /dev/shared2 ]; then
         ln -s /dev/sdc1  /dev/shared2
fi
#
# Create device links for shared disks if the disks are not in the
# same I/O slot in all cluster members
#
if [ ! -h /dev/shared_lun2 ]; then
         ln -s /dev/sdd  /dev/shared_lun2
fi
```

SGI recommends that the two shared quorum partitions should be on different FC controllers; ideally, they should be on separate FC controllers at the front end, on separate HBAs on the Altix, and on separate RAID LUNs or RAID arrays if possible. They should be at least 10 MB in size and the partition type must be `Linux`. For more information, see Appendix B, "Setting the Partition Type to `Linux`" on page 113.

You can use the `lspci` command to see the FC cards and you can use the `hwinfo --disk` command to see information about the shared disks. For example:

```
# lspci
...
0000:05:02.0 Fibre Channel: QLogic Corp. QLA2300 64-bit Fibre Channel Adapter (rev 01)
...

# hwinfo --disk --short

disk:
  /dev/sda             SGI ST373307LC
  /dev/sdb             SGI TP9100 FFX2
  /dev/sdc             SGI TP9100 FFX2
  /dev/sdd             SGI TP9100 FFX2
  /dev/sde             SGI TP9100 FFX2
  /dev/sdf             SGI TP9100 FFX2
  /dev/sdg             SGI TP9100 FFX2
  /dev/sdh             SGI TP9100 FFX2
```

For more information, see the `hwinfo`(8) man page.

Partition 1 from disk on FC target 2 and FC target 3 are used for storing shared state. You could create symlinks to the block device filenames:

```
# ln -s /dev/sdb1  /dev/shared1
# ln -s /dev/sdc1  /dev/shared2
```

You should add these symlink commands to the `/usr/lib/clumanager/create_device_links` script on the cluster member. For more information, see the `ln`(1) man page.

The shared quorum partitions are `/dev/shared1` and `/dev/shared2`.

To define the shared quorum partitions in the GUI configuration window, select the following from the **Cluster Configuration** window:

Cluster
> Shared State

In the CLI:

```
sgicm-config-cluster-cmd --sharedstate \
                         --type=raw \
                         --rawprimary=path1 \
                         --rawshadow=path2
```

For example:

```
# sgicm-config-cluster-cmd --sharedstate --type=raw \
--rawprimary=/dev/shared1 --rawshadow=/dev/shared2
```

You should perform this step before defining the cluster ("Step 2: Create the Cluster" on page 32).

Do not modify the `/etc/init.d/clumanager` script.

Step 2: Create the Cluster

To create the cluster in the GUI, type the cluster name in the **Cluster Name** field in cluster configuration window. The default cluster name is `SGI High Availability cluster`.

In the CLI:

```
sgicm-config-cluster-cmd --cluster --name "clustername"
```

Step 3: Define the Members

To define a member in the GUI, do the following:

- Select the following in the **Cluster Status** window:

  Cluster
  > Configure

- Click the **Members** tab.

- Click **New**.
- Provide the hostname to be used for communication. SGI recommends that hostnames are resolvable using the `/etc/hosts` file rather than using DNS/NIS.
- Disable the software watchdog.

Note: The software watchdog is not supported by the SGI Cluster Manager.

In the CLI (where the watchdog is disabled by default):

```
sgicm-config-cluster-cmd --add_member --name=membername
```

Step 4: Add Power Controller Configuration

For each member, you must provide information about its power controller. The SGI Cluster Manager supports the L2 system controller using either serial cables or Ethernet cables. (The **Serial** and **Network** power controllers shown in the GUI are not supported by SGI Cluster Manager. However, network-based power controllers should not be confused with the `l2network` L2 Ethernet connection.)

In the GUI **Cluster Configuration** window, select the member and click **Add Child**. The fields for SGI controllers are as follows:

- **Type**: the power controller type of the member being defined (the local member):
  - `l2` for an L2 using serial cables (default in the GUI).
  - `l2network` for an L2 using the Ethernet connection. Altix partitions can share the same L2 in this configuration. You must use `l2network` if you are using an Altix 3700 Bx2 or are also running CXFS.

  This is the `type` field in the CLI; in the CLI, there is no default value.

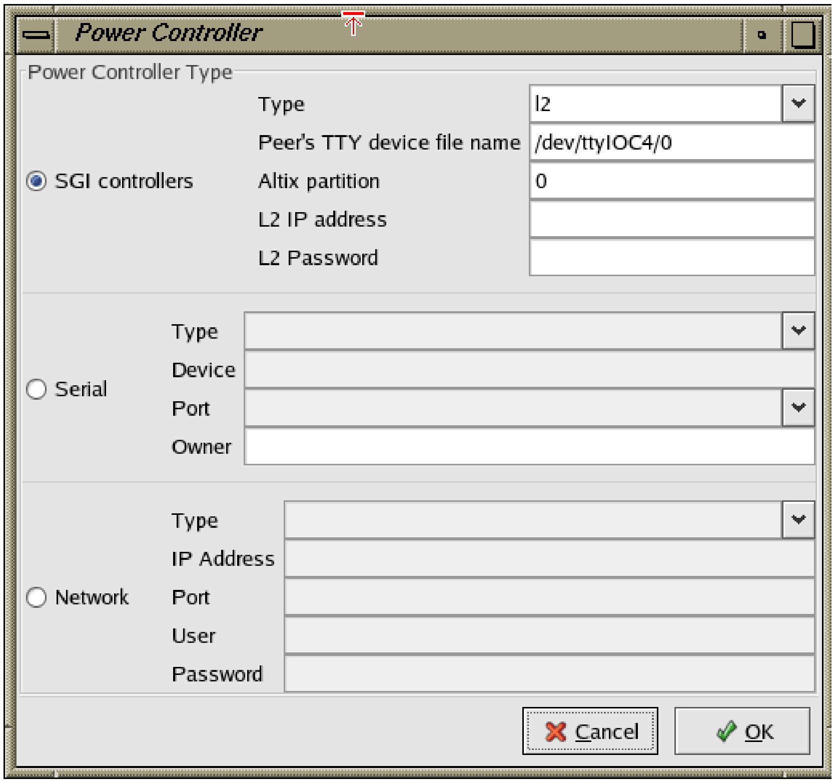
- **Peer's TTY device file name**: the `tty` device filename on the **peer member** to which the local system controller is connected. The default value in the GUI is `/dev/ttyIOC1`.

  This is the `device` field in the CLI.

- **Altix partition**: the local member's system partition ID. If there are no partitions, partition ID is `0`. The default value in the GUI is `0`.

  This is the `partion` field in the CLI.

Figure 4-2 shows an example in the GUI for an L2 using serial cables and Figure 4-3 shows an example for an L2 using the Ethernet network.



Power Controller

Power Controller Type

● SGI controllers

Type: l2
Peer's TTY device file name: /dev/ttyIOC4/0
Altix partition: 0
L2 IP address:
L2 Password:

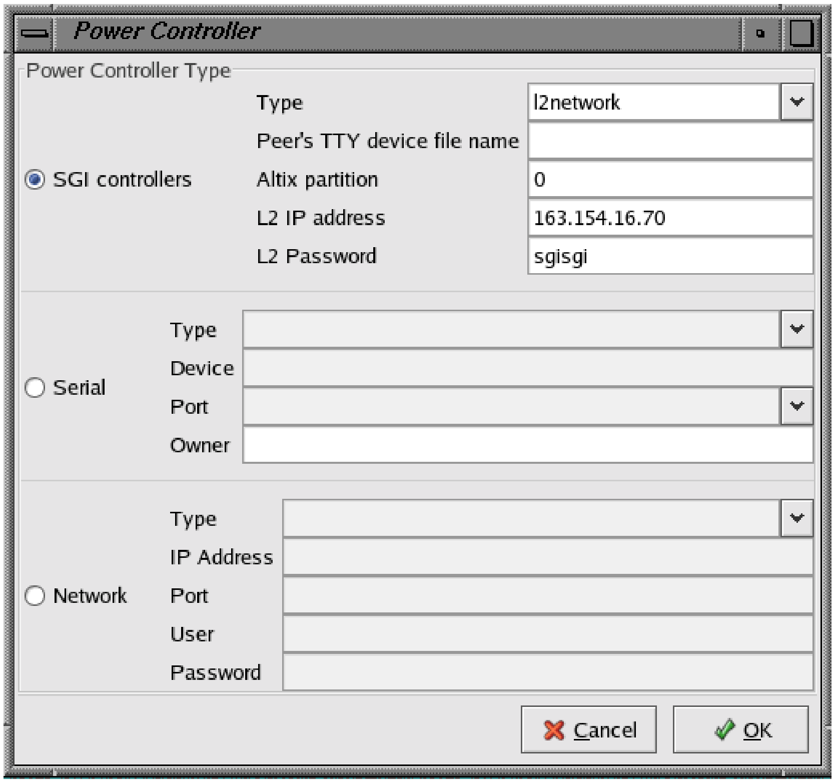
○ Serial

Type:
Device:
Port:
Owner:

○ Network

Type:
IP Address:
Port:
User:
Password:

Figure 4-2 Power Controller Information for an L2 Using Serial Cables



Power Controller

Power Controller Type

● SGI controllers

Type: l2network

Peer's TTY device file name:

Altix partition: 0

L2 IP address: 163.154.16.70

L2 Password: sgisgi

○ Serial

Type:

Device:

Port:

Owner:

○ Network

Type:

IP Address:

Port:

User:

Password:

Figure 4-3 Power Controller Information for an L2 Using an Ethernet Network

In the CLI:

```
sgicm-config-cluster-cmd --member=membername \
                         --add_powercontroller \
                         --type=l2|l2network \
                               required only for l2network:
                               --ipaddress=L2_IPaddress \
                               --password=L2_password_(if_defined) \
                               --partition=Altix_partition_ID \
                          --device=/dev/ttyIOCx \
                          --partition=n
```

You can optionally set a password for the L2 to prevent unauthorized access to L2 functions via Ethernet. If you choose to use this security feature, SGI Cluster Manager must know the password in order to access L2 functionality. For more information, see *SGI L1 and L2 Controller Software User's Guide*.

For example, the following defines an L2 using the Ethernet method:

```
# sgicm-config-cluster-cmd --member=member1  --add_powercontroller \
--type=l2network --ipaddress=190.2.0.100 --partition=3 --password=foo
```

For example, the following defines an L2 using the serial cable method:

```
# sgicm-config-cluster-cmd --member=member1  --add_powercontroller \
--type=l2
```

For hardware information, see "Power Controllers" on page 12.

Step 5: Change the Heartbeat Interval, Timeout, and Failover Speed

You can modify the time it takes to detect a member failure, known as the *failover speed*.

Note: The default failover speed differs depending upon which tool (GUI or CLI) you use to define the cluster. You cannot change the value for failover speed while the cluster daemons are running.

Failover Speed and the GUI

In the GUI, you can supply the failover speed directly:

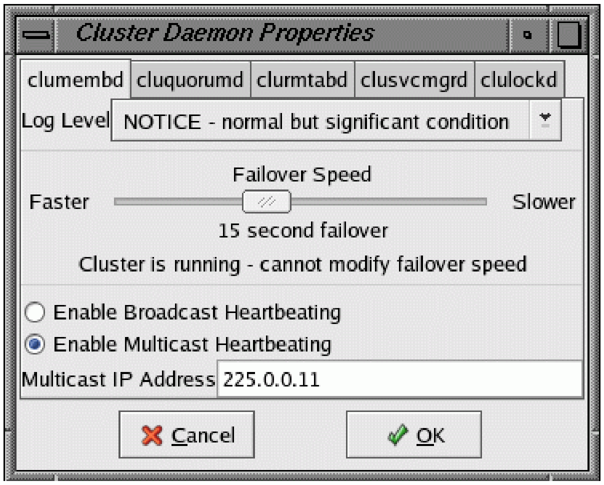
1. In the **Cluster Configuration** window, select the following:

   Cluster
   > Daemon properties

2. Select the **clumembd** tab

3. Use the sliding bar to adjust failover speed, as shown in Figure 4-4. The GUI provides 15 seconds as the default failover speed value.

4. You can choose to enable either broadcast heartbeating or multicast heartbeating.



Log Level: NOTICE - normal but significant condition

15 second failover

Cluster is running - cannot modify failover speed

○ Enable Broadcast Heartbeating

● Enable Multicast Heartbeating

Multicast IP Address: 225.0.0.11

Figure 4-4 Adjusting Failover Speed

Failover Speed and the CLI

The `clumembd` daemon lets you specify the failover speed indirectly by defining the heartbeat interval and the timeout, from which the failover speed is automatically calculated:

- `interval` specifies the *heartbeat interval*, which is the number of microseconds before a heartbeat is sent to all other members in the cluster. The default value is 500000 (0.5 seconds).

- `tko_count` specifies the *heartbeat timeout*, which is the number of heartbeats missed before a member is declared as failed. The default value is 20.

Note: The GUI does not let you display or set the heartbeat interval or the heartbeat timeout individually.

The failover speed is calculated as follows:

interval_value * *tko_count_value* = *failover_speed*

Therefore, the default member failure detection time is 10 seconds (0.5 * 20 = 10).

Table 4-1 shows the failure detection times and parameter values that are supported.

Table 4-1 Supported Failure Detection Times and Parameter Values

Failover Speed (in seconds)	`interval` (in microseconds)	`tko_count`
30	1000000	30
25	1000000	25
20	1000000	20
15	750000	20
10	500000	20
5	330000	15

For example, the following command displays the heartbeat `interval` and `tko_count` values:

```
# sgicm-config-cluster-cmd --clumembd

clumembd:
  loglevel = 5
  interval = 500000
  tko_count = 20
  thread = yes
  broadcast = no
  multicast = yes
  multicast_ipaddress = 225.0.0.11
```

The failover speed is therefore 10 seconds. The following command changes the failover speed 15 seconds:

```
# sgicm-config-cluster-cmd --clumembd --interval=750000 --tko_count=20
```

Note: You cannot change the values for `interval` and `tko_count` while the cluster daemons are running.

For more information about using the command-line interface, see `sgicm-config-cluster-cmd` man page.

Step 6: Set the Tiebreakers

There are two types of tiebreakers:

- *Network tiebreaker* is used to avoid a *split-brain scenario,* in which both members attempt to form individual clusters. The network tiebreaker ensures that only the member that can contact the tiebreaker IP address is able to form a cluster. The network tiebreaker is the IP address of a machine or a router that **does not participate** in the cluster. Usually, it is the IP address of a network router that connects the members to the external world (clients).

  Note: You must verify that the network tiebreaker can be accessed by the `ping`(1) command. (Some sites like to disable internet control message protocols at routers so the router or machines more than one hop away do not answer; such a router or machine could not be used as a tiebreaker.)

- *Disk tiebreaker*: If two members cannot talk to each other, they look at the status on the shared quorum partition disk to decide which member should survive and be part of the cluster membership. If the disk cannot be accessed or membership on the disk does not include a given machine, all SGI Cluster Manager processes on the machine exit. You can specify the number of seconds between the updates to the on-disk status. In the GUI, the default is 2 seconds.

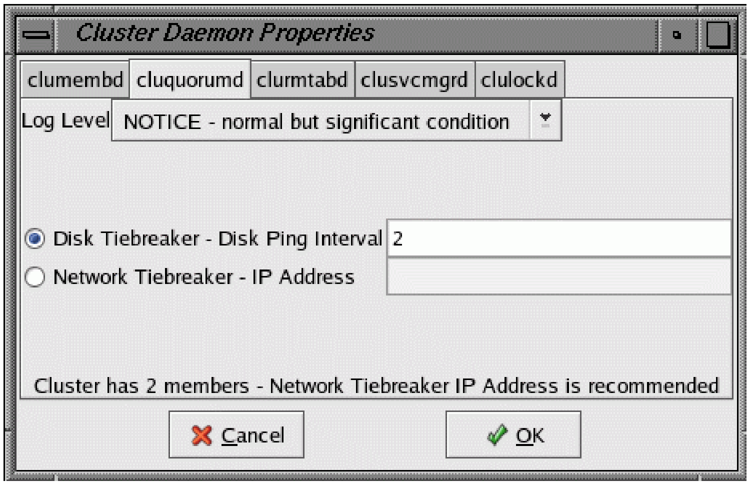
In the GUI:

1. Select the following in the **Cluster Configuration** window:

   Cluster
       > Daemon properties

2. Select the **cluquorumd** tab.
3. Specify the desired values for the tiebreakers.

Figure 4-5 shows an example of the **cluquorumd** window.



Log Level NOTICE - normal but significant condition

● Disk Tiebreaker - Disk Ping Interval 2

○ Network Tiebreaker - IP Address

Cluster has 2 members - Network Tiebreaker IP Address is recommended

Figure 4-5 Tiebreakers

In the CLI:

```
sgicm-config-cluster-cmd --cluquorumd \
                         --tiebreaker_ip=IPaddress \
                         --pinginterval=seconds
```

Step 7: Create the Failover Domain

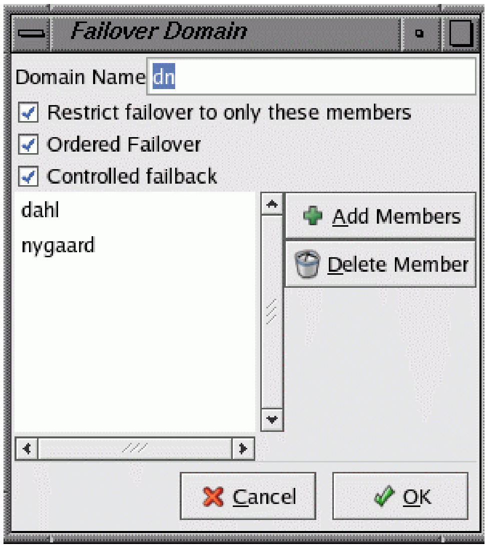
The failover domain is optional; if a failover domain is not defined, the service will be started on any member. For more information, see "Failover Domains" on page 6.

In the GUI **Cluster Configuration** window:

1. Select the **Failover Domains** tab.
2. Click **New**.
3. Enter the domain name and choose the desired failover and failback options.
4. Click **OK** to create the domain.

For information about the failover and failback options, see "Failover Domains" on page 6.

Figure 4-6 shows an example.



Domain Name dn

☑ Restrict failover to only these members

☑ Ordered Failover

☑ Controlled failback

dahl
nygaard

Figure 4-6 Failover Domain

In the CLI:

```
sgicm-config-cluster-cmd --add_failoverdomain \
                         --name=domainname   \
                         --restricted=yes|no \
                         --ordered=yes|no \
                         --controlled=yes|no

sgicm-config-cluster-cmd --failoverdomain=domainname \
                         --add_failoverdomainnode \
                         --name=membername
```

The default for `--restricted`, `--ordered`, and `--controlled` is `no`.

Step 8: Configure the Service

You can specify the following for a service (the service must be disabled in order to configure it):

- Service name.

  Note: If you are using the GUI, you cannot include white space within a service name.

- Failover domain name (see "Step 7: Create the Failover Domain" on page 40).
- Monitor interval (in seconds).
- Service timeout (in seconds), which is common for all actions (start, stop, and status check) that apply to the service. A service timeout of `0` means that there is no timeout (the service action will never timeout).

  Note: You cannot specify individual timeouts for each resource within the service nor for each action (stop/start/monitor).

- Monitor level (for NFS and Samba only):
  - `Check for processes`

    NFS checks for `nfsd` processes.

    Samba checks for `smb` and `nmb` processes
  - `Check as client`

    NFS sends null RPCs to the NFS server.

    Samba sends `smb` and `nmb` queries to the samba server.
- Restart count limit, which is the number of local restarts allowed for a service. When the limit is exceeded, the service is failed over to the other member. If there are no monitor failures for a day, the number of restart failures is reinitialized to 0. The maximum is 500.
- User application script or directory, if applicable.

In this field, you can specify a directory that contains scripts or an individual script. A script contain shell functions to fail over user applications. This directory or the script is specified as a service parameter.

Each function will be called with two parameters:

- An action: one of `start`, `stop`, or `status`
- A service ID

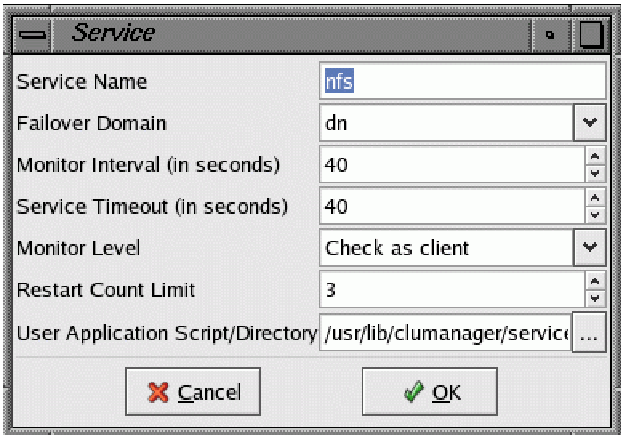
If successful, the function must return 0; if it fails, it must return a non-zero value.

For an example script, see "Sample User Application Script" on page 74.

In the GUI **Cluster Configuration** window:

1. Select the **Services** tab.
2. Click **New**.
3. Enter the desired values.
4. Click **OK** to create the service.

Figure 4-7 shows an example of configuring an NFS high-availability service.



Service Name	nfs
Failover Domain	dn
Monitor Interval (in seconds)	40
Service Timeout (in seconds)	40
Monitor Level	Check as client
Restart Count Limit	3
User Application Script/Directory	/usr/lib/clumanager/service

Figure 4-7 Configuring a High-Availability Service

In the CLI:

```
sgicm-config-cluster-cmd --add_service \
                         --name=servicename \
                         --failoverdomain=domainname \
                         --checkinterval=seconds \
                         --servicetimeout=seconds \
                         --monitorlevel="level" \
                         --restartcount=N \
                         --userscript=pathname
```

Note: The monitoring-level string values are case-sensitive and should be either of the following:

```
"Check for processes"
"Check as client"
```

Step 9: Add a Service IP Address

In the GUI **Cluster Configuration** window:

1. Select the **Services** tab.
2. Select the service name.
3. Click **Add Child**.
4. Choose **Add service IP address** and click **OK**.
5. Enter the IP address and optional netmask and broadcast address.
6. Click **OK**.

In the CLI:

```
sgicm-config-cluster-cmd --service=servicename \
                         --add_service_ipaddress \
                         --ipaddress=IPaddress \
                         --netmask=netaddress \
                         --broadcast=broadcastaddress
```

Step 10: Add the Disk and Filesystem Information to the Service *(Optional)*

In the GUI **Cluster Configuration** window:

1. Select the **Services** tab.
2. Select the service name.
3. Click **Add Child**.
4. Choose **Add Device** and click **OK**.
5. Enter information for the following, as appropriate:
   - Device special filename.
   - Samba share name.
   - Local XVM physical volumes (physvols). This must be a comma-separated list.
   - Mount point.
   - Filesystem type `xfs` or `cxfs` (if using the CXFS plug-in). Default is `xfs`.
   - Mount options

   Enable **Force Unmount**.
6. Click **OK**.

In the CLI:

```
sgicm-config-cluster-cmd --service=servicename \
                         --add_device \
                         --name=path

sgicm-config-cluster-cmd --service=servicename \
                         --device=path \
                         --mount   \
                         --mountpoint=mountpoint \
                         --fstype=xfs|cxfs \
                         --options=mountoptions \
                         --forceunmount=yes
```

Step 11: Add a Samba Share *(Optional)*

Samba share names must be unique within the cluster.

The **Samba Druid** is a configuration guide that lets you create a new Samba service or add Samba to an existing service. In the GUI **Cluster Configuration** window, start the **Samba Druid** by selecting the following:

Add Exports
> Samba

For more information, see "Samba Druid Example" on page 50.

In the CLI:

```
sgicm-config-cluster-cmd --service=servicename \
                         --device=path \
                         --sharename=sharename
```

Step 12: Define the NFS Information *(Optional)*

Define the NFS export point and NFS client information.

The **NFS Druid** is a configuration guide that lets you create a new NFS service or add NFS export points to an existing service. In the GUI **Cluster Configuration** window, start the **NFS Druid** by selecting the following:

Add Exports
> NFS

For more information, see "NFS Druid Example" on page 55.

In the CLI:

```
sgicm-config-cluster-cmd --service=servicename \
                         --device=path \
                         --add_nfsexport \
                         --name=exportdirectory

sgicm-config-cluster-cmd --service=servicename \
                         --device=path \
                         --nfsexport=exportpath \
                         --add_client \
                         --name=\* \
                         --options=options
```

The value * for the NFS client name means “all NFS clients.” For better security, supply a list of NFS client systems instead of the * character. For more information, see the exports(4) man page.

Step 13: Save the Cluster Configuration *(GUI only)*

If you are using the GUI, you must explicitly save the configuration information as noted in "Cluster Configuration Tools" on page 27. Select the following from the **Cluster Configuration** window:

File
> Save

Step 14: Synchronize Configuration Changes Across the Cluster

You must manually copy the /etc/cluster.xml file to the other member in the cluster whether you use the GUI or the CLI.

Step 15: Verify that Configuration Changes are Synchronized

Each member has an /etc/cluster.xml file that contains cluster configuration information. If you make a change to this file on one member, you must copy the file to the other member using a command such as scp(1).

After making configuration changes, you must verify that the configuration files across the cluster are in synchronization. To do this, you can run the following command on each node and compare the config_viewnumber value on each, which lists the configuration file version number:

```
sgicm-config-cluster-cmd --cluster
```

The config_viewnumber value is updated each time a change is made to the configuration file.

For example, the following output from Machine1 and Machine2 shows that the configuration files are in synchronization for `test-cluster` because they both have the same `config_viewnumber` value (`10`):

- Machine1:

  ```
  Machine1# sgicm-config-cluster-cmd  --cluster
  cluster:
    name = test-cluster
    config_viewnumber = 10
  ```

- Machine2:

  ```
  Machine2# sgicm-config-cluster-cmd  --cluster
  cluster:
    name = test-cluster
    config_viewnumber = 10
  ```

In another example, the following output from Machine1 and Machine2 shows that the configuration files are out synchronization because they have different`config_viewnumber` values (`10` and `11`):

- Machine1:

  ```
  Machine1# sgicm-config-cluster-cmd  --cluster
  cluster:
    name = test-cluster
    config_viewnumber = 10
  ```

- Machine2:

  ```
  Machine2# sgicm-config-cluster-cmd  --cluster
  cluster:
    name = test-cluster
    config_viewnumber = 11
  ```

If the `config_viewnumber` values are different, then configuration files are different. You should copy the configuration file with higher `config_viewnumber` number (which indicates the more recent configuration file) to the other member. In this case, you would copy the configuration file from Machine2 (which has the higher number of `11`) to Machine1 (which has the lower number of `10`).

Step 16: Start the Cluster Daemons

To automatically restart the SGI Cluster Manager daemons after a reboot, do the following in the CLI:

1. Enter the following command:

   ```
   # chkconfig clumanager on
   ```

2. Start local cluster daemons on each member in the cluster by doing either of the following:

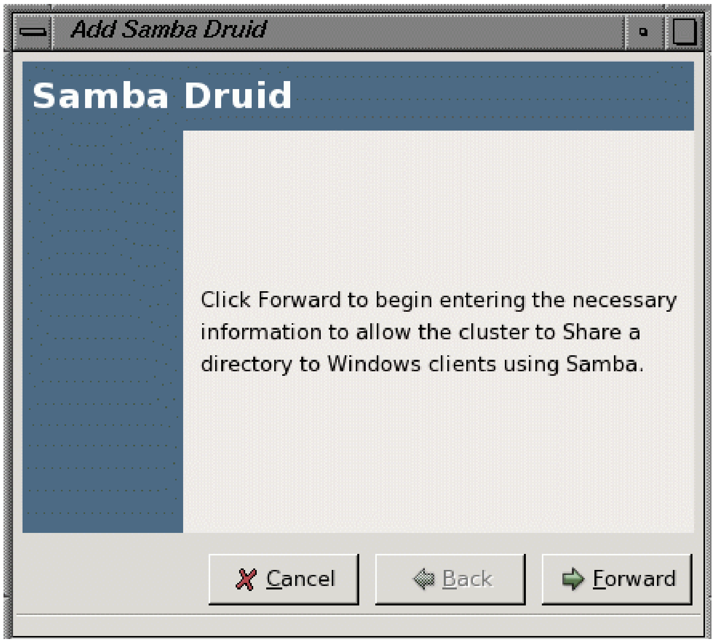
   - Enter `/etc/init.d/clumanager start`
   - In the GUI, select the following in the **Cluster Status** window:

     Cluster
     > Start Local Cluster Daemons

For more information, see Chapter 5, "Administration" on page 63.

Samba Druid Example

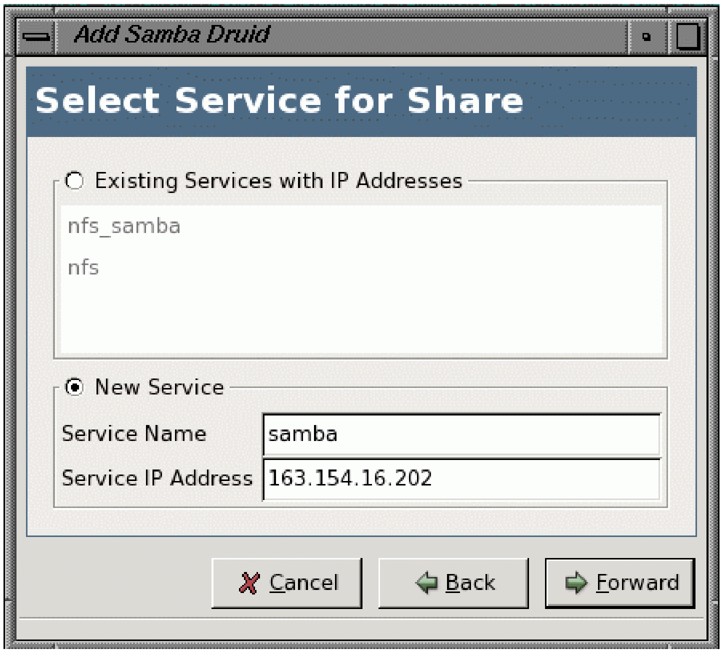
Figure 4-8 shows the **Samba Druid** initial window. Click **Forward** to configure the Samba service.



Click Forward to begin entering the necessary information to allow the cluster to Share a directory to Windows clients using Samba.

Figure 4-8 Samba Druid

You can choose to add Samba to an existing service or to create a new Samba service. In Figure 4-9, a new Samba service named `samba` with service IP address `163.154.16.202` is being created.



Select Service for Share

○ Existing Services with IP Addresses

nfs_samba

nfs

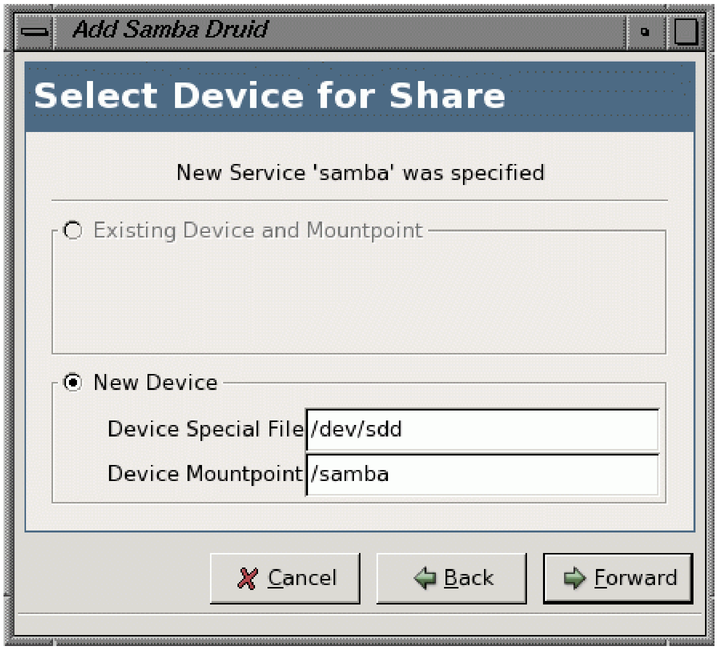
● New Service

Service Name: samba

Service IP Address: 163.154.16.202

Figure 4-9 Samba Druid: Select Service for Share

You can choose the device and mount point of an existing service or add a new device and mount point. In Figure 4-10, a new device (`/dev/sdd`) and mount point (`/samba`) are being added. To change mount options, you must double-click on the device in the **Cluster Configuration** window after completing the **Samba Druid** configuration.



Add Samba Druid

Select Device for Share

New Service 'samba' was specified

○ Existing Device and Mountpoint

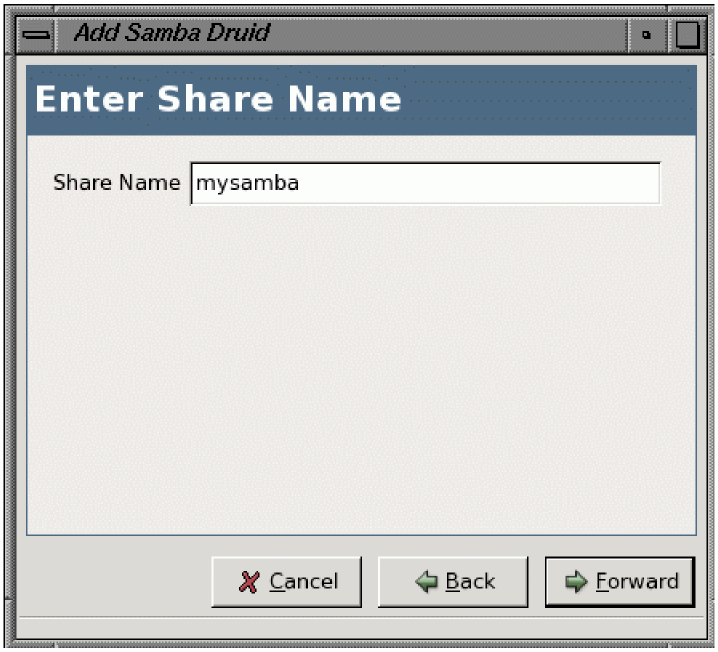
● New Device

Device Special File: /dev/sdd

Device Mountpoint: /samba

Figure 4-10 Samba Druid: Select Device for Share

In Figure 4-11, the name of the share is specified as `mysamba`. Only one share is configured at a time.

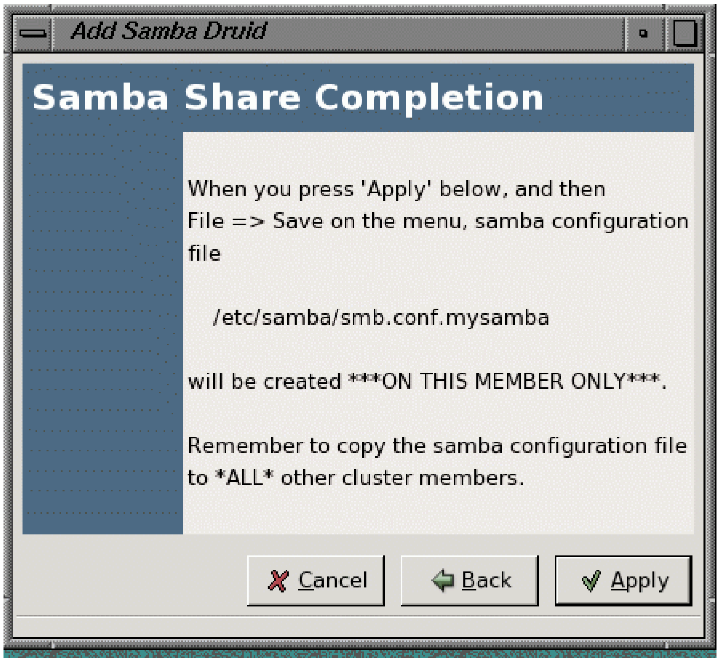


Enter Share Name

Share Name: mysamba

Figure 4-11 Samba Druid: Enter Share Name

Click **Apply** to complete the configuration of the Samba service. You must copy the `/etc/samba/smb.conf.mysamba` configuration file to the other member in the cluster. See Chapter 7, "Samba Plug-In" on page 77 for information about the newly created Samba configuration file.



Add Samba Druid

Samba Share Completion

When you press 'Apply' below, and then
File => Save on the menu, samba configuration
file

/etc/samba/smb.conf.mysamba

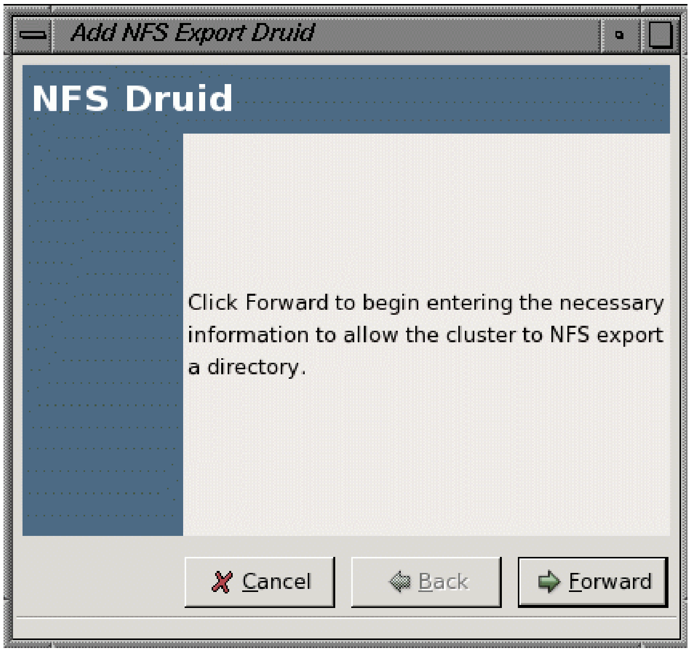
will be created ***ON THIS MEMBER ONLY***.

Remember to copy the samba configuration file
to *ALL* other cluster members.

Figure 4-12 Samba Druid: Samba Share Completion

NFS Druid Example

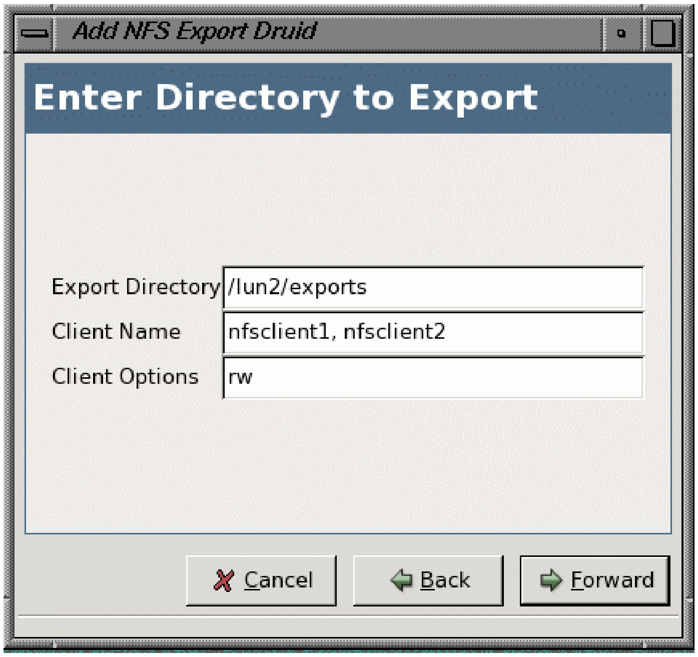
Figure 4-13 shows the **NFS Druid** initial window. Click **Forward** to proceed.



Click Forward to begin entering the necessary information to allow the cluster to NFS export a directory.

Figure 4-13 NFS Druid

Figure 4-14 shows the window that lets you enter the name of the export directory and its export options. You can add only one export directory at a time.



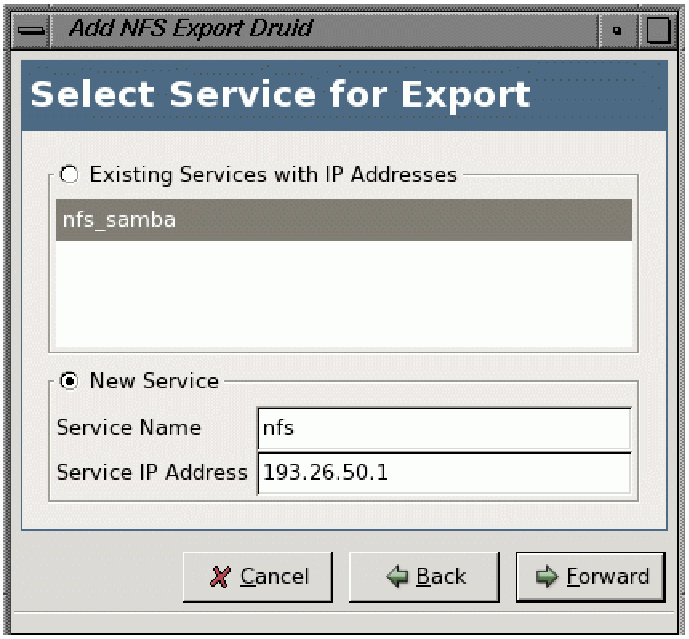
Export Directory /lun2/exports

Client Name nfsclient1, nfsclient2

Client Options rw

Figure 4-14 NFS Druid: Enter Directory to Export

You are given the choice of adding the export directory to an existing service or creating a new service for the export directory. In Figure 4-15, a new service `nfs` is being created with service IP address `193.26.50.1`.



Select Service for Export

○ Existing Services with IP Addresses

nfs_samba

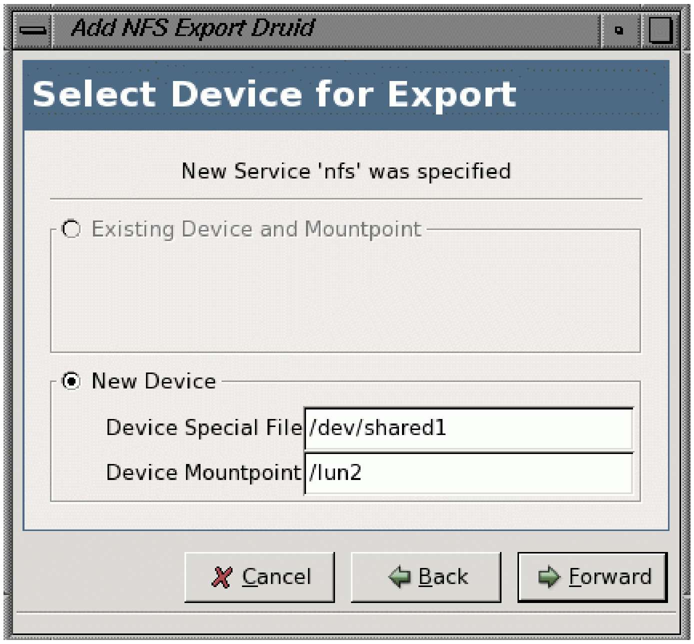
● New Service

Service Name: nfs

Service IP Address: 193.26.50.1

Figure 4-15 NFS Druid: Select Service for Export

You can add devices (filesystems) to the service. If you had chosen an existing service in the **Select Service for Export** window (Figure 4-15), you could choose an existing device mount point in the **Select Device for Export**. In Figure 4-16, a new device (`/dev/shared1`) and mount point (`/lun2`) are specified. To add filesystem mount options, you must double-click the device entry in the **Cluster Configuration** window after completing the NFS service configuration.



Add NFS Export Druid

Select Device for Export

New Service 'nfs' was specified

○ Existing Device and Mountpoint

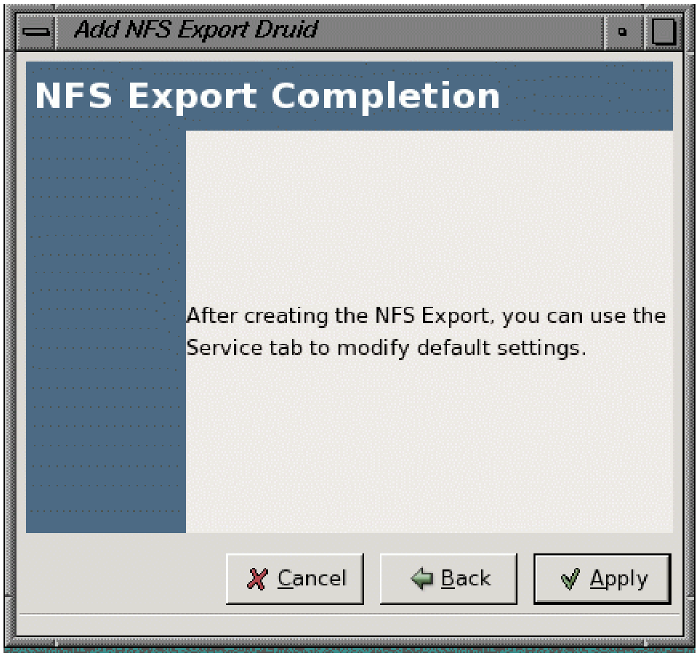
● New Device

Device Special File /dev/shared1

Device Mountpoint /lun2

Figure 4-16 NFS Druid: Select Device for Export

Click **Apply** to complete the NFS configuration. If you want to modify service parameters, you must double-click the service in the **Cluster Configuration** window.



After creating the NFS Export, you can use the Service tab to modify default settings.

Figure 4-17 NFS Druid: NFS Export Completion

Cluster Configuration Example

The following example uses `sgicm-config-cluster-cmd` commands to create a two-member cluster with a service providing Samba shares and NFS service:

- `member1` is an Altix 350 system with no partitions that is connected to an L2 power controller
- `member2` is partition 3 of an Altix 3700 system that is connected to an L2 power controller using Ethernet, where `167.58.9.2` is the IP address of the L2 connected to `member2`
- The network tiebreaker is the IP address of a network router or another machine that determines which member should have connectivity to the public network

- `service1` is the IP address that will be used by clients to access the Samba share and NFS export point
- The service is allowed to restart four times within one day before a failover occurs

Note: Commands that modify the configuration file do not print anything if they are successful. The command exit status is `0` when successful.

Do the following:

1. Define shared state:

```
# sgicm-config-cluster-cmd --sharedstate --type=raw --rawprimary=/dev/shared_1 \
--rawshadow=/dev/shared_2
```

2. Create the cluster:

```
# sgicm-config-cluster-cmd --cluster --name "test-cluster"
```

3. Define the members:

```
# sgicm-config-cluster-cmd --add_member --name=member1 --watchdog=no

# sgicm-config-cluster-cmd --add_member --name=member2 --watchdog=no
```

4. Add power controller information for the members (`167.58.9.2` is the IP address of the L2):

```
# sgicm-config-cluster-cmd --member=member1 --add_powercontroller --type=l2 \
--device=/dev/ttyIOC1 --partition=0

# sgicm-config-cluster-cmd --member=member2 --add_powercontroller --type=l2network \
--ipaddress=167.58.9.2 --partition=3
```

5. Change the heartbeat timeout to 20 seconds with heartbeat interval of 1 second, resulting in a failover speed of 20 seconds:

```
# sgicm-config-cluster-cmd --clumembd --interval=1000000 --tko_count=20
```

6. Set up a network tiebreaker for the cluster:

```
# sgicm-config-cluster-cmd --cluquorumd --tiebreaker_ip=192.0.2.245
```

7. Create a failover domain with an ordered failover policy where the primary member is `member1` and the backup member is `member2`:

```
# sgicm-config-cluster-cmd --add_failoverdomain --name=domain1 \
--restricted=yes --ordered=yes

# sgicm-config-cluster-cmd --failoverdomain=domain1 --add_failoverdomainnode \
--name=member1

# sgicm-config-cluster-cmd --failoverdomain=domain1 --add_failoverdomainnode \
--name=member2
```

8. Create the service definition:

```
# sgicm-config-cluster-cmd --add_service --name=service1 --checkinterval=60  \
--servicetimeout=40 --monitorlevel="Check as client" \
--failoverdomain=domain1 --restartcount=4
```

9. Add a service IP address:

```
# sgicm-config-cluster-cmd --service=service1 --add_service_ipaddress \
--ipaddress=163.154.17.200 --netmask=255.255.255.0 \
--broadcast=163.154.17.255
```

10. Add the shared quorum partition and filesystem information to `service1`:

```
# sgicm-config-cluster-cmd --service=service1 --add_device --name=/dev/shared1

# sgicm-config-cluster-cmd --service=service1 --device=/dev/shared1 --mount  \
--mountpoint=/mnt1 --fstype=xfs --options=rw,sync \
--forceunmount=yes
```

11. Add a Samba share name:

```
# sgicm-config-cluster-cmd --service=service1 --device=/dev/shared1 \
--sharename=share1
```

12. Define the NFS export point and NFS client information. The directory is exported to all clients with read-only access:

```
# sgicm-config-cluster-cmd --service=service1 --device=/dev/shared1 \
--add_nfsexport --name=/shared1/export_dir

# sgicm-config-cluster-cmd --service=service1 --device=/dev/shared1 \
--nfsexport=/shared1/export_dir --add_client \
--name=\* --options=ro
```

Note: The value of `*` for the NFS client name means “all NFS clients.” For better security, supply a list of NFS client systems instead of the `*` character. For more information, see the `exports`(4) man page.

13. (If you were using the GUI, you would have to save the configuration at this point.)

14. Synchronize the configuration changes. For example:

```
# scp /etc/cluster.xml root@member2:/etc/cluster.xml
root@member2’s password:ENTER_ROOT_PASSWORD
cluster.xml                                            100% 3297    57.1MB/s   00:00
```

15. Verify that the changes are synchronized by running the following command on each member:

```
# sgicm-config-cluster-cmd  --cluster
```

16. Start the SGI Cluster Manager daemons:

    a. Enter the following command:

    ```
    # chkconfig clumanager on
    ```

    b. Start local cluster daemons on each member in the cluster doing either of the following:

    ```
    # service clumanager start
    ```

    or

    ```
    # /etc/init.d/clumanager start
    ```

For more information and additional examples, see the `sgicm-config-cluster-cmd`(8) man page.

Chapter 5

Administration

This section discusses the following:

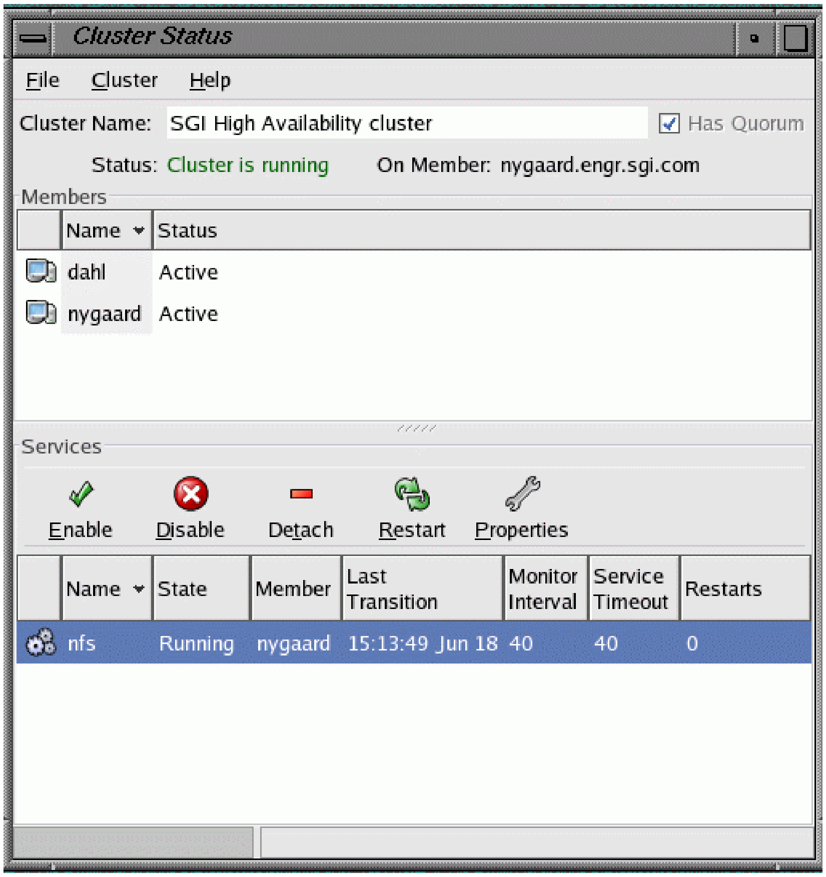
- "Monitoring Status" on page 63
- "Displaying Service Information" on page 64
- "Starting Cluster Processes" on page 65
- "Stopping Cluster Processes" on page 66
- "Service Administration" on page 66
- "Cluster Service States" on page 67
- "Message Logging" on page 69

Monitoring Status

To monitor status, use the following:

- The `sgicm-config-cluster` GUI to monitor the status of the cluster and the services
- `clustat` to monitor the cluster status

Figure 5-1 shows an example of the GUI.



Cluster Name: SGI High Availability cluster ☑ Has Quorum

Status: Cluster is running On Member: nygaard.engr.sgi.com

Members

Name	Status
dahl	Active
nygaard	Active

Services

Name	State	Member	Last Transition	Monitor Interval	Service Timeout	Restarts
nfs	Running	nygaard	15:13:49 Jun 18	40	40	0

Figure 5-1 Status

Displaying Service Information

To display information about a service using the GUI, click on the service name in the **Cluster Status** window.

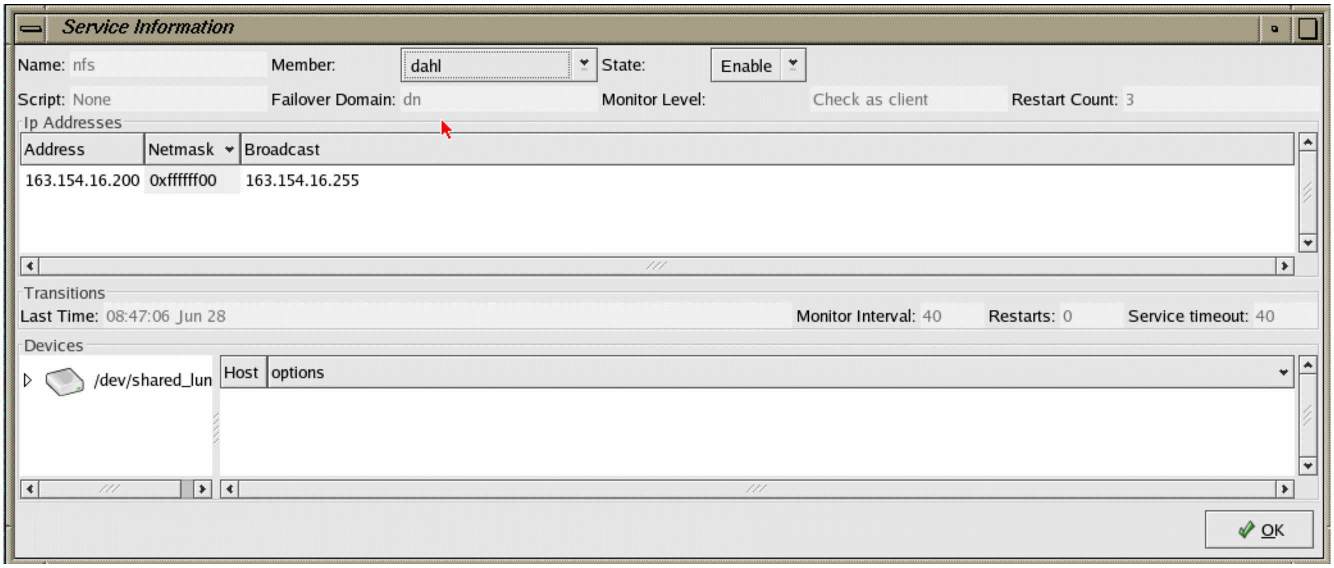
In the CLI:

```
sgicm-config-cluster-cmd --service=servicename
```

For example:

```
# sgicm-config-cluster-cmd --service=nfs
```

Figure 5-2 shows an example of the status window.



Name: nfs
Member: dahl
State: Enable
Script: None
Failover Domain: dn
Monitor Level: Check as client
Restart Count: 3

Address	Netmask	Broadcast
163.154.16.200	0xffffff00	163.154.16.255

Last Time: 08:47:06 Jun 28
Monitor Interval: 40
Restarts: 0
Service timeout: 40

/dev/shared_lun

Host	options

Figure 5-2 Service Information

Starting Cluster Processes

Use the following GUI selection in the **Cluster Status** window to start cluster daemons on the local member:

Cluster
> Start Local Cluster Daemons

In the CLI:

```
/etc/init.d/clumanager start
```

To start the daemons on other members, you must run the GUI or CLI on those other machines.

Stopping Cluster Processes

Use the following GUI selection in the **Cluster Status** window to stop cluster daemons on the local member:

Cluster
  > Stop Local Cluster Daemons

In the CLI:

```
/etc/init.d/clumanager stop
```

To stop the daemons on other members, you must run the GUI or CLI on those other machines.

Service Administration

In the GUI, use the **Cluster Status** window to enable, disable, detach, restart, or stop services or to view service properties. You can also restart and relocate a service by using drag and drop on the service icon to the target node icon.

When you *enable* a service, you start it for the first time. The service will start on any member in the cluster based on the failover domain. When you *restart* the service, it restarts the service that was already running on the local node.

In a successful *detach* operation, the service is no longer monitored and is not part of the cluster, but continues to run on the member. (The difference between *detach* and *disable* is that the services are not stopped with a detach.)

You can also use the `clusvcadm` command as follows:

- Enable the service on the local member:

  ```
  clusvcadm -e service
  ```

- Enable the service on the specified member:

  ```
  clusvcadm -e service -m member
  ```

- Disable the service:

  ```
  clusvcadm -d service
  ```

- Detach the service:

  ```
  clusvcadm -t service
  ```

- Restart the service on the local member:

  ```
  clusvcadm -R service
  ```

- Relocate the service:

  ```
  clusvcadm -r service -m member
  ```

- Stop the service:

  ```
  clusvcadm -s service
  ```

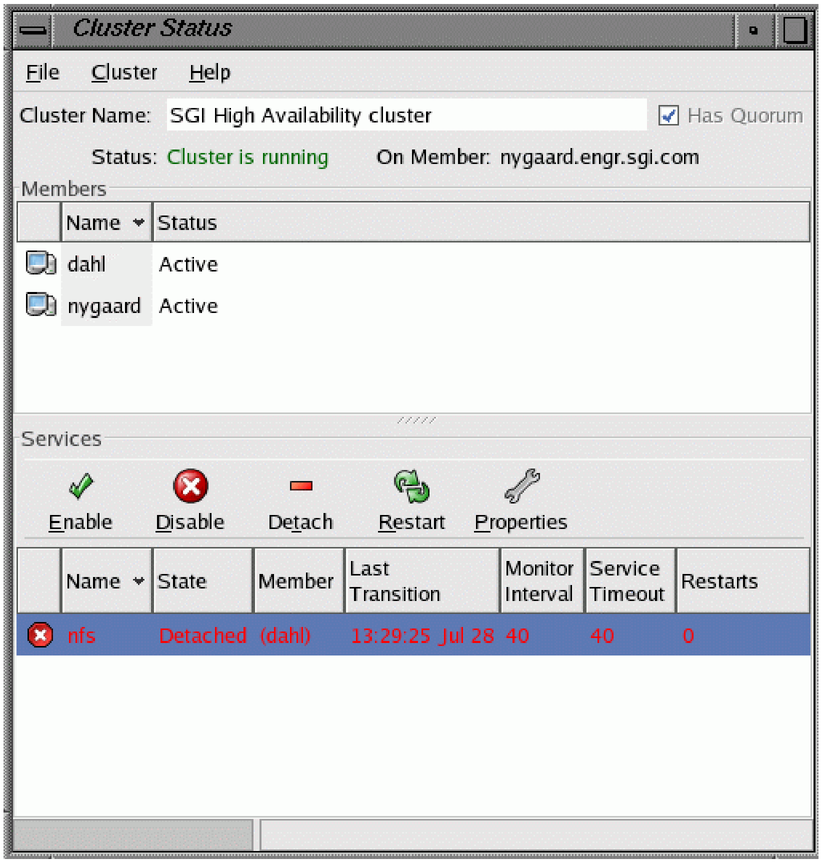
To avoid seeing output, use the `-q` option.

Cluster Service States

A service can have one of the following states:

State	Description
Uninitialized	Transitioning when `clusvcmgrd` daemon starts
Pending	Transitioning to running or disabled
Running	Online and is being actively monitored
Disabled	Not online and service was stopped
Stopped	Disabled but will start when cluster processes are started again
Failed	Needs operator attention
Detached	Not online but the service was not stopped in the cluster

A detached service has no owner and last owner is the member where the service application is still running. The GUI and the `clustat` command display the last owner for services in the detached state, as shown in the Figure 5-3.



Cluster Name: SGI High Availability cluster ☑ Has Quorum

Status: Cluster is running On Member: nygaard.engr.sgi.com

	Name	Status
	dahl	Active
	nygaard	Active

	Name	State	Member	Last Transition	Monitor Interval	Service Timeout	Restarts
☒	nfs	Detached	(dahl)	13:29:25 Jul 28	40	40	0

Figure 5-3 Detached State

To recover from detached state, you must disable the service and then enable it. When a disable action is performed on the service, the service's `stop` scripts are executed on the last owner. If you try to perform an enable or restart action on a service in the detached state, it will fail with the following error message:

```
Service servicename is in detached state. Disable
and then enable service.
```

If the last owner of a service in detached state leaves cluster membership, or if the cluster daemons are stopped on the last owner of the service, the service will move to disabled state.

⚠ **Caution:** Although the service is in disabled state, the service application is still running on the last owner and is not stopped by SGI Cluster Manager. If you attempt to enable the service at this point, it will cause data integrity problems.

Message Logging

SGI Cluster Manager logs messages to `/var/log/messages` using the `syslog` facility `local4`. You can use `syslog.conf` to redirect messages to another location. To rotate logs, use `logrotate`(8).

SGI Cluster Manager uses the following message levels:

Level	Description
0	`EMERG` (emergency)
1	`ALERT`
2	`CRIT` (critical problem)
3	`ERROR`
4	`WARNING` (default)
5	`NOTICE`
6	`INFO` (informational)
7	`DEBUG`

Creating a New Highly Available Application

This chapter discusses the following:

- "The clusvcmgrd Daemon" on page 71
- "The service Script" on page 71
- "Adding a Service" on page 72
- "Example of Failing Over Multiple User Applications" on page 74
- "Sample User Application Script" on page 74

The clusvcmgrd Daemon

All services in SGI Cluster Manager for Linux are managed by the clusvcmgrd daemon. The clusvcmgrd daemon does the following:

- Determines the cluster member where a service must run
- Processes service events
- Executes service scripts in a sequential manner

The service Script

The service script starts, stops, or determines the status of given service. The functions within the service script take the following parameters:

- An action, which can be one of start, stop, or status
- A *service ID* which is a number that identifies the service (the ID is automatically determined and is not user-configurable)

The functions within the `service` script run application scripts in the following order:

- `start` order:

  ```
  device (including local XVM volumes)
  filesystem (including CXFS)
  nfs
  ip address
  samba
  user-defined application (such as DMF and TMF applications)
  ```

- `stop` order:

  ```
  user-defined application (such as DMF and TMF applications)
  ip address
  nfs
  samba
  filesystem (including CXFS)
  device (including local XVM volumes)
  ```

You cannot change the order in which the application scripts are run.

The status of each application in a service is checked in a sequential manner. If the status of an application in the service fails, the status of other applications is not checked.

User application scripts are usually present in the `/usr/lib/clumanager/services` directory. These scripts return `$FAIL` (value `1`) on failure and `$SUCCESS` (value `0`) on success for each action.

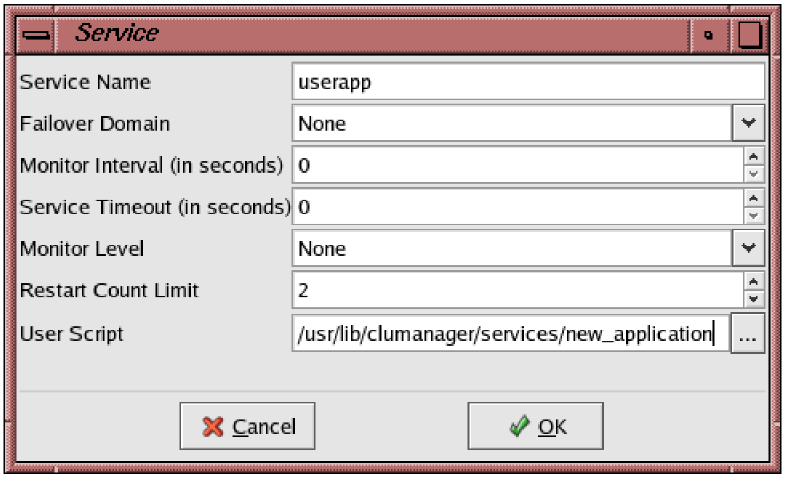
Adding a Service

To add a new application, you must write a set of scripts that are specific to the user application. The user application script must be a `bash` shell script and should contain a shell function with a name that is the same as the application and should take an action (`start`, `stop`, or `status`) and a service ID as parameters. For example: a user application script for failing over an apache webserver could be called `apache_webserver` and it should have a shell function `apache` that takes an action and a service ID as parameters. The shell function will be called by the `service` script to execute appropriate action for a service.

The newly written script is configured as a user application script parameter. You must add all devices and IP addresses that the application depends on to the service. NFS export points and Samba shares can also be part of the service.

For general information about creating a service, see "Step 8: Configure the Service" on page 42.

Figure 6-1 shows the GUI screen to create a service. To get to this window, select the **Services** tab from the **Cluster Configuration** window.



Service

Service Name: userapp
Failover Domain: None
Monitor Interval (in seconds): 0
Service Timeout (in seconds): 0
Monitor Level: None
Restart Count Limit: 2
User Script: /usr/lib/clumanager/services/new_application

Figure 6-1 Creating a Service

The following command creates a service named `userapp` with the newly defined user script `new_application`:

```
# sgicm-config-cluster-cmd --add_service --name=userapp  \
--userscript=/usr/lib/clumanager/services/new_application   \
--checkinterval=40 servicetimeout=60
```

You must copy the newly created script to the following location in all members in the cluster:

```
/usr/lib/clumanager/services/new_application
```

Example of Failing Over Multiple User Applications

To fail over an apache webserver and mySQL database as part of a service, you must do the following:

- Create a directory for the service application scripts. For example:

  ```
  # mkdir /usr/lib/clumanager/services/service1
  ```

- Create a script within the directory for each application. For example, they could be named `apache_webserver` and `mySQL`:

  - `apache_webserver` should contain a shell function that takes an action and service ID as parameter. This function should perform start/stop/status operation on the apache server for `service1`.
  - `mySQL` should contain a shell function that performs start/stop/status operation on the mySQL database server for `service1`.

Note: The directory can contain symlinks to actual scripts that are present in some other directory.

Sample User Application Script

The following is an example user application script named `service_test`. This example script contains a shell function `test` that takes an action (`start`, `stop` or `status`) and service ID as parameters. The shell function `test` can call shell functions (as in the example) to perform the actions or to execute other scripts or commands to perform the action passed as parameters.

```
#
# startTest serviceID
#
startTest()
{

        if [ $# -ne 1 ]; then
          logAndPrint $LOG_ERR "Usage: startTest serviceID"
          return $FAIL
        fi
```

```
        typeset svcID=$1
        typeset svc_name=$(getSvcName $DB $svcID)

        logAndPrint $LOG_INFO "Running test start script for service $svc_name "

        return $SUCCESS
}

#
# stopTest serviceID
#
stopTest()
{

        if [ $# -ne 1 ]; then
          logAndPrint $LOG_ERR "Usage: stopTest serviceID"
          return $FAIL
        fi

        typeset svcID=$1
        typeset svc_name=$(getSvcName $DB $svcID)

        logAndPrint $LOG_INFO "Running test stop script for service $svc_name "
        return $SUCCESS
}

#
# statusTest serviceID
#
statusTest()
{

        if [ $# -ne 1 ]; then
          logAndPrint $LOG_ERR "Usage: statusTest serviceID"
          return $FAIL
        fi

        typeset svcID=$1
        typeset svc_name=$(getSvcName $DB $svcID)

        logAndPrint $LOG_INFO "Running test status script for service $svc_name "
        return $SUCCESS
}


# Given an action and service ID number run that action for that service.
test()
{
        if [ $# -ne 2 ]; then
          logAndPrint $LOG_ERR "Usage: test [start, stop, status] serviceID"
          return $FAIL
        fi

        typeset action=$1
        typeset svcID=$2

        case "$action" in
        ’start’)
          startTest $svcID
          return $?
          ;;

        ’stop’)
          stopTest $svcID
          return $?
          ;;

        ’status’)
          statusTest $svcID
          return $?
          ;;
        esac
}
```

Samba Plug-In

SGI Cluster Manager supports Samba as shipped with SGI ProPack for Linux. See "Software Requirements" on page 6 for the supported levels.

Samba Process ID, Locks, and Password File

The Samba process ID (PID), locks, and password file are kept in the shared partitions and in the log file on the local disk. The lock directory is not removed during failover.

The locations are as follows:

- PID directory: *mountpoint*`/.samba/`*sharename*`/pid`
- Log directory: `/var/log/samba`
- Lock directory: *mountpoint*`/.samba/`*sharename*`/locks`
- Password file: *mountpoint*`/.samba/`*sharename*`/private/smbpasswd`

The Samba Share Configuration File

When you create a Samba service in SGI Cluster Manger, the `netbios name` entry is automatically added to the `/etc/samba/smb.conf.`*SambaShareName* file with a value set to the IP name associated with highly available IP address configured for the Samba service. You can modify the `netbios name` value as long as it remains unique for the SGI Cluster Manager cluster.

When you create a Samba service in SGI Cluster Manger, the `smb passwd file` entry is automatically added to the `/etc/samba/smb.conf.`*SambaShareName* file. However, when you use the `smbpasswd`(8) command, that entry is commented out and the `private dir` entry is added. For example:

```
#       smb passwd file = /lxvm2/.samba/samba_lxvm2/private/smbpasswd
        private dir = /lxvm2/.samba/samba_lxvm2/private
```

Samba Start/Stop Order

For the order in which Samba is started/stopped, see Chapter 6, "Creating a New Highly Available Application" on page 71.

Defining NFS Exports and Samba Exports

You can edit the `/etc/samba/smb.conf.`*SambaShareName* Samba configuration file that is generated by SGI Cluster Manager to include additional Samba shares. If you change this file, you must copy it to the other member in the cluster. For examples of using the Samba Druid and NFS Druid, see "Samba Druid Example" on page 50 and "NFS Druid Example" on page 55.

Service Monitoring Levels

For information about service monitoring levels, see "Step 8: Configure the Service" on page 42.

Chapter 8

CXFS Plug-In

Using the CXFS clustered filesystem product with SGI Cluster Manager for Linux requires the value-add SGI product on the *SGI Cluster Manager x.x for Linux - Storage Software Plug-ins* CD and the supported level of CXFS (see "Software Requirements" on page 6).

You should configure the CXFS cluster, nodes, and filesystems according to *CXFS Administration Guide for SGI InfiniteStorage*.

Usually, all CXFS metadata servers are members of the SGI Cluster Manager cluster. If CXFS fails over the metadata server to another system then the services that use that filesystem (such as NFS, Samba, and so on) should also be failed over to that same system. The services may suffer serious performance degradation if they are not running on the CXFS metadata server.

Relocation Support

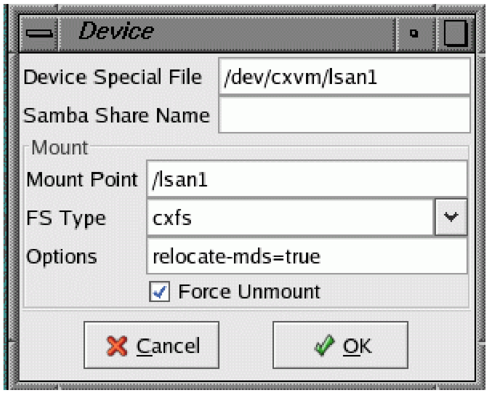
To use CXFS relocation and fail over the service from one member to another, you must set the `relocation_ok` parameter to `1` (enable) on all potential CXFS metadata servers. For more details, see the *CXFS Administration Guide for SGI InfiniteStorage*.

Members and I/O Fencing

For I/O fencing, SGI Cluster Manager members should use `l2network` power controllers in order to prevent conflicts with CXFS I/O fencing methods. For more information, see "L2 Connections" on page 13.

Including a CXFS Filesystem in the Cluster Configuration

To include CXFS filesystems in the SGI Cluster Manager configuration, add filesystems as devices used by a service, as shown in Figure 8-1.



Device Special File: /dev/cxvm/lsan1
Samba Share Name:
Mount
Mount Point: /lsan1
FS Type: cxfs
Options: relocate-mds=true
☑ Force Unmount

Figure 8-1 Adding a CXFS Filesystem as a Device

Enter the following:

- **Device Special File**: the block XVM device file
- **Mount Point**: the CXFS filesystem mount point
- **FS Type**: the filesystem type must be `cxfs`
- **Options**: one of the following:
  - `relocate-mds=true`, which allows the metadata server for the CXFS filesystem to be failed over when the service is failed over
  - `relocate-mds=false` (default)

Note: The **Force Unmount** item in the GUI and CLI is ignored for CXFS filesystems.

In the CLI, do the following:

```
sgicm-config-cluster-cmd --service=servicename \
                         --add_device \
                         --name=/dev/cxvm/volumename

sgicm-config-cluster-cmd --service=servicename \
                         --device=/dev/cxvm/volumename \
                         --mount \
--mountpoint=mountpoint \
--fstype=cxfs \
--options=relocate-mds=true|false
```

You can specify multiple CXFS filesystems by adding multiple devices to the service.

Note: You will not define a `--userscript` value when defining a service to failover CXFS filesystems. User scripts are used for failing over user-written applications. For more information on user scripts, see Chapter 6, "Creating a New Highly Available Application" on page 71.

For more information, see "Step 10: Add the Disk and Filesystem Information to the Service *(Optional)*" on page 45.

Members and Potential Metadata Servers

The members in the failover domain for the service that has CXFS filesystems should be same as the list of potential metadata servers for the CXFS filesystem. For example: machines `node1` and `node2` can be metadata servers for CXFS filesystem `/cxfs_san1`. The SGI Cluster Manager service `nfs1` that uses `/cxfs_san1` should have a failover domain of `node1` and `node2`.

CXFS Start/Stop Order

You should start CXFS cluster services and CXFS services before starting SGI Cluster Manager daemons. SGI Cluster Manager will wait for the CXFS filesystem to be mounted by CXFS before starting NFS, Samba, and other applications running on the CXFS filesystem. Therefore, service timeouts for all SGI Cluster Manager services that include CXFS filesystems should be carefully adjusted accordingly.

For the order in which CXFS is started/stopped, see Chapter 6, "Creating a New Highly Available Application" on page 71.

Chapter 9

Data Migration Facility (DMF) Plug-In

Using the Data Migration Facility (DMF) with SGI Cluster Manager for Linux requires the value-add SGI product on the *SGI Cluster Manager x.x for Linux — Storage Software Plug-ins* CD and the supported level of DMF (see "Software Requirements" on page 6).

You should configure DMF according to *DMF Administrator's Guide for SGI InfiniteStorage*.

Adding the DMF User Script to an Existing Service

The following command adds the DMF user script to an existing service. The script used is `/usr/lib/clumanager/services/svclib_dmf`:

```
# sgicm-config-cluster-cmd --service=service1   \
 --userscript=/usr/lib/clumanager/services/svclib_dmf
```

You could also add the script by modifying the service in the GUI. For more information, see "Step 8: Configure the Service" on page 42.

DMF Administrative Filesystems and Directories

To run DMF, you must configure the parameters shown in Table 9-1. A *required* parameter must be defined by all users of DMF. An *optional* parameter is needed only by users of certain MSPs or the library server. DMF cannot start unless the required filesystems and directories defined by these parameters are first mounted and available on shared disks.

Table 9-1 DMF Administrative Filesystem and Directory Parameters

Parameter	Status	Description
`HOME_DIR`	Required	Specifies the DMF databases
`JOURNAL_DIR`	Required	Specifies the DMF database journals
`SPOOL_DIR`	Required	Specifies the DMF log files

Parameter	Status	Description
MOVE_FS	Optional	Moves files between MSPs
CACHE_DIR	Optional	Used by the library server as a cache for merging data from sparse tapes to new tapes
FTP_DIRECTORY	Optional	Used by the FTP MSP to store files
STORE_DIRECTORY	Optional	Used by the disk MSP to store files

In addition, the working directory used by the dmaudit(8) command must also be available when DMF starts. To configure the directory, run the dmaudit command and select the <workdir> item in the <config> menu.

You can configure the DMF administrative filesystems as local XVM filesystems or as CXFS filesystems. SGI Cluster Manager ensures that the DMF plug–in script is called after the necessary filesystems are mounted.

If you use local XVM filesystems, you must define them as instructed in "Configuring DMF for Local XVM Filesystems" on page 84.

If you use CXFS filesystems, you must define them as instructed in "Configuring DMF for CXFS Filesystems " on page 85.

Configuring DMF for Local XVM Filesystems

To configure the DMF administrative filesystems as local XVM filesystems, do the following:

1. Ensure that the DMF configuration is identical on all members.
2. Create the DMF administrative filesystems on shared disks as local XVM filesystems (xvm type). See "Step 10: Add the Disk and Filesystem Information to the Service *(Optional)*" on page 45.
3. Configure the SGI Cluster Manager local XVM volumes using the local XVM plug-in. See Chapter 11, "Local XVM Plug-In" on page 97.

Configuring DMF for CXFS Filesystems

DMF cannot start until the DMF administrative filesystems are available. If they are CXFS filesystems, CXFS must recover them before they are accessible.

To configure DMF filesystems as CXFS filesystems, do the following:

1. Ensure that the DMF configuration is identical on all members.
2. Create the DMF administrative filesystems as CXFS filesystems (`cxfs` type). See "Step 10: Add the Disk and Filesystem Information to the Service *(Optional)*" on page 45.
3. Configure the SGI Cluster Manager CXFS filesystems using the CXFS plug-in. For DMF-managed filesystems, configure `relocate-mds=true` (on) because DMF must run on the CXFS metadata server for that filesystem. See Chapter 8, "CXFS Plug-In" on page 79.

DMF Start/Stop Order

For the order in which DMF is started/stopped, see Chapter 6, "Creating a New Highly Available Application" on page 71.

Ensuring that Only SGI Cluster Manager Starts DMF

After installing `clumanager-sgi-1.0.0`, you should perform the following actions on each member of the cluster in the failover domain. These commands ensure that DMF can only be started via SGI Cluster Manager:

```
# touch /etc/dmf_failsafe
# chkconfig dmf off
```

Using TMF with DMF

To use the Tape Management Facility (TMF) with DMF in a SGI Cluster Manager environment, you must configure the appropriate TMF device groups in the `/etc/tmf/sgicm_tmf.config` file according to the instructions in Chapter 10, "Tape Management Facility (TMF) Failover Script" on page 87.

If TMF is configured as a mount service in the /etc/dmf/dmf.conf file, the DMF plug-in will automatically call the /usr/lib/clumanager/service/helper_tmf TMF failover script and pass along the appropriate TMF device group names.

The service timeout value should be at least 100 seconds if DMF is being used with TMF-managed tape devices. The following command will set the service timeout to 100 seconds for the SGI Cluster Manager service service1:

```
# sgicm-config-cluster-cmd --service service1 --servicetimeout=100
```

To do this with the GUI, see "Step 8: Configure the Service" on page 42.

Tape Management Facility (TMF) Failover Script

Using the Tape Management Facility (TMF) with SGI Cluster Manager requires the value-add SGI product on the *SGI Cluster Manager x.x for Linux — Storage Software Plug-ins* CD and the supported level of TMF (see "Software Requirements" on page 6). Only Storage Technology Corporation (STK) hardware controlled by the Automated Cartridge System Library Software (ACSLS) software is supported.

For more information about TMF, see the *TMF Administrator's Guide*.

The `helper_tmf` Script

If your application requires tape support via TMF, then your user application script should call the `/usr/lib/clumanager/service/helper_tmf` TMF failover script, passing the appropriate parameters. See "Using the TMF Failover Script from the User Application Script" on page 94.

The DMF plug-in will automatically call the `helper_tmf` script if a Library Server Drive Group uses TMF as a mounting service.

The `helper_tmf` script lets you manage one or more *TMF device groups*, which are sets of tape devices defined in the `/etc/tmf/tmf.config` TMF configuration file.

The following example is part of a /etc/tmf/tmf.config that defines a TMF device group named EGLF:

```
DEVICE_GROUP
                name = EGLF
        AUTOCONFIG
{
                DEVICE
                        NAME   = f9840f1 ,
                        device_group_name = EGLF ,
                        FILE    = /hw/tape/500104f000417a18/lun0/c4p1 ,
                        status = down ,
                        access = EXCLUSIVE ,
                        vendor_address = (1,0,0,2),
                        LOADER = l180
}
```

The helper_tmf script performs the following functions for the calling user service or userapp script:

- Starts TMF if it is not already running.
- Configures the associated loader up if it is not already up.
- Allows the monitoring of multiple TMF device groups and their associated tape devices.
- Monitors the number of tape devices that are available within each TMF device group. If the number of devices currently available is less than the minimum threshold level, a monitoring failure will occur.
- Releases previous reservations that are held by another member (if the tape device firmware supports this option).
- Lets you assign different TMF device groups to each instance of an SGI Cluster Manager service or userapp script.

TMF Stop/Start Order

For the order in which TMF is started/stopped, see Chapter 6, "Creating a New Highly Available Application" on page 71.

Configuring a TMF Device Group

The helper_tmf script lets you specify device groups to stop, start, and monitor. Each of these managed device groups must be defined in the following files:

- /etc/tmf/sgicm_tmf.config (SGI Cluster Manager configuration file for TMF)
- /etc/tmf/tmf.config (standard TMF configuration file)

The resource directive in the /etc/tmf/sgicm_tmf.config file specifies a TMF device group. This directive is required for each TMF device group that you plan to use within SGI Cluster Manager. See "The resource Directive" on page 90.

Optional Configuration Specifications

There are other optional configuration specifications associated with a TMF device group. These specifications provide information to the helper_tmf script that lets it communicate with the tape library. They also identify the tape devices within the library on which helper_tmf will force dismounts.

The helper_tmf script can force a dismount of tapes from devices within the library. There may be various reasons why you might want to do this when a failover occurs. In the case of DMF, you would want to ensure that any DMF tapes that were in use on a previous member are available to DMF on the new member after a failover. If these tapes were in tape devices assigned to the previous member, they must be ejected and returned to the library so that they are again accessible to DMF on the new member. You may want the helper_tmf script to dismount only tape devices associated with a particular TMF device group or you may not want the helper_tmf script to dismount any tapes at all.

Some of the functions of the helper_tmf script are performed through TMF; the script issues commands to the TMF daemon to use these functions. However, the helper_tmf script forces a dismount of a tape from a device by issuing a command to the library software controlling the loader/library. The helper_tmf script communicates its request to the ACSLS software that controls the loader. The helper_tmf script uses an expect script that issues commands to login to the loader and issue a dismount request to a tape device.

The `/etc/tmf/sgicm_tmf.config` File

The `/etc/tmf/sgicm_tmf.config` file lets you configure other information required by the `helper_tmf` script. The `sgicm_tmf.config` file exists on all members in the cluster and should be edited as necessary on each member.

The contents of the `sgicm_tmf.config` file are dependent on the tape devices assigned to each member in the cluster. If all members in the failover domain are configured through TMF to use exactly the same tape devices, this file would be the same on each member in the failover domain.

Note: You must maintain the `sgicm_tmf.config` file on each member; a change on one member is unknown to the other members.

You can specify the following directives in the `sgicm_tmf.config` file:

- "The `resource` Directive" on page 90
- "The `loader` Directive " on page 91
- "The `remote_devices` Directive" on page 92

The `resource` Directive

The `resource` directive defines the TMF device groups that can be managed by the `helper_tmf` script:

`resource` *device-group* *devices-minimum* *devices-loaned* *email-addresses*

where:

device-group — The TMF device group that is to be monitored. This is a device group that is defined in `/etc/tmf/tmf.config`.

devices-minimum — The minimum number of devices of the specified *device-group* that you must have available to you on a member before you fail over.

devices-loaned — Currently unused; should be set to `0`.

email-addresses — List of addresses to send email when the monitor script detects that tape devices in the *device-group* have become unavailable. Corrective action can then be taken to repair the tape devices before the *devices-minimum* threshold is crossed. This may be a comma- or white-space-separated list of names.

The loader Directive

The loader directive provides information about a TMF loader, which controls one or more tape devices that are members of TMF device groups being managed by SGI Cluster Manager. There may be multiple loader directives in the sgicm_tmf.config file.

The loader information is used by the helper_tmf script to force a dismount of tapes from tape devices that cannot be made available (that is, that have tmstat states other than assn, free, conn, or idle) so that those tapes can be used via other tape devices in the same device group. The information is also used to force a dismount of tapes from devices that are only connected to the other member, not to this member (as described in "The remote_devices Directive" on page 92).

If the file does not contain a loader directive, the helper_tmf script will make no attempt to force a dismount of tapes from any devices.

The directive has the following format:

loader *lname* *ltype* *lhost* *luser* *lpassword*

where:

lname Name of the loader as defined in /etc/tmf/tmf.config

ltype Type of the loader as defined in /etc/tmf/tmf.config, which must be STKACS

lhost Server name of the loader as defined in /etc/tmf/tmf.config

luser User name of the loader's administrator account, which must be acssa

lpassword Password for the loader's administrator account

The tmmls command shows the name of the loader and the server associated with it:

```
# /usr/sbin/tmmls
loader type status m  server   old  m_pnd  d_pnd  r_qd  comp  avg
 operator  OPERATOR      UP A  IRIX       0      0      0     0     0    0(sec)
 wolfy       STKACS    DOWN A  wolfcree   0      0      0     0     0    0(sec)
 panther     STKACS    DOWN A  stk9710    0      0      0     0     0    0(sec)
 l180        STKACS      UP A  stk9710    0      0      0     0     0    0(sec)
```

For example, suppose you want to have the `helper_tmf` script dismount tape devices that are in the `l180` loader/library listed above. That library has the `stk9710` server associated with it. The loader directive in the `sgicm_tmf.config` file would look like the following:

```
loader l180 STKACS stk9710 acssa acssapassword
```

If the initial attempt to configure the device up fails, the `helper_tmf` script would force a dismount for each tape device that is specified in the `tmf.config` file to be in the `l180` loader/library and in the TMF device group. If you do not want the script to dismount any tape devices associated with a particular TMF device group, you would not place a loader directive in the `sgicm_tmf.config` file.

The `remote_devices` Directive

The `remote_devices` directive provides information about one or more tape devices that are part of a TMF device group, but which are not visible on this member.

For example, suppose you have a library with four SCSI tape devices where two tape devices are connected to each of two cluster members. If member A should crash, member B must be able to force a dismount of any tapes in A's tape devices so that they can then be used from member B. Because the tape devices are not visible on member B, the `remote_devices` directive provides the information needed to force a dismount of unseen tape devices.

The directive has the following format:

`remote_devices` *device-group* *lname* *tape-device-ID* ...

where:

device-group
Name of the TMF device group with which the *tape-device-IDs* are associated.

lname
Name of the loader as defined in `/etc/tmf/tmf.config`. There must be a `loader` directive for *lname* elsewhere in this file, or the `remote_devices` directive will be ignored.

tape-device-ID
The vendor ID of the drive on which to force a dismount. This is the unique name by which the loader identifies the tape device. For `STKACS`, this will be a

comma-separated four-digit string listing the ACS, LSM, drive panel, and drive (for example, 0,0,1,3).

Note: No blanks should exist within the ID.

You can specify multiple vendor IDs in the same remote_devices directive as long as they all pertain to the same loader. If all the vendor IDs will not fit on a single line, add additional remote_devices directives for the same loader. For example, to enable the helper_tmf script to force a dismount of the remote tape devices 0,0,1,0 , 0,0,1,1 , 0,0,1,2 , and 0,0,1,3 in the l180 loader/library for TMF device group tmf_eglf, the directive would be:

```
remote_devices tmf_eglfl  180  0,0,1,0  0,0,1,1  0,0,1,2  0,0,1,3
```

If multiple TMF device groups are defined, only the TMF device group named tmf_eglf will force a dismount of these tape devices.

Configuring Tapes and TMF

If tape devices that are managed by the helper_tmf script are configured on more than one member in the cluster, they should be configured consistently. The same tape driver (for example, ts) should be used on each member where the tape device is configured.

When configuring the helper_tmf script, you should be aware of several parameters in the /etc/tmf/tmf.config file. The helper_tmf script will try to start the loader associated with its device-group if it is not up. However, if the configuration file specifies status=UP for the loader, this step may not be necessary and the devices may become available sooner.

A tape device that is managed by the helper_tmf script will be configured in /etc/tmf/tmf.config on one or more members within the cluster. It should be configured with status=down.

If the tape devices being used do not support persistent reserve, then they should each be configured in /etc/tmf/tmf.config with access=shared. If the tape devices do support persistent reserve, it is recommended that you use this feature when using the helper_tmf script. To use persistent reserve, you should set access=exclusive in /etc/tmf/tmf.config for each tape device. The access option should be consistent across all members in the cluster where the tape devices are configured.

The `-g` option of the `tmconfig` command reassigns a device to a different device group name. The `helper_tmf` script does not support reassigning a device into a device group. That is because, in case of failover, the `helper_tmf` script on the member we have failed over to would not have any knowledge of this reassigned tape device . It would not be able to dismount tapes that are in the tape device. If you use `tmconfig -g` to move devices out of a device group, that will decrease the number of available tape devices that the monitor function of the `helper_tmf` script can detect. Also, in the case of failover or stop, the tape device will be configured down.

Using the TMF Failover Script from the User Application Script

You must write a user application script in order to use the `helper_tmf` script. For information on how to write user application script, see Chapter 6, "Creating a New Highly Available Application" on page 71.

In order to manage TMF device groups in an SGI Cluster Manager environment, the user application script must pass the appropriate parameters to the TMF failover script. This script called via the following command line:

`/usr/lib/clumanager/scripts/helper_tmf` *action* *device-groups*

where:

action	One of `start`, `stop`, or `status`
device-groups	One or more TMF device groups upon which the action should be taken

Note: It is more efficient to invoke the `helper_tmf` script once with several *device-group* arguments rather than invoking it several times, each with a single *device-group* argument. For example, the following:

```
# /usr/lib/clumanager/scripts/helper_tmf start 9840 9940 LTO2
```

is more efficient than the following:

```
# /usr/lib/clumanager/scripts/helper_tmf start 9840
# /usr/lib/clumanager/scripts/helper_tmf start 9940
# /usr/lib/clumanager/scripts/helper_tmf start LTO2
```

For example, to start the 9840 device group:

```
/usr/lib/clumanager/services/helper_tmf start 9840
if [ $? -ne 0 ]; then
               logAndPrint $LOG_ERROR "start of 9840 device group failed"
               return 1;
fi
```

To stop the 9840 device group:

```
/usr/lib/clumanager/services/helper_tmf stop 9840
if [ $? -ne 0 ]; then
               logAndPrint $LOG_ERROR "unable to stop 9840 device group"
               return 1;
fi
```

To check the status of the 9840 device group:

```
/usr/lib/clumanager/services/helper_tmf status 9840
if [ $? -ne 0 ]; then
               logAndPrint $LOG_ERROR "device group 9840 not running"
               return 1;
fi
```

Service Timeout

The service timeout for the calling `userapp` or user script should be at least 100 seconds. The following command will set the service timeout to 100 seconds for the SGI Cluster Manager service `service1`:

```
sgicm-config-cluster-cmd --service service1 --servicetimeout=100
```

Chapter 11

Local XVM Plug-In

SGI Cluster Manager supports failover of XVM volumes in *local* mode. This support is available as part of the `clumanager-sgi` RPM in on the *SGI Cluster Manager x.x for Linux — Storage Software Plug-ins* CD.

Note: XVM in **cluster** mode is supported only with CXFS. See Chapter 8, "CXFS Plug-In" on page 79.

For more information about XVM, see *XVM Volume Manager Administrator's Guide*.

Local XVM Device Configuration

Local XVM devices are configured as a device for a service. You can specify multiple XVM devices for a service. For each local XVM volume device, specify the list of physical volumes that it contains, separating each element in the list by a comma (`,`) character.

Following is an example to fail over local XVM volume `m0`:

1. Install and configure XVM on both members in the cluster.
2. Find the physical volumes that are part of volume `m0`:

```
# xvm
xvm:local> show -topology -extend vol/m0
vol/m0                             0 online,open
    subvol/m0/data            497824768 online,open
        stripe/stripe0            497824768 online,tempname,open (unit size: 128)
            mirror/mirror8             35558944 online,tempname,open
                slice/dks5d1s0             35558944 online,open (dks5d1:/dev/rdsk/dks5d1vol)
                slice/dks4d1s0             35558944 online,open (dks4d1:/dev/rdsk/dks4d1vol)
            mirror/mirror4             35558944 online,tempname,open
                slice/dks11d1s0            35558944 online,open (dks11d1:/dev/rdsk/dks11d1vol)
                slice/dks7d1s0             35558944 online,open (dks7d1:/dev/rdsk/dks7d1vol)
```

The list of physical volumes that belong to volume `m0` are `dks5d1`, `dks4d1`, `dks11d1`, and `dks7d1`.

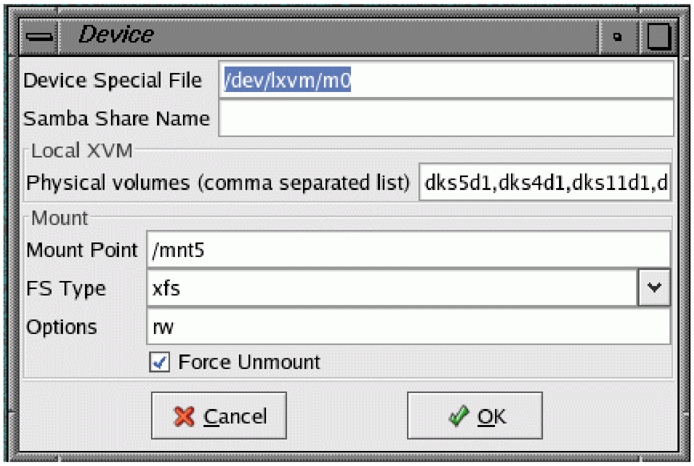
3. Add the device to the service using the sgicm-config-cluster GUI or the sgicm-config-cluster-cmd command-line interface. The device name will be /dev/lxvm/m0 and the physical volumes will be dks5d1,dks4d1,dks11d1,dks7d1.

   For example, the following output from the CLI after the device item shows the information that has been added to service nfs1:

```
# sgicm-config-cluster-cmd --service=nfs1 \
--device=/dev/lxvm/m0

device:
  name = /dev/lxvm/m0
  sharename =   physvols = dks5d1,dks4d1,dks11d1,dks7d1

mount:
  mountpoint = /mnt5
  fstype = xfs
  options = rw
  forceunmount = yes

nfsexport:
  name = /mnt5

client:
  name = challenger.engr.sgi.com
  options = rw
```

Note: SGI Cluster Manager uses the xvm subcommands give and steal during failover for local XVM volumes. However, the list of physical volumes can be specified or modified only if the clumanager-sgi RPM is installed on the member.

Figure 11-1 shows an example in the GUI.



Device Special File: /dev/lxvm/m0
Samba Share Name:
Local XVM
Physical volumes (comma separated list): dks5d1,dks4d1,dks11d1,d
Mount
Mount Point: /mnt5
FS Type: xfs
Options: rw
☑ Force Unmount

Figure 11-1 Adding an XVM Device

For more information on configuration, see "Step 8: Configure the Service" on page 42.

Local XVM Start/Stop Order

For the order in which local XVM is started/stopped, see Chapter 6, "Creating a New Highly Available Application" on page 71.

Chapter 12

Troubleshooting

This chapter provides information about the following:

- "Best Practices" on page 101
- "Recovery from a clulockd Failure" on page 101
- "Watchdog Errors" on page 102
- "Shared Quorum Partitions" on page 103
- "Serial Cable or Reset issues" on page 105
- "Failed State for a Service" on page 106
- "Error Messages" on page 106
- "Reporting Problems to SGI" on page 107

Best Practices

If you run into problems, do the following:

- Check the messages in /var/log/messages (see "Message Logging" on page 69)
- Use shutil to see if shared quorum partitions are accessible
- Use clufence to check the status of the reset cable
- Verify that the failover domain is defined correctly

Recovery from a clulockd Failure

If the clulockd daemon dies unexpectedly, it freezes all of the locks on the shared quorum partition. clulockd will log a message such as the following in the logs:

```
Feb  6 17:25:14 3U:nygaard clulockd[6924]:  Signal 11 received; freezing
```

The clusvcmgrd daemon will not be able to monitor, start, or stop services. Logs on all members will have a message such as the following:

```
Feb  6 17:14:48 2U:dahl clusvcmgrd[3255]:  Couldn’t connect to member #0: Connection timed out
Feb  6 17:14:48 3U:dahl clusvcmgrd[3255]:  Unable to obtain cluster lock: No locks available
```

To recover from this situation, do the following:

1. Stop cluster daemons on both members.
2. Reinitialize the shared state from one member in the cluster:

   ```
   shutil -i
   ```

3. Make sure that /etc/cluster.xml is same on both members.
4. Initialize the configuration on the shared quorum partition from one member in the cluster:

   ```
   shutil -s /etc/cluster.xml
   ```

5. Verify that the configuration has been initialized correctly from one member in the cluster:

   ```
   shutil -p /cluster/config.xml
   ```

For more information, see the shutil(8) man page.

Watchdog Errors

Software and hardware watchdog timers are not supported. If you enable software watchdog when configuring a member, you will see the following error messages when cluster daemons are starting:

```
Creating /dev/watchdog: execvp: No such file or directory
^[[FAILED]
Loading Watchdog Timer (softdog):  modprobe: Can’t locate module softdog
^[[FAILED]
```

Disable the software watchdog. See "Step 3: Define the Members" on page 32.

Shared Quorum Partitions

This section discusses the following:

- "Verify Accessibility" on page 103
- "Read the Configuration File" on page 103
- "Verify Metadata Information is Consistent" on page 103
- "Write the Configuration File" on page 104
- "Displaying Metadata Remotely" on page 105
- "Last Resort: Clear Information" on page 105

For more information, see the `shutil`(8) man page.

Verify Accessibility

To see if shared quorum partitions are accessible, enter the following:

```
shutil
```

Read the Configuration File

To read the configuration file from the shared quorum partition, enter the following:

```
shutil -r -
```

You should use this command to compare the configuration files in the shared quorum partitions and the local copy.

Verify Metadata Information is Consistent

To verify that the service metadata information is the same on all members, run the following command at the same time on each member:

```
shutil -m /service/0/status
```

For example, the following output from member jackhammer and member jackhammer2 indicates a problem:

- jackhammer output:

  ```
  # shutil -m /service/0/status
  Metadata information for /service/0/status

  Data Length:   40 bytes
  Data CRC:      0x2dae1205
  Header CRC:    0x7c7185f1
  Last modified: 12:34:58 Mar 31 2004
  ```

- jackhammer2 output:

  ```
  # shutil -m /service/0/status
  Metadata information for /service/0/status

  Data Length:   40 bytes
  Data CRC:      0x80711487
  Header CRC:    0x9ba9e2cf
  Last modified: 12:34:51 Mar 31 2004
  ```

In this case, the service metadata information from both members is inconsistent (the CRC information and the Last modified time stamps are different). The information must be identical from all the members.

Write the Configuration File

To write the configuration file, use the following command:

```
shutil -s /etc/cluster.xml
```

You should use this command if one of the following is true:

- The configuration file in the shared quorum partitions is not consistent with the /etc/cluster.xml file
- The shared quorum partition was cleared using the shutil -i command

Displaying Metadata Remotely

To display the metadata information from the shared quorum partition, use the following command:

```
shutil -p /service/0/status
```

Last Resort: Clear Information

Caution: Do not run this command while the cluster is enabled.

To clear all cluster information, use the following command:

```
shutil -i
```

Serial Cable or Reset issues

The `clufence` command will fail with a nonzero error code for any of the following reasons:

- The serial cable is not connected
- The cable is faulty
- The system controller is not responding

The messages shown in the following output are also logged to `/var/log/messages`:

```
# clufence -s jackhammer2
[12314] info: STONITH: Power controller l2 connected to peer’s /dev/ttyIOC1 controls jackhammer
[12314] info: STONITH: Power controller l2 connected to peer’s /dev/ttyIOC1 controls jackhammer2
[12314] err: STONITH: Device at /dev/ttyIOC1 controlling jackhammer2 FAILED status check:
Timed out
```

Failed State for a Service

The following output indicates that the action to disable a service (in this case, `nfs_samba`) has failed, and the service is moved to failed state:

```
# clusvcadm -d nfs_samba
Member machine1 disabling nfs_samba...failed
Service nfs_samba might be running in the cluster. Stop the service manually.
```

To recover, do the following:

- Fix the problem.
- Stop the resources in the service manually using the `ifconfig`(8), `exportfs`(8), and `umount`(8) commands .
- Disable the service using the `clusvcadm`(8) command or the SGI Cluster Manager GUI.

  Note: SGI Cluster Manager does not verify that the service has been stopped before disabling.

For more information, see"Service Administration" on page 66 and "Cluster Service States" on page 67.

Error Messages

Following are common error messages.

```
Shared partition device file names must be defined.
```

An attempt was made to define the cluster before defining the shared state. Use the `--sharedstate` command line option or shared state GUI menu to define devices. See "Step 1: Define the Shared Quorum Partitions" on page 30.

```
Shared partition device file names primary /dev/shared1 and shadow /dev/shared2 are not valid.
```

```
Shared storage initialization failed.
Fix shared storage and write configuration file to shared storage.
Continuing ...
```

The shared quorum partitions are not accessible or not valid and a configuration change or query was made using the CLI.

```
[12314] err: STONITH: Device at /dev/ttyIOC1 controlling jackhammer2 FAILED status check:
Timed out
```

There is a problem with the serial cable or system controller. See "Serial Cable or Reset issues" on page 105.

```
clumembd[8431]:  No heartbeat channels available!
clumembd[8431]:  Heartbeat failed to initialize!
```

These messages (logged by the `clumembd` process when the local cluster manager daemons are started using GUI or command line) mean that the IP address for the hostname could not be determined or that the IP address assigned to the hostname is invalid. You can verify this by sending `ping` packets local machine's hostname. Fix the hostname IP address and restart the local cluster daemons.

```
Traceback (most recent call last):
   File "/usr/sbin/sgicm-config-cluster", line 47, in ?
     from clusterpkg.cluconfig_module  import cluconfig
   File "/usr/share/sgicm-config-cluster/configure/clusterpkg/cluconfig_module.py", line 2, in ?
     from clusterpkg.cluster_module    import cluster
   File "/usr/share/sgicm-config-cluster/configure/clusterpkg/cluster_module.py", line 2, in ?
     from xml.dom import minidom
 ImportError: No module named xml.dom
```

These messages will occur if you try to run SGI Cluster Manager without first installing the appropriate packages from the SUSE LINUX Enterprise Server 9 CDs. See "Software Packages" on page 21.

Reporting Problems to SGI

If you encounter problems, collect the following data from each member:

- Output from the following commands:

  ```
  hinv
  chkconfig --list
  shutil -r -
  rpm -qa
  uname -a
  ```

```
ps -ef | grep clu
clustat
ls -l each_shared_quorum_partition
ls -lL each_shared_quorum_partition
clufence -s other_members
exportfs    (in NFS configurations)
mount
cxfs_dump    (in CXFS configurations)
```

- Contents of the following files:

```
/etc/cluster.xml
/usr/lib/clumanger/create_device_links
/var/log/messages
/etc/samba/smb.conf*   (in Samba configurations)
```

Appendix A

FailSafe and SGI Cluster Manager

Table A-1 summarizes the differences between IRIX FailSafe and SGI Cluster Manager for Linux for those readers who may be familiar with FailSafe.

Note: SGI Cluster Manager for Linux members and FailSafe nodes do not work together and cannot form a high-availability cluster.

Table A-1 Differences Between FailSafe and SGI Cluster Manager

Topic	FailSafe	SGI Cluster Manager
Operating system	IRIX	SLES9 with SGI ProPack 4 for Linux
Terminology	node resource	member application
Size of cluster	8 nodes	2 members
Node/member name	Hostname or private network address	Hostname only
NFS lock failover	Supported	Not supported
Network tiebreaker	A node that is participating the cluster membership. FailSafe tries to include the tiebreaker node in the membership in case of split-brain scenarios.	The IP address of machine or a router that **does not participate** in the cluster membership. Usually it is the IP address of a network router that connects the SGI Cluster Manager members to the external world (clients). In a split-brain scenario, only those members that can contact the tiebreaker IP address can form a cluster. There is also a disk tiebreaker.
Rolling upgrade	Supported	Not supported

Topic	FailSafe	SGI Cluster Manager
Configuration information storage	Information is stored in the cluster database. The cluster database is replicated on all nodes automatically and kept in synchronization.	Information is stored in the `/etc/cluster.xml` configuration file and in the shared partitions. You must copy this file to all members, such as by using `scp`. After making configuration changes, you must verify that configuration files are in synchronization. See "Step 15: Verify that Configuration Changes are Synchronized" on page 47.
Making changes while the service is enabled	Device parameter, IP address parameters, and check interval can be changed.	Device parameter, IP address parameters, and check interval cannot be changed.
Script location for resources and resource types	`/var/cluster/ha/resource_types`	`/usr/lib/clumanager/services/service`
Heartbeat interval and timeout	You can specify cluster membership heartbeat interval and timeout (in milliseconds).	In the command line, you can specify the heartbeat interval (in microseconds) and the number of heartbeats that can be consecutively missed (`tko_count`). You can also specify the aggregate failover speed in the GUI.
Heartbeat networks	Allows multiple networks to be designated as heartbeat networks. You can choose a list of networks.	Allows heartbeat on all networks or as a multicast on the hostname network. However, you cannot choose a list of networks.
Action scripts	Separate scripts named `start`, `stop`, `monitor`, `restart`, `exclusive`.	A `bash` script that contains `start`, `stop`, and `status` parameters (see Chapter 6, "Creating a New Highly Available Application" on page 71). The equivalent for `restart` in SGI Cluster Manager is to perform a `stop` and then a `start`; there is no equivalent in SGI Cluster Manager for `exclusive`.
Resource timeouts	Timeouts can be specified for each action (`start`, `stop`, `monitor`, `restart`, `exclusive`) and for each resource type independently.	Timeout can be specified for each service irrespective of the action or the number of resources it contains.

Topic	FailSafe	SGI Cluster Manager
Resource dependencies	Resource and resource type dependencies are supported and can be modified by the user.	Applications have fixed dependencies. The start and stop order of applications cannot be modified.
Failover policies	The ordered and round-robin failover policies are predefined. User-defined failover policies are supported.	Only the predefined ordered policy is supported. No user-defined failover policies are supported.

Appendix B

Setting the Partition Type to Linux

To set a partition type to Linux, use fdisk(8) command as follows:

1. Use the t subcommand to change a partition’s system ID.
2. Enter hexadecimal code 83, which represents Linux.
3. Enter w to write the change and exit the fdisk tool.

For example, to change partition 1 to Linux, do the following (some output is truncated):

```
# fdisk /dev/xscsi/pci04.01.0/target3/lun0/disc

The number of cylinders for this disk is set to 69424.
There is nothing wrong with that, but this is larger than 1024,
and could in certain setups cause problems with:
1) software that runs at boot time (e.g., old versions of LILO)
2) booting and partitioning software from other OSs
   (e.g., DOS FDISK, OS/2 FDISK)

Command (m for help): m
Command action
   a   toggle a bootable flag
   b   edit bsd disklabel
   c   toggle the dos compatibility flag
   d   delete a partition
   l   list known partition types
   m   print this menu
   n   add a new partition
   o   create a new empty DOS partition table
   p   print the partition table
   q   quit without saving changes
   s   create a new empty Sun disklabel
   t   change a partition’s system id
   u   change display/entry units
   v   verify the partition table
   w   write table to disk and exit
   x   extra functionality (experts only)
```

```
Command (m for help): p

Disk disc: 72.7 GB, 72796340224 bytes
64 heads, 32 sectors/track, 69424 cylinders
Units = cylinders of 2048 * 512 = 1048576 bytes

Device Boot    Start         End    Blocks   Id  System
 part1             1          11     11248    5  Extended
 part2            12          22     11264   83  Linux
 part3            23       19096  19531776   83  Linux
 part4         19097       69424  51535872    5  Extended
 part5         19097       38170  19531760   83  Linux
 part6         38171       57244  19531760   83  Linux
 part7         57245       69424  12472304   83  Linux

Command (m for help): t
Partition number (1-7): 1
Hex code (type L to list codes): L

...
 5  Extended        40  Venix 80286     83  Linux           c7  Syrinx
 ...
Hex code (type L to list codes): 83

Command (m for help): w
```

To verify the partition type, use the `p` subcommand. For example:

```
Command (m for help): p

Disk disc: 72.7 GB, 72796340224 bytes
64 heads, 32 sectors/track, 69424 cylinders
Units = cylinders of 2048 * 512 = 1048576 bytes

Device Boot    Start         End    Blocks   Id  System
 part1             1          11     11248   83  Linux
 part2            12          22     11264   83  Linux
 part3            23       19096  19531776   83  Linux
 part4         19097       69424  51535872    5  Extended
 part5         19097       38170  19531760   83  Linux
 part6         38171       57244  19531760   83  Linux
 part7         57245       69424  12472304   83  Linux
```

Glossary

CLI

Command line interface (sgicm-config-cluster-cmd).

cluster global lock manager daemon

The clulockd daemon, which stores locks on the shared partition.

cluster membership daemon

The clumembd daemon, which performs network heartbeats and checks the liveliness of other members in the cluster.

cluster quorum daemon

The cluquorumd daemon, which computes new membership, implements quorum, enforces I/O fencing, and reads/writes membership information to the shared partition.

cluster remote NFS mount table daemon

The clurmtabd daemon, which synchronizes NFS mount point entries by polling the /var/lib/nfs/rmtab file.

cluster service manager daemon

The clusvcmgrd daemon, which starts/stops and checks the status of services running in the cluster.

control messages

Messages that SGI Cluster Manager software sends between the members to request operations or distribute information to ensure that services remain highly available.

controlled failback

The service will not be moved to a machine that has newly joined the cluster even if the new machine is the preferred member according to the failover domain. The system administrator must manually relocate the service in order to move it back to the preferred member.

disk tiebreaker

If two members cannot talk to each other, they look at the status on the shared partition disk to decide which member should survive and be part of the cluster membership. If the disk cannot be accessed or membership on the disk does not include a given machine, all SGI Cluster Manager processes on the machine exit.

failback option

A failover domain option that is considered when a member rejoins the cluster.

failover

The process by which one member restarts the highly available applications of a failed member.

failover domain

The list of members in the cluster where a service can be online.

failover option

A failover domain option that is considered when a failure occurs and a new target member for the service must be determined.

failover speed

The time it takes to detect a member failure.

GUI

Graphical user interface (`sgicm-config-cluster`).

heartbeat interval

The number of microseconds before a heartbeat is sent to all other members in the cluster.

heartbeat

Messages that SGI Cluster Manager software sends between the members that indicate a machine is up and running.

heartbeat timeout

The number of heartbeats missed before a member is declared as failed.

highly available services

Applications that are monitored by the SGI Cluster Manager software. If one member fails, the other member restarts the highly available applications of the failed member. To clients, the services on the replacement member are indistinguishable from the original services before failure occurred. It appears as if the original member has crashed and rebooted quickly. The clients notice only a brief interruption in the highly available service.

IX brick

System component that provides the base I/O functionality for the system; it contains the electronics and hardware necessary to boot.

IO10

A full-size PCI expansion board that provides basic system I/O capabilities via the PCI bus.

L2

SGI system controller used to monitor and manage the server.

local member

The machine being configured.

local XVM volumes

Logical volumes that are local to a member and not shared across the cluster.

lowest-ordered

A higher preference for a service to be started on that member.

member

A machine or system partition that is defined as part of a cluster.

multiport serial adapter cable

A device that provides four DB9 serial ports from a 36-pin connector.

network tiebreaker

Ensures that only the member that can contact the tiebreaker IP address can form a cluster. The tiebreaker is the IP address of a machine or a router that **does not participate** in the cluster. Usually, it is the IP address of a network router that connects the members to the external world (clients).

ordered failover

A failover domain option that causes the service to start on the first member defined if it is available.

partition

See *shared partitions* and *system partition*.

peer member

The other member in the cluster, to which the local system controller is connected.

primary partition

One of the two disk partitions without filesystems where SGI Cluster Manager keeps configuration, cluster, and service status information. See also *shared partition* and *shadow partition*.

plug-in

The set of software that allows a service to be highly available without modifying the application itself.

restricted failover

A failover domain option that permits failover only to the members listed.

SATA

Serial ATA disk.

service ID

A number that identifies the service (the ID is automatically determined and is not user-configurable).

shadow partition

One of the two disk partitions without filesystems where SGI Cluster Manager keeps configuration, cluster, and service status. The shadow partition is the backup partition. See also *primary partition*and *shared partitions*.

shared partitions

The two disk partitions without filesystems (primary partition and shadow partition) where SGI Cluster Manager keeps configuration, cluster, and service status information.

split-brain scenario

Network partition in which both members attempt to form individual clusters.

symlink

Symbolic link

system partition

A machine that is logically divided into multiple servers. Also referred to as an *Altix partition*.

Index