PRIMECLUSTER™

Cluster Foundation (CF) (Solaris™)
Configuration and Administration Guide

Edition June 2009

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Contents

1 Preface

The Cluster Foundation (CF) provides a comprehensive base of services that user applications and other PRIMECLUSTER services need to administrate and communicate in a cluster. These services include the following:

- Internode communications
- Node state management
- Cluster-wide configuration information
- Management and administration
- Distributed lock management

In addition, the foundation provides the following optional services:

- RCFS is a cluster-wide file share service
- RCVM is a cluster-wide volume management service

This document assumes that the reader is familiar with the contents of the PRIMECLUSTER *Concepts Guide* and that the PRIMECLUSTER software has been installed as described in the PRIMECLUSTER *Installation Guide*.

1.1 Contents of this manual

This manual contains the configuration and administration information for the PRIMECLUSTER components. This manual is organized as follows:

- The Chapter “Cluster Foundation” describes the administration and configuration of the Cluster Foundation.
- The Chapter “CF Registry and Integrity Monitor” discusses the purpose and physical characteristics of the CF synchronized registry, and it discusses the purpose and implementation of CIM.
- The Chapter “Cluster resource management” discusses the database which is a synchronized clusterwide database holding information specific to several PRIMECLUSTER products.
- The Chapter “GUI administration” describes the administration features in the CF portion of the Cluster Admin graphical user interface (GUI).

- The Chapter “LEFTCLUSTER state” discusses the `LEFTCLUSTER` state, describes this state in relation to the other states, and discusses the different ways a `LEFTCLUSTER` state is caused.
- The Chapter “CF topology table” discusses the CF topology table as it relates to the CF portion of the Cluster Admin GUI.
- The Chapter “Shutdown Facility” describes the components and advantages of PRIMECLUSTER SF and provides administration information.
- The Chapter “System console” discusses the `SCON` product functionality and configuration. The `SCON` product is installed on the cluster console.
- The Chapter “CF over IP” discusses CF communications based on the use of interconnects.
- The Chapter “Diagnostics and troubleshooting” provides help for troubleshooting and problem resolution for PRIMECLUSTER Cluster Foundation.
- The Chapter “CF messages and codes” provides a listing of messages and codes.
- The Chapter “Manual pages” lists the manual pages for PRIMECLUSTER.

1.2 Related documentation

The documentation listed in this section contains information relevant to PRIMECLUSTER and can be ordered through your sales representative.

In addition to this manual, the following manuals are also available for PRIMECLUSTER:

- Release notices for all products—These documentation files are included as HTML files on the PRIMECLUSTER Framework CD. Release notices provide late-breaking information about installation, configuration, and operations for PRIMECLUSTER. Read this information first.
- *Concepts Guide (Solaris, Linux)*—Provides conceptual details on the PRIMECLUSTER family of products.
- *Installation Guide (Solaris)*—Provides instructions for installing and upgrading PRIMECLUSTER products.
- *Reliant Monitor Services (RMS) with Wizard Tools (Solaris, Linux) Configuration and Administration Guide*—Provides instructions for configuring and administering RMS using PRIMECLUSTER Wizard Tools.

- *Reliant Monitor Services (RMS) with PCS (Solaris, Linux) Configuration and Administration Guide*—Provides instructions for configuring and administering RMS *using PRIMECLUSTER Configuration Services (PCS).*
- *Reliant Monitor Services (RMS) (Solaris, Linux) Troubleshooting Guide*—Describes diagnostic procedures to solve RMS configuration problems, including how to view and interpret RMS log files. Provides a list of all RMS error messages with a probable cause and suggested action for each condition.
- *Scalable Internet Services (SIS) (Solaris, Linux) Configuration and Administration Guide*—Provides information on configuring and administering Scalable Internet Services (SIS).
- *Global Disk Services (Solaris) Configuration and Administration Guide*—Provides information on configuring and administering Global Disk Services (GDS).
- *Global File Services (Solaris) Configuration and Administration Guide*—Provides information on configuring and administering Global File Services (GFS).
- *Global Link Services (Solaris) Configuration and Administration Guide: Redundant Line Control Function*—Provides information on configuring and administering the redundant line control function for Global Link Services (GLS).
- *Global Link Services (Solaris) Configuration and Administration Guide: Redundant Line Control Function*—Provides information on configuring and administering the redundant line control function for Global Link Services (GLS).
- *Web-Based Admin View (Solaris/Linux) Operation Guide*—Provides information on using the Web-Based Admin View management GUI.
- *SNMP Reference Manual (Solaris, Linux)*—Provides reference information on the Simple Network Management Protocol (SNMP) product.
- *Data Management Tools (Solaris) Configuration and Administration Guide*—Provides reference information on the Volume Manager (RCVM) and File Share (RCFS) products.
- *RMS Wizards documentation package*—Available on the PRIMECLUSTER CD. These documents deal with topics such as the configuration of file systems and IP addresses. They also describe the different kinds of wizards.

1.3 Conventions

In order to standardize the presentation of material, this manual uses a number of notational, typographical, and syntactical conventions.

1.3.1 Notation

This manual uses the following notational conventions.

1.3.1.1 Prompts

Command line examples that require system administrator (or root) privileges to execute are preceded by the system administrator prompt, the hash sign (#). Entries that do not require system administrator rights are preceded by a dollar sign ($).

In some examples, the notation *node#* indicates a root prompt on the specified node. For example, a command preceded by fuji2# would mean that the command was run as user `root` on the node named fuji2.

1.3.1.2 The keyboard

Keystrokes that represent nonprintable characters are displayed as key icons such as [Enter] or [F1]. For example, [Enter] means press the key labeled *Enter*; [Ctrl-b] means hold down the key labeled *Ctrl* or *Control* and then press the [B] key.

1.3.1.3 Typefaces

The following typefaces highlight specific elements in this manual.

Typeface	Usage
`Constant Width`	Computer output and program listings; commands, file names, manual page names and other literal programming elements in the main body of text.
Italic	Variables that you must replace with an actual value. Items or buttons in a GUI window.
Bold	Items in a command line that you must type exactly as shown.

Typeface conventions are shown in the following examples.

1.3.1.4 Example 1

Several entries from an `/etc/passwd` file are shown below:

```
sysadm:x:0:0:System Admin.:/usr/admin:/usr/sbin/sysadm
setup:x:0:0:System Setup:/usr/admin:/usr/sbin/setup
daemon:x:1:1:0000-Admin(0000):/:
```

1.3.1.5 Example 2

To use the `cat` command to display the contents of a file, enter the following command line:

$ **`cat`** *file*

1.3.2 Command syntax

The command syntax observes the following conventions.

Symbol	Name	Meaning
[ ]	Brackets	Enclose an optional item.
{ }	Braces	Enclose two or more items of which only one is used. The items are separated from each other by a vertical bar (|).
|	Vertical bar	When enclosed in braces, it separates items of which only one is used. When not enclosed in braces, it is a literal element indicating that the output of one program is piped to the input of another.
( )	Parentheses	Enclose items that must be grouped together when repeated.
...	Ellipsis	Signifies an item that may be repeated. If a group of items can be repeated, the group is enclosed in parentheses.

1.4 Notation symbols

Material of particular interest is preceded by the following symbols in this manual:

Contains important information about the subject at hand.

Caution

Indicates a situation that can cause harm to data.

1.5 Abbreviations

- Solaris^{TM} operating system is abbreviated as Solaris.
- If "Solaris X" is indicated in the reference manual name of the Solaris manual, replace "Solaris X" with "Solaris 9 operating system (Solaris 9)" or the "Solaris 10 operating system (Solaris 10)".

2 Cluster Foundation

This chapter describes the administration and configuration of the Cluster Foundation (CF).

This chapter discusses the following:

- The Section “CF, CIP, and CIM configuration” describes CF, Cluster Interconnect Protocol (CIP) and Cluster Integrity Monitor (CIM) configuration that must be done prior to other cluster services.
- The Section “CIP configuration file” describes the format of the CIP configuration file.
- The Section “Cluster Configuration Backup and Restore (CCBR)” details a method to save and restore PRIMECLUSTER configuration information.

2.1 CF, CIP, and CIM configuration

You must configure CF before any other cluster services, such as Reliant Monitor Services (RMS) or Scalable Internet Services (SIS). CF defines which nodes are in a given cluster. After you configure CF, SIS can be run on the configured nodes. In addition, after you configure CF and CIP, the Shutdown Facility (SF) and RMS can be run on the nodes.

The Shutdown Facility (SF) is responsible for node elimination. This means that even if RMS is not installed or running in the cluster, missing CF heartbeats will cause SF to eliminate nodes.

You can use the Cluster Admin CF Wizard to easily configure CF, CIP, and CIM for all nodes in the cluster, and you can use the Cluster Admin SF Wizard to configure SF.

A CF configuration consists of the following main attributes:

- Cluster name—This can be any name that you choose as long as it is 31 characters or less per name and each character comes from the set of printable ASCII characters, excluding white space, newline, and tab characters. Cluster names are always mapped to upper case.

- Set of interfaces on each node in the cluster used for CF networking—For example, the interface of an IP address on the local node can be an Ethernet device.
- CF node name—By default, in Cluster Admin, the CF node names are the same as the Web-Based Admin View names; however, you can use the CF Wizard to change them.

The dedicated network connections used by CF are known as interconnects. They typically consist of some form of high speed networking such as 100 MB or Gigabit Ethernet links. There are a number of special requirements that these interconnects must meet if they are to be used for CF:

1. The network links used for interconnects must have low latency and low error rates. This is required by the CF protocol. Private switches and hubs will meet this requirement. Public networks, bridges, and switches shared with other devices may not necessarily meet these requirements, and their use is not recommended.

   It is recommended that each CF interface be connected to its own private network with each interconnect on its own switch or hub.

2. The interconnects should not be used on any network that might experience network outages of 5 seconds or more. A network outage of 10 seconds will, by default, cause a route to be marked as `DOWN`. `cfset`(1M) can be used to change the 10 second default. See the Section “cfset.”

   Since CF automatically attempts to bring up downed interconnects, the problem with split clusters only occurs if all interconnects experience a 10-second outage simultaneously. Nevertheless, CF expects highly reliable interconnects.

CF can also be run over IP. Any IP interface on the node can be chosen as an IP device, and CF will treat this device much as it does an Ethernet device. However, all the IP addresses for all the cluster nodes on that interconnect must be on the same IP subnetwork, and their IP broadcast addresses must be the same (refer to the Chapter “CF over IP” for more information).

The IP interfaces used by CF must be completely configured by the System Administrator before they are used by CF. You can run CF over both Ethernet devices and IP devices.

Higher level services, such as RMS, SF, GFS, and so forth, will not notice any difference when CF is run over IP.

You should carefully choose the number of interconnects you want in the cluster before you start the configuration process. If you decide to change the number of interconnects after you have configured CF across the cluster, you will need to bring down CF on each node to do the reconfiguration. Bringing down CF requires that higher level services, like RMS, SF, SIS and applications, be stopped on that node, so the reconfiguration process is neither trivial nor unobtrusive.

i Your configuration should specify at least two interconnects to avoid a single point of failure in the cluster.

Before you begin the CF configuration process, ensure that all of the nodes are connected to the interconnects you have chosen and that all of the nodes can communicate with each other over those interconnects. For proper CF configuration using Cluster Admin, all of the interconnects should be working during the configuration process.

CIP configuration involves defining virtual CIP interfaces and assigning IP addresses to them. Up to eight CIP interfaces can be defined per node. These virtual interfaces act like normal TCP/IP interfaces except that the IP traffic is carried over the CF interconnects. Because CF is typically configured with multiple interconnects, the CIP traffic will continue to flow even if an interconnect fails. This helps eliminate single points of failure as far as physical networking connections are concerned for intracluster TCP/IP traffic.

Except for their IP configuration, the eight possible CIP interfaces per node are all treated identically. There is no special priority for any interface, and each interface uses all of the CF interconnects equally. For this reason, many system administrators may chose to define only one CIP interface per node.

To ensure that you can communicate between nodes using CIP, the IP address on each node for a specific CIP interface should use the same subnet.

CIP traffic is really intended only to be routed within the cluster. The CIP addresses should not be used outside of the cluster. Because of this, you should use addresses from the non-routable reserved IP address range.

Address Allocation for Private Internets (RFC 1918) defines the following address ranges that are set aside for private subnets:

Subnets(s)	Class	Subnetmask
`10.0.0.0`	`A`	`255.0.0.0`
`172.16.0.0 ... 172.31.0.0`	`B`	`255.255.0.0`
`192.168.0.0 ... 192.168.255.0`	`C`	`255.255.255.0`

For CIP nodenames, it is strongly recommended that you use the following convention for RMS:

cfname`RMS`

cfname is the CF name of the node and `RMS` is a literal suffix. This will be used for one of the CIP interfaces on a node. This naming convention is used in the Cluster Admin GUI to help map between normal nodenames and CIP names. In general, only one CIP interface per node is needed to be configured.

i A proper CIP configuration uses `/etc/hosts` to store CIP names. You should make sure that `/etc/nsswitch.conf`(4) is properly set up to use `files` criteria first in looking up its nodes. Refer to the PRIME-CLUSTER *Installation Guide (Solaris)* for more details.

The recommended way to configure CF, CIP and CIM is to use the Cluster Admin GUI. A CF/CIP Wizard in the GUI can be used to configure CF, CIP, and CIM on all nodes in the cluster in just a few screens. Before running the wizard, however, the following steps must have been completed:

1. CF/CIP, Web-Based Admin View, and Cluster Admin should be installed on all nodes in the cluster.

2. If you are running CF over Ethernet, then all of the interconnects in the cluster should be physically attached to their proper hubs or networking equipment and should be working.

3. If you are running CF over IP, then all interfaces used for CF over IP should be properly configured and be up and running. See Chapter “CF over IP” for details.

4. Web-Based Admin View configuration must be done. Refer to the PRIME-CLUSTER *Installation Guide (Solaris)* for details.

In the *cf* tab in Cluster Admin, make sure that the CF driver is loaded on that node. Press the *Load Driver* button if necessary to load the driver. Then press the *Configure* button to start the CF Wizard.

The CF/CIP Wizard is invoked by starting the GUI on a node where CF has not yet been configured. When this is done, the GUI will automatically bring up the CF/CIP Wizard in the *cf* tab of the GUI. You can start the GUI by entering the following URL with a browser running a proper version of the Java plug-in:

`http://`*management_server*`:8081/Plugin.cgi`

management_server is the primary or secondary management server you configured for this cluster. Refer to the PRIMECLUSTER *Installation Guide (Solaris)* for details on configuring the primary and secondary management service and on which browsers and Java plug-ins are required for the Cluster Admin GUI.

2.1.1 Differences between CIP and CF over IP

Although the two terms CF over IP and CIP (also known as IP over CF) sound similar, they are two very distinct technologies.

CIP defines a reliable IP interface for applications on top of the cluster foundation (CF). CIP itself distributes the traffic generated by the application over the configured cluster interconnects (see Figure 1).

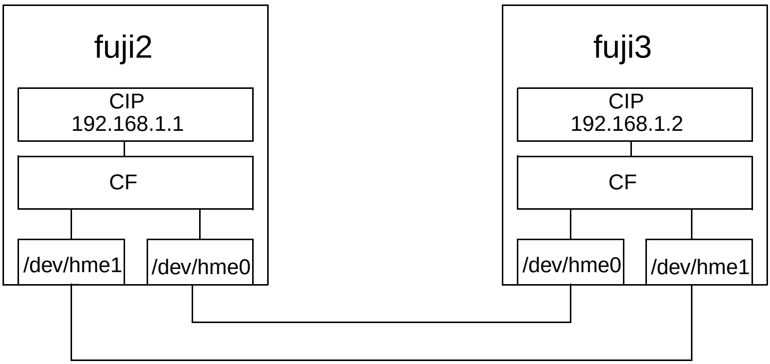


Figure 1: CIP diagram

CF over IP uses an IP interface, provided by the operating system, as a CF interconnect. The IP interface should not run over the public network. It should only be on a private network, which is also the local network. The IP interface over the private interconnect can be configured by using an IP address designed for the private network. The IP address normally uses the following address:

`192.168.0.`*x*

x is an integer between 1 and 254.

During the cluster joining process, CF sends broadcast messages to other nodes; therefore, all the nodes must be on the same local network. If one of the nodes is on a different network or subnet, the broadcast will not be received by that node. Therefore, the node will fail to join the cluster.

The following are possible scenarios for CF over IP:

- Where the cluster spans over two Ethernet segments of the same sub network. Each sub-level Ethernet protocol is not forwarded across the router but does pass IP traffic.
- When you need to reach beyond the physical cable length. Regular Ethernet is limited to the maximum physical length of the cable. Distances that are longer than the maximum cable length cannot be reached.
- If some of the network device cards that only support TCP/IP (for example, some Fiber channel) are not integrated into CF.

Use CF with the Ethernet link-level connection whenever possible because CF over IP implies additional network/protocol information and usually will not perform as well (see Figure 2).

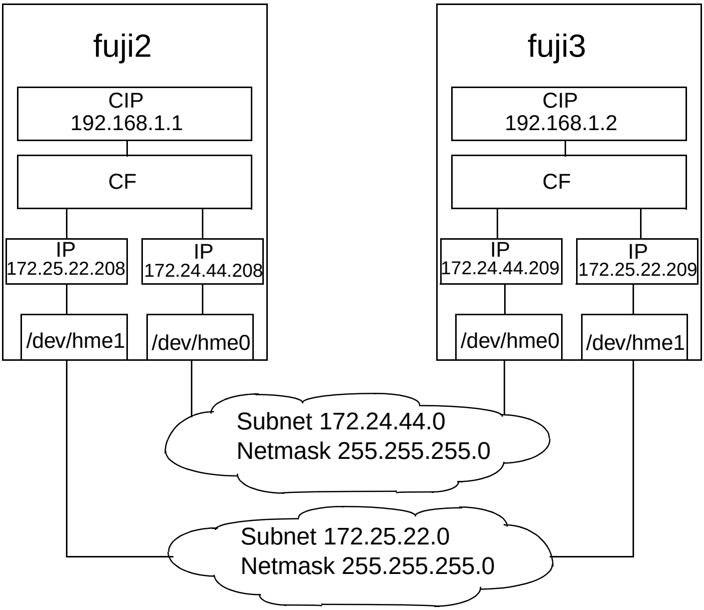


Figure 2: CF over IP diagram

2.1.2 cfset

The `cfset`(1M) utility can be used to set certain tunable parameters in the CF driver. The values are stored in `/etc/default/cluster.config`. The `cfset`(1M) utility can be used to retrieve and display the values from the kernel or the file as follows:

- A new file under `/etc/default` called `cluster.config` is created.
- The values defined in `/etc/default/cluster.config` can be set or changed using the GUI (for `cfcp` and `cfsh` during initial cluster configuration) or by using a text editor.

- The file consists of the following tupple entries, *Name* and *Value*:

  Name:

  – This is the name of a CF configuration parameter. It must be the first token in a line.

  – Maximum length for *Name* is 31 bytes. The name must be unique.

  – Duplicate names will be detected and reported as an error when the entries are applied by `cfconfig -l` and by the `cfset`(1M) utility (`cfset -r` and `-f` option). This will log invalid and duplicate entries to `/var/adm/messages`.

  – `cfset`(1M) can change the *Value* for the *Name* in the kernel if the driver is already loaded and running.

  Value:

  – This represents the value to be assigned to the CF parameter. It is a string, enclosed in double quotes or single quotes. Maximum length for *Value* is 4K characters.

  – New lines are not allowed inside the quotes.

  – A new line or white space marks the close of a token.

  – However, if double quotes or single quotes start the beginning of the line, treat the line as a continuation value from the previous value.

- The maximum number of *Name*/*Value* pair entries is 100.
- The hash sign (#) is used for the comment characters. It must be the first character in the line, and it causes the entries on that line to be ignored.
- Single quotes can be enclosed in double quotes or vice versa.

`cfset`(1M) options are as follows:

`cfset [ -r | -f | -a | -o` ***name*** `| -g` ***name*** `| -h ]`

i Refer to the Chapter “Manual pages” and to the `cfset`(1M) manual page for more details on options.

The settable are as follows:

- `CLUSTER_TIMEOUT` (refer to the example that follows)
- `CFSH` (refer to the following Section “CF security”)
- `CFCP` (refer to the following Section “CF security”)

After any change to `cluster.config`, run the `cfset`(1M) command as follows:

```
# cfset -r
```

Example

Use `cfset`(1M) to tune timeout as follows:

```
CLUSTER_TIMEOUT "30"
```

This changes the default 10-second timeout to 30 seconds. The minimum value is 1 second. There is no maximum. It is strongly recommended that you use the same value on all cluster nodes.

`CLUSTER_TIMEOUT` represents the number of seconds that one cluster node waits while for a heartbeat response from another cluster node. Once `CLUSTER_TIMEOUT` seconds has passed, the non-responding node is declared to be in the `LEFTCLUSTER` state. The default value for `CLUSTER_TIMEOUT` is `10`, which experience indicates is reasonable for most PRIMECLUSTER installations. We allow this value to be tuned for exceptional situations, such as networks which may experience long switching delays.

2.1.3 CF security

PRIMECLUSTER includes the following facilities for cluster communications if you do not want to use .rhosts:

- cfcp/cfsh
- sshconf

These tools are provided to allow cluster configuration in an environment which does not permit `rsh` and `rcp`. They are specialized utilities that do not provide all the functionality of `rsh` and `rcp` and are not intended as replacements.

2.1.3.1 cfcp/cfsh

CF includes the ability to allow cluster nodes to execute commands on another node (`cfsh`) and to allow cluster nodes to copy files from one node to another (`cfcp`). However, this means that your cluster interconnects must be secure since any node that can join the cluster has access to these facilities. Because of this, these facilities are disabled by default.

PRIMECLUSTER 4.1 offers a chance to configure these facilities. As one of the final steps of the CF Configuration Wizard in the Cluster Adm GUI, there are two checkboxes. Checking one enables remote file copying and checking the other enables remote command execution.

The PRIMECLUSTER family of products assume that the cluster interconnects are private networks; however, it is possible to use public networks as cluster interconnects because Internode Communication Facility (ICF) does not interfere with other protocols running on the physical media. The security model for running PRIMECLUSTER depends on physical separation of the cluster interconnect networks from the public network.

i For reasons of security, it is strongly recommended not to use public networks for the cluster interconnect.

The use of public networks for the cluster interconnects will allow any node on that public network to join the cluster (assuming that it is installed with the PRIMECLUSTER products). Once joined, an unauthorized user, through the node, would have full access to all cluster services.

To enable remote access using cfcp/cfsh, set the following parameters in `cluster.config`:

```
CFCP "cfcp"
CFSH "cfsh"
```

To deactivate, remove the settings from the `/etc/default/cluster.config` file and run `cfset -r`. `cfsh` does not support interactive commands like `hvreset` and, therefore, is not a fully functional alternative to the `rsh` interface.

Refer to the Section “cfset” in this chapter for more information.

2.1.3.2 sshconf

You can use the `sshconf` tool to set up non-interactive `ssh` access among a list of nodes. Running `sshconf` is similar to setting up the `.rhosts` file for `rsh`.

`sshconf` uses the RSA authentication method and protocol version 2. If it exists, `sshconf` uses the default authentication key `$HOME/.ssh/id_rsa`, or it creates the key it if does not already exist.

i To operate, `sshconf` needs `/bin/bash` to exist on all nodes.

Examples of the `sshconf` tool are as follows:

- Enable one way access between nodes:

fuji2# **sshconf fuji3 fuji4 fuji5**

Running this command on `fuji2` sets up one way `ssh` access from `fuji2` to `fuji3`, `fuji4`, and `fuji5` respectively.

- Disable one-way access to a node:

  fuji2# **sshconf −d fuji3 fuji4 fuji5**

  Running this command on `fuji2` disables `ssh` access from `fuji2` to `fuji3`, `fuji4`, and `fuji5`. This means that `fuji2` does not have `ssh` access to `fuji3`, `fuji4`, and `fuji5`; however, `fuji3`, `fuji4`, and `fuji5` still have the same `ssh` access as before running the command.

- Enable two-way access without password:

  fuji2# **sshconf −c fuji3 fuji4 fuji5**

  Running this command on `fuji2` sets up `ssh` access among `fuji3`, `fuji4`, and `fuji5` without being asked for a password. Note that `fuji2` (where the command is run) is not automatically included. `fuji2` only has one-way `ssh` access to `fuji3`, `fuji4`, and `fuji5`.

2.1.4 Signed applets

Cluster Admin uses Java applets. The main advantage of trusting signed applets is that Cluster Admin can use the client system’s resources. For example, you can copy and paste messages from the Java window into other applications.

2.1.5 Example of creating a cluster

The following example shows what the Web-Based Admin View and Cluster Admin screens would look like when creating a two-node cluster. The nodes involved are named `fuji2` and `fuji3`, and the cluster name is `FUJI`.

This example assumes that Web-Based Admin View configuration has already been done. `fuji2` is assumed to be configured as the primary management server for Web-Based Admin View, and `fuji3` is the secondary management server.

The first step is to start Web-Based Admin View by entering the following URL in a java-enabled browser:

http://*Management_Server***:8081/Plugin.cgi**

`fuji2` is a management server. Enter the following:

http://fuji2:8081/Plugin.cgi

After a few moments, a login pop-up appears asking for a user name and password (see Figure 3).

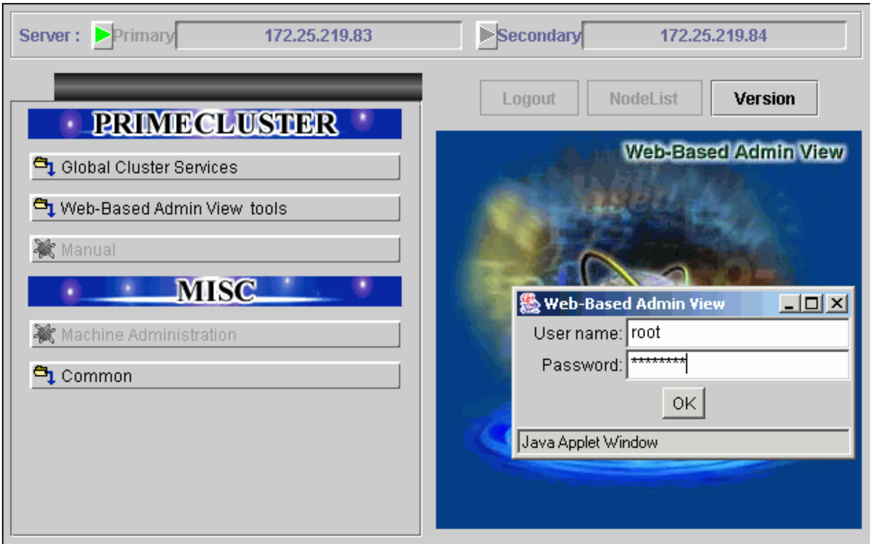


Figure 3: Login pop-up

Since you will be running the Cluster Admin CF Wizard, which does configuration work, you will need a privileged user ID such as root. There are three possible categories of users with sufficient privilege:

- The user `root`—You can enter `root` for the user name and root's password on `fuji2`. The user `root` is always given the maximum privilege in Web-Based Admin View and Cluster Admin.
- A user in group `clroot`—You can enter the user name and password for a user on `fuji2` who is part of the UNIX group `clroot`. This user will have maximum privilege in Cluster Admin, but will be restricted in what Web-Based Admin View functions they can perform. This should be fine for CF configuration tasks.
- A user in group `wvroot`—You can enter the user name and password for a user on `fuji2` who is part of the UNIX group `wvroot`. Users in `wvroot` have maximum Web-Based Admin View privileges and are also granted maximum Cluster Admin privileges.

For further details on Web-Based Admin View and Cluster Admin privilege levels, refer to the PRIMECLUSTER *Installation Guide (Solaris)*.

After clicking on the *OK* button, the top menu appears (see Figure 4). Click on the button labeled *Global Cluster Services*.

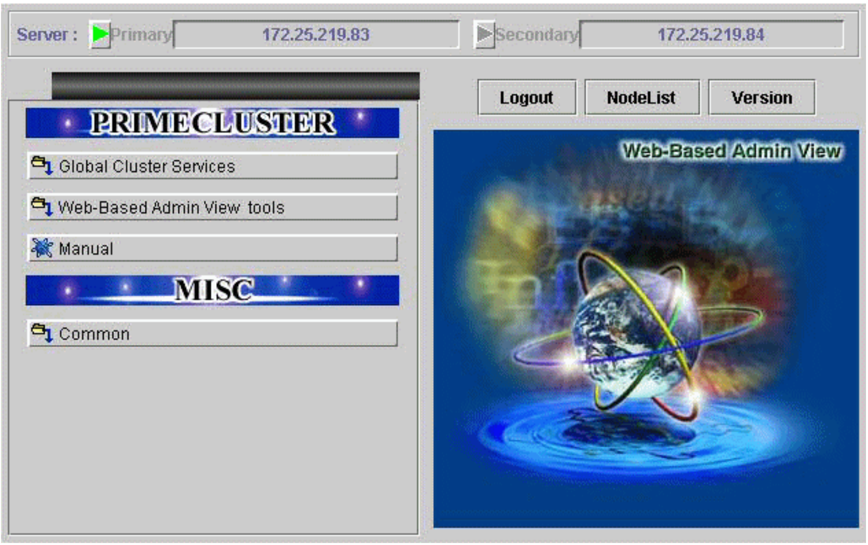


Figure 4: Main Web-Based Admin View window after login

The Cluster Admin selection window appears (see Figure 5).

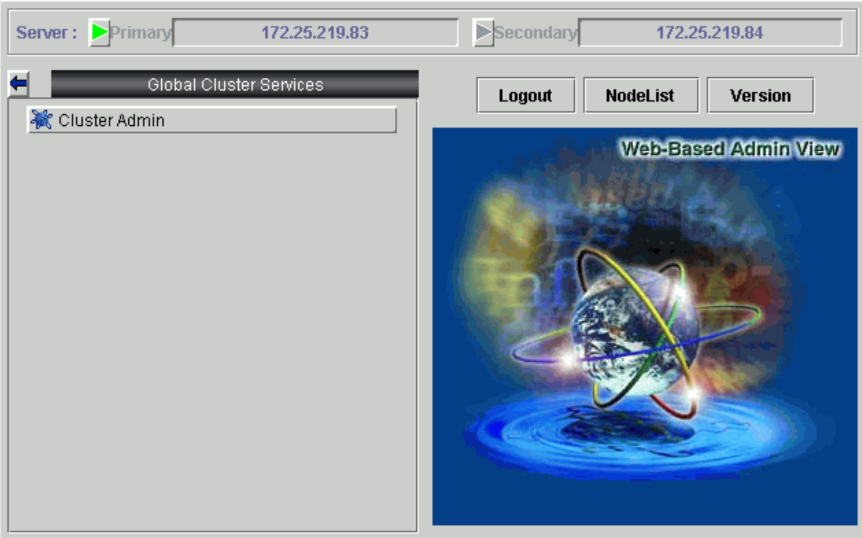


Figure 5: Global Cluster Services window in Web-Based Admin View

Click on the button labeled *Cluster Admin* to launch the Cluster Admin GUI.

The *Choose a node for initial connection* window appears (see Figure 6).

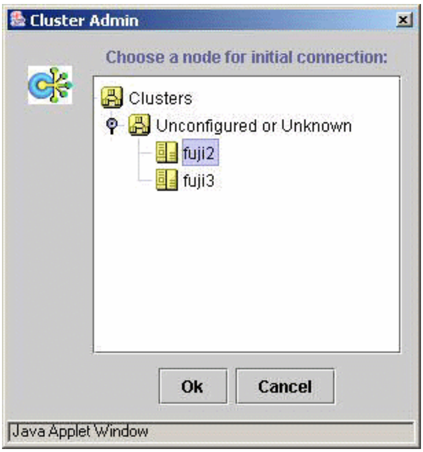


Figure 6: Initial connection pop-up

The *Choose a node for initial connection* window (see Figure 6) lists the nodes that are known to the Web-Based Admin View management station. If you select a node where CF has not yet been configured, then Cluster Admin will let you run the CF Wizard on that node.

In this example, neither `fuji2` nor `fuji3` have had CF configured, so either would be acceptable as a choice. In Figure 6, `fuji2` is selected. Clicking on the *OK* button causes the main Cluster Admin GUI to appear. Since CF is not configured on `fuji2`, a window similar to Figure 7 appears.

Figure 7: CF is unconfigured and unloaded

Click on the *Load driver* button to load the CF driver.

A window indicating that CF is loaded but not configured appears (see Figure 8).

Figure 8: CF loaded but not configured

Click on the *Configure* button to bring up the CF Wizard.

The CF Wizard begins by looking for existing clusters (see Figure 9).

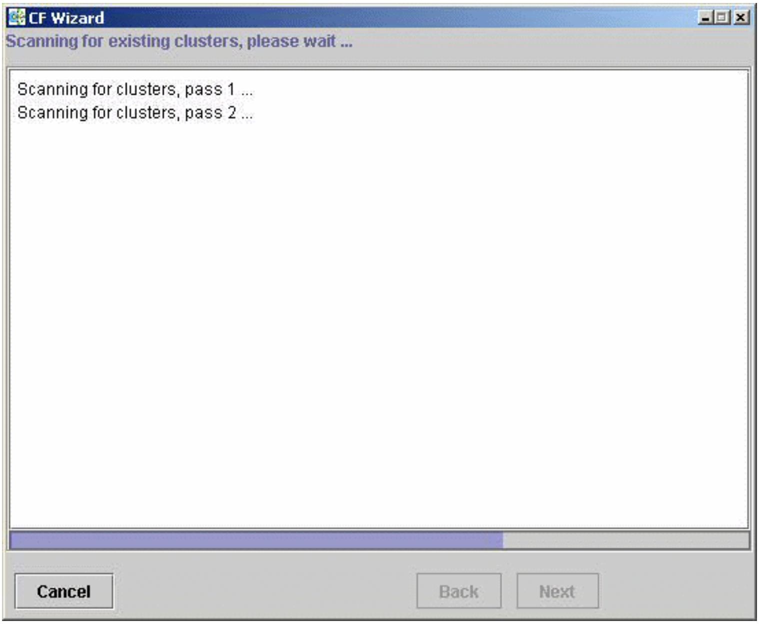


Figure 9: Scanning for clusters

After the CF Wizard finishes looking for clusters, a window similar to Figure 10 appears.

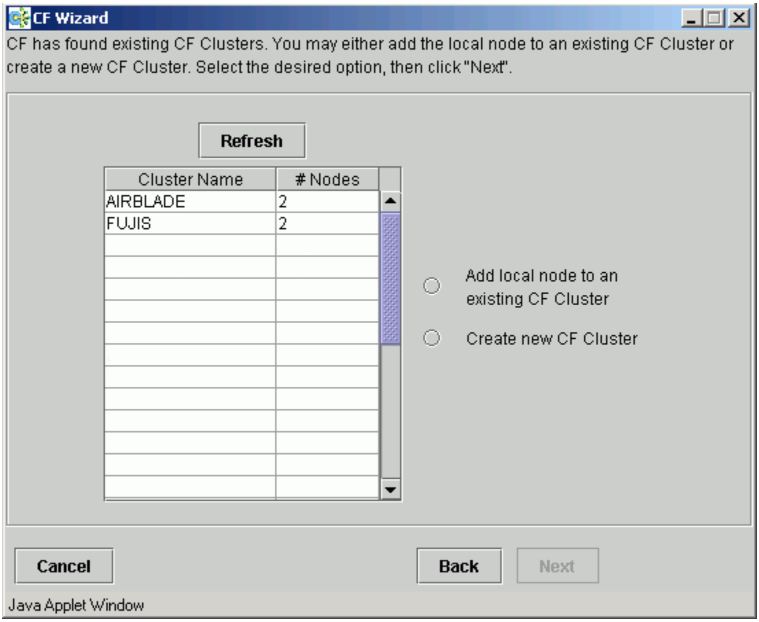


Figure 10: Creating or joining a cluster

This window lets you decide if you want to join an existing cluster or create a new one. To create a new cluster, ensure that the *Create new CF Cluster* button is selected. Then, click on the *Next* button.

The window for creating a new cluster appears (see Figure 11).

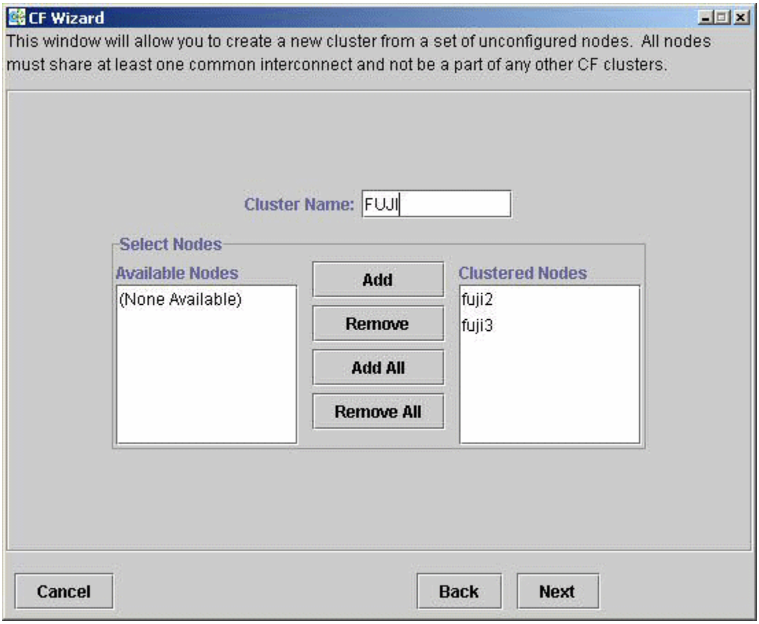


Figure 11: Selecting cluster nodes and the cluster name

This window lets you chose the cluster name and also determine what nodes will be in the cluster. In the example above, we have chosen `FUJI` for the cluster name.

Below the cluster name are two boxes. The one on the right, under the label *Clustered Nodes*, contains all nodes that you want to become part of this CF cluster. The box on the left, under the label *Available Nodes*, contains all the other nodes known to the Web-Based Admin View management server. You should select nodes in the left box and move them to the right box using the *Add* or *Add All* button. If you want all of the nodes in the left box to be part of the CF cluster, then just click on the *Add All* button.

If you get to this window and you do not see all of the nodes that you want to be part of this cluster, then there is a very good chance that you have not configured Web-Based Admin View properly. When Web-Based Admin View is initially installed on the nodes in a potential cluster, it configures each node as if it were a primary management server independent of every other node. If no additional Web-Based Admin View configuration were done, and you started up

Cluster Admin on such a node, then Figure 11 would show only a single node in the right-hand box and no additional nodes on the left-hand side. If you see this, then it is a clear indication that proper Web-Based Admin View configuration has not been done.

Refer to the PRIMECLUSTER *Installation Guide (Solaris)* for more details on Web-Based Admin View configuration.

After you have chosen a cluster name and selected the nodes to be in the CF cluster, click on the *Next* button.

The CF Wizard then loads CF on all the selected nodes and does CF pings to determine the network topology. While this activity is going on, a window similar to Figure 12 appears.

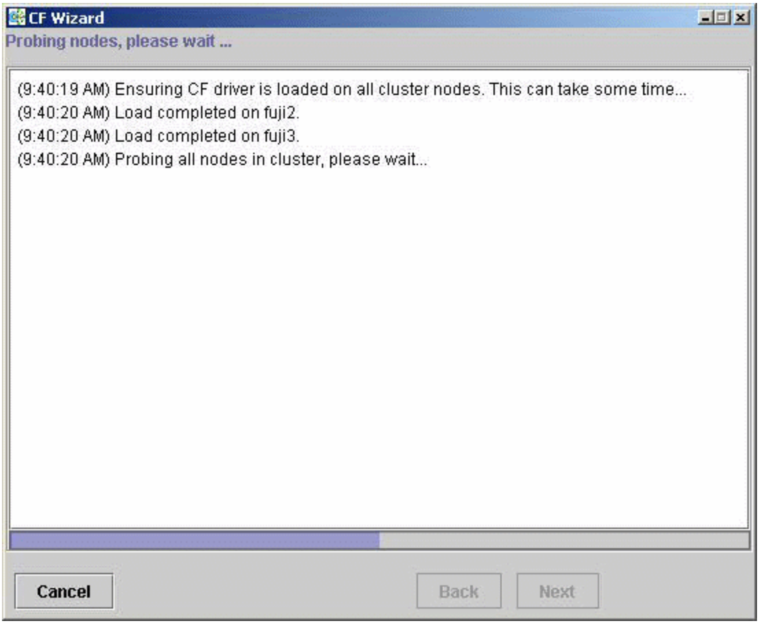


Figure 12: CF loads and pings

On most systems, loading the CF driver is a relatively quick process. However, on some systems that have certain types of large disk arrays, the first CF load can take up to 20 minutes or more.

The window that allows you to edit the CF node names for each node appears (see Figure 13). By default, the CF node names, which are shown in the right-hand column, are the same as the Web-Based Admin View names which are shown in the left-hand column.

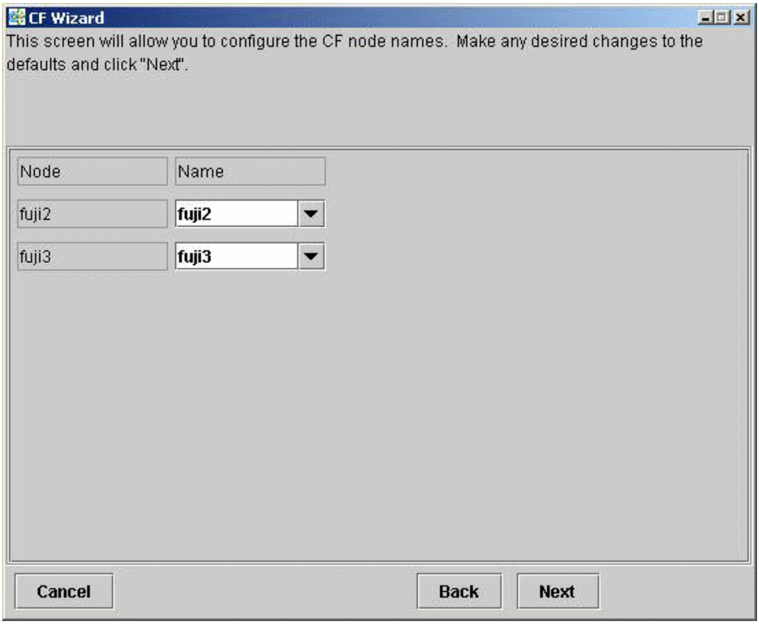


Figure 13: Edit CF node names

Make any changes to the CF node name and click *Next*.

After the CF Wizard has finished the loads and the pings, the CF topology and connection table appears (see Figure 14).

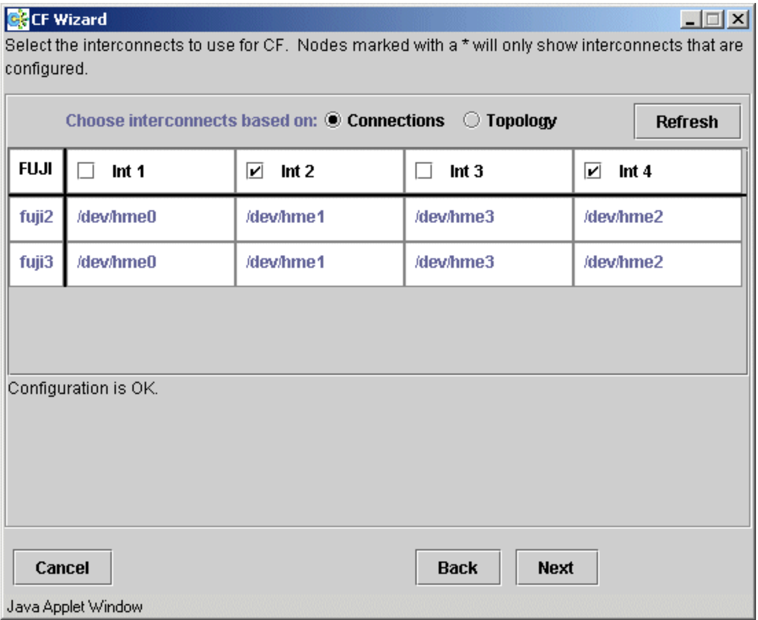


Figure 14: CF topology and connection table

Before using the CF topology and connection table in Figure 14, you should understand the following terms:

- Full interconnect—An interconnect where CF communication is possible to all nodes in the cluster.
- Partial interconnect—An interconnect where CF communication is possible between at least two nodes, but not to all nodes. If the devices on a partial interconnect are intended for CF communications, then there is a networking or cabling problem somewhere.
- Unconnected devices—These devices are potential candidates for CF configuration, but are not able to communicate with any other nodes in the cluster.

The CF Wizard determines all the full interconnects, partial interconnects, and unconnected devices in the cluster using CF pings. If there are one or more full interconnects, then it will display the connection table shown in Figure 14.

Connections table

The connection table lists all full interconnects. Each column with an `Int` header represents a single interconnect. Each row represents the devices for the node whose name is given in the left-most column. The name of the CF cluster is given in the upper-left corner of the table.

In Figure 14, for example, Interconnect 1 (`Int 1`) has `/dev/hme0` on `fuji2` and `fuji3` attached to it. The cluster name is `FUJI`.

> **i** The connections and topology tables typically show devices that are on the public network. Using devices on a public network is a security risk; therefore, in general, do not use any devices on the public network as a CF interconnect. Instead, use devices on a private network.

Although the CF Wizard may list `Int 1`, `Int 2`, and so on, it should be pointed out that this is simply a convention in the GUI. CF itself does not number interconnects. Instead, it keeps track of point-to-point routes to other nodes.

To configure CF using the connection table, click on the interconnects that have the devices that you wish to use. In Figure 14, Interconnects 2 and 4 have been selected. If you are satisfied with your choices, then you can click on *Next* to go to the CIP configuration window.

Occasionally, there may be problems setting up the networking for the cluster. Cabling errors may mean that there are no full interconnects. If you click on the button next to *Topology*, the CF Wizard will display all the full interconnects, partial interconnects, and unconnected devices it has found. If a particular category is not found, it is omitted. For example, in Figure 14, only full interconnects are shown because no partial interconnects or unconnected devices were found on `fuji2` or `fuji3`.

Topology table

The topology table gives more flexibility in configuration than the connection table. In the connection table, you could only select an interconnect, and all devices on that interconnect would be configured. In the topology table, you can individually select devices.

While you can configure CF using the topology table, you may wish to take a simpler approach. If no full interconnects are found, then display the topology table to see what your networking configuration looks like to CF. Using this information, correct any cabling or networking problems that prevented the full interconnects from being found. Then go back to the CF Wizard window where the cluster name was entered and click on *Next* to cause the Wizard to reprobe the interfaces. If you are successful, then the connection table will show the full interconnects, and you can select them. Otherwise, you can repeat the process.

The text area at the bottom of the window will list problems or warnings concerning the configuration.

When you are satisfied with your CF interconnect (and device) configuration, click on *Next*. The CF over IP window appears (see Figure 15).

> **i** The CF over IP window (see Figure 15) shows devices that are on the public network. This is for demonstration purposes only. The IP interface should not run over the public network. CF over IP should only be run on a private network.

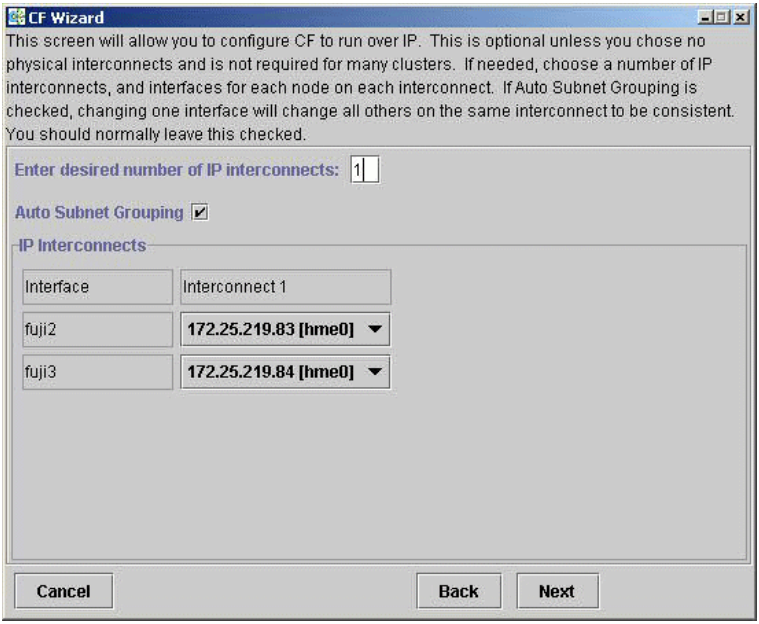


Figure 15: CF over IP window

This is optional. If desired, enter the desired number of IP interconnects and press [Return]. The CF Wizard then displays interconnects sorted according to the valid subnetworks, netmasks, and broadcast addresses.

> **i** Only interfaces that are configured at system boot can be used for CF over IP.

All the IP addresses for all the nodes on a given IP interconnect must be on the same IP subnetwork and should have the same netmask and broadcast address. CF over IP uses the IP broadcast address to find all the CF nodes during join process. So the dedicated network should be used for IP interconnects.

Auto Subnet Grouping should always be checked in this window. If it is checked and you select one IP address for one node, then all of the other nodes in that column have their IP addresses changed to interfaces on the same subnetwork.

Choose the IP interconnects from the combo boxes on this window, and click on *Next*. The CIP Wizard window appears (see Figure 16).

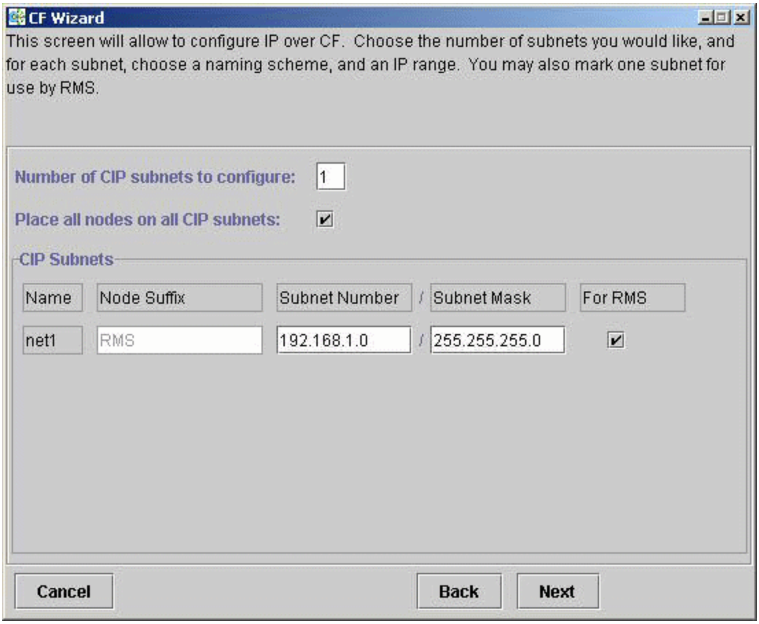


Figure 16: CIP Wizard window

This window allows you to configure CIP. You can enter a number in the box after *Number of CIP subnets to configure* to set the number of CIP subnets to configure. The maximum number of CIP subnets is 8.

For each defined subnet, the CIP Wizard configures a CIP interface on each node defined in the CF cluster. The CIP interface will be assigned the following values:

- The IP address will be a unique IP number on the subnet specified in the *Subnet Number* field. The node portions of the address start at 1 and are incremented by 1 for each additional node.

  The CIP Wizard will automatically fill in a default value for the subnet number for each CIP subnetwork requested. The default values are taken from the private IP address range specified by RFC 1918. Note that the values entered in the *Subnet Number* have 0 for their node portion even though the CIP Wizard starts the numbering at 1 when it assigns the actual node IP addresses.

- The IP name of the interface will be of the form *cfnameSuffix* where *cfname* is the name of a node from the CF Wizard, and the *Suffix* is specified in the field *Host Suffix*. If the checkbox *For RMS* is selected, then the host suffix will be set to `RMS` and will not be editable. If you are using RMS, one CIP network must be configured for RMS.

- The *Subnet Mask* will be the value specified.

In Figure 16, the system administrator has selected `1` CIP network. The *For RMS* checkbox is selected, so the RMS suffix will be used. Default values for the *Subnet Number* and *Subnet Mask* are also selected. The nodes defined in the CF cluster are `fuji2` and `fuji3`. This will result in the following configuration:

- On `fuji2`, a CIP interface will be configured with the following:
  IP nodename: `fuji2RMS`
  IP address: `192.168.1.1`
  Subnet Mask: `255.255.255.0`

- On `fuji3`, a CIP interface will be configured with the following:
  IP nodename: `fuji3RMS`
  IP address: `192.168.1.2`
  Subnet Mask: `255.255.255.0`

The CIP Wizard stores the configuration information in the file `/etc/cip.cf` on each node in the cluster. This is the default CIP configuration file. The Wizard will also update `/etc/hosts` on each node in the cluster to add the new IP nodenames. The cluster console will not be updated.

The CIP Wizard always follows an orderly naming convention when configuring CIP names. If you have done some CIP configuration by hand before running the CIP Wizard, then you should consult the Wizard documentation to see how the Wizard handles irregular names.

When you click on the *Next* button, CIM configuration window appears (see Figure 17).

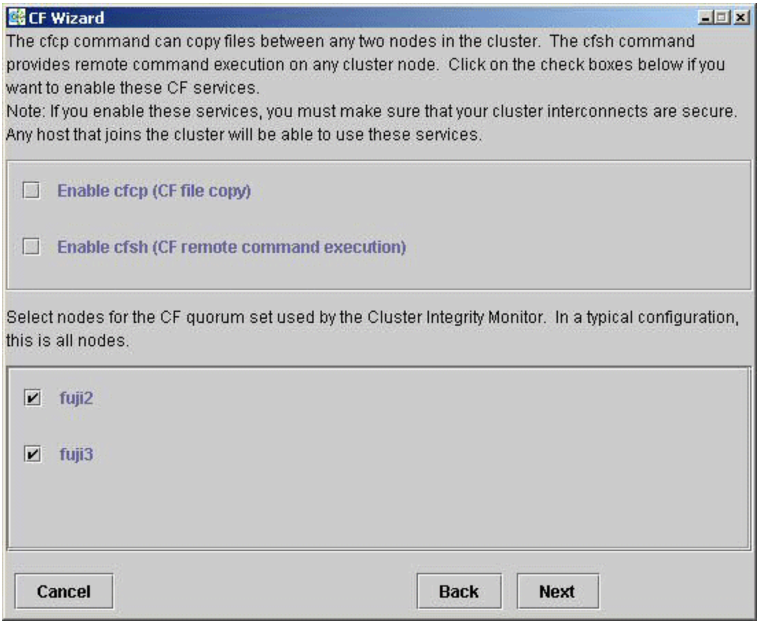


Figure 17: CIM configuration window

The CIM configuration window in Figure 17 has the following parts:

- The upper portion allows you to enable `cfcp` and `cfsh`.

  `cfcp` is a CF-based file copy program. It allows files to be copied among the cluster hosts. `cfsh` is a remote command execution program that similarly works between nodes in the cluster. The use of these programs is optional. In this example these items are not selected. If you enable these services, however, any node that has access to the cluster interconnects can copy files or execute commands on any node with root privileges.

- The lower portion allows you to determine which nodes should be monitored by CIM.

This window also lets you select which nodes should be part of the CF quorum set. The CF quorum set is used by the CIM to tell higher level services when it is safe to access shared resources.

Caution

Do not change the default selection of the nodes that are members of the CIM set unless you fully understand the ramifications of this change.

A checkbox next to a node means that node will be monitored by CIM. By default, all nodes are checked. For almost all configurations, you will want to have all nodes monitored by CIM.

This window will also allow you to configure CF Remote Services. You can enable either remote command execution, remote file copying, or both.

Caution

Enabling either of these means that you must trust all nodes on the CF interconnects and the CF interconnects must be secure. Otherwise any system able to connect to the CF interconnects will have access to these services.

Click on the *Next* button to go to the summary window (see Figure 18).

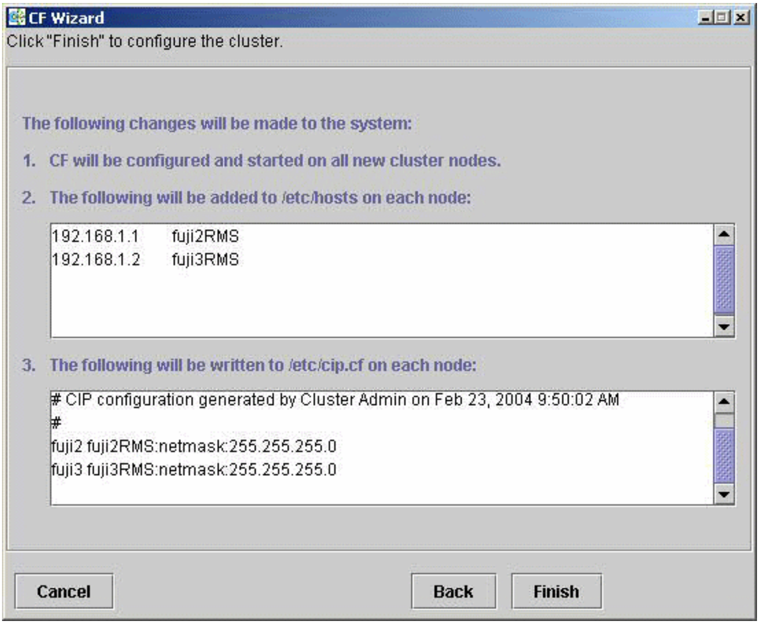


Figure 18: Summary window

This window summarizes the major changes that the CF, CIP, and CIM Wizards will perform. When you click on the *Finish* button, the CF Wizard performs the actual configuration on all nodes.

A window similar to Figure 19 is displayed while the configuration is being done.

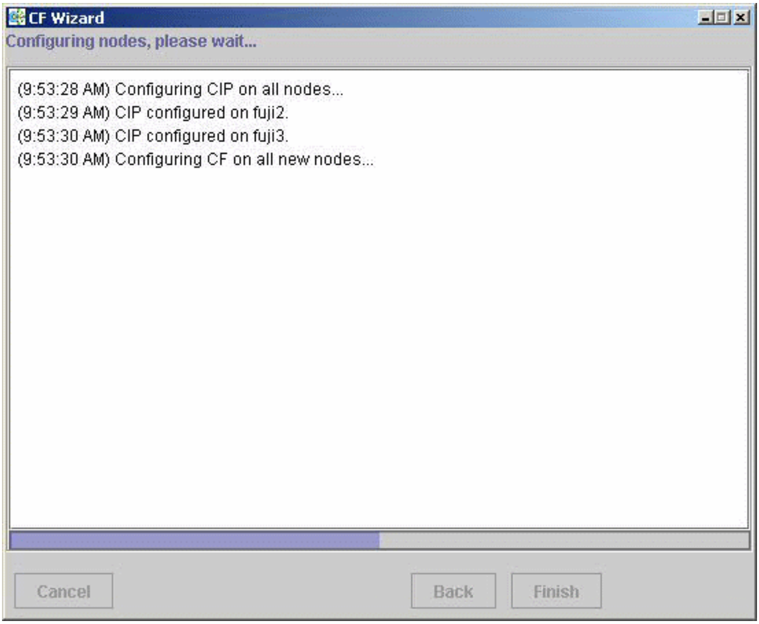


Figure 19: Configuration processing window

This window is updated after each configuration step. When configuration is complete, a pop-up appears announcing this fact (see Figure 20).

Figure 20: Configuration completion pop-up

Click on the *OK* button, and the pop-up is dismissed. The configuration processing window now has a *Finish* button (see Figure 21).

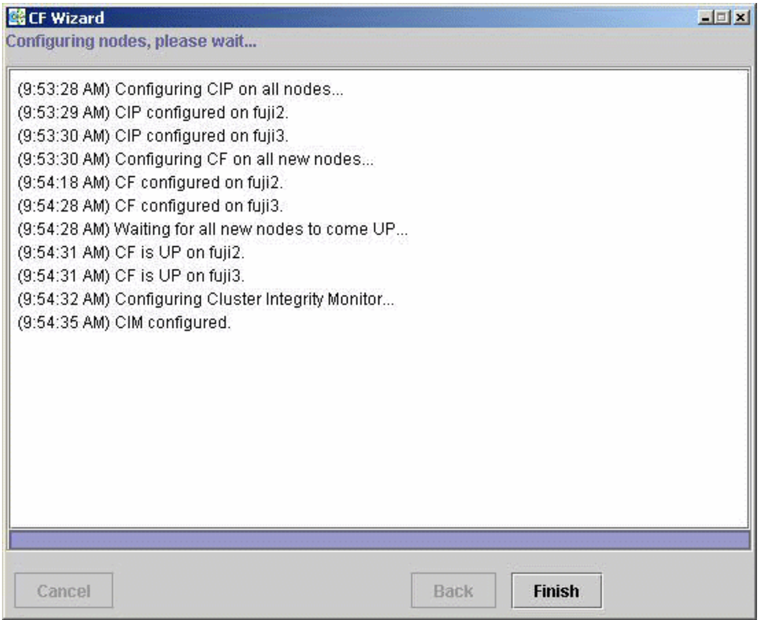


Figure 21: Configuration window after completion

You might see the following error message in the window shown in Figure 21:

```
cf:cfconfig     OSDU_stop: failed to unload cf_drv
```

Unless you are planning to use the dynamic hardware reconfiguration feature of PRIMEPOWER, then you can safely ignore this message.

When the CF Wizard is run on an unconfigured node, it will ask the CF driver to push its modules on every Ethernet device on the system. This allows CF to do CF pings on each interface so that the CF Wizard can discover the network topology.

Occasionally, this unload will fail. To correct this problem, you need to unload and reload the CF driver on the node in question. This can be done easily through the GUI (refer to the Section “Starting and stopping CF”).

Click on the *Finish* button to dismiss the window in Figure 21. A small pop-up appears asking if you would like to run the SF Wizard. Click on *yes*, and run the SF Wizard (described in the Section “Invoking the Configuration Wizard”).

After the CF (and optionally the SF) Wizards are done, you see the main CF window. After several moments, the window will be updated with new configuration and status information (see Figure 22).

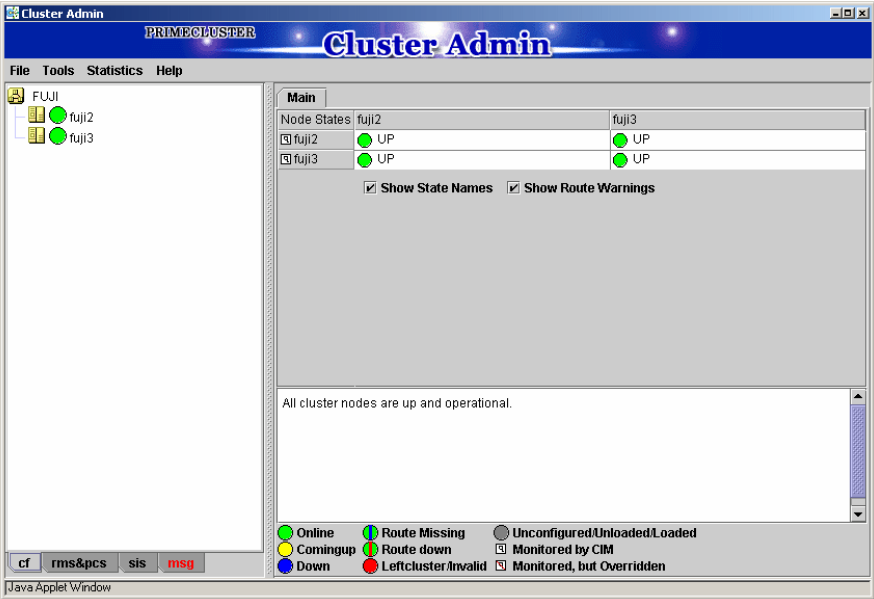


Figure 22: Main CF window

2.1.6 Adding a new node to CF

This section describes how to add a node to an existing CF cluster.

The first step is to make sure that Web-Based Admin View is properly configured on the new node. Refer to the PRIMECLUSTER *Installation Guide (Solaris)* for additional details on Web-Based Admin View configuration options.

After you have properly configured Web-Based Admin on the new node, you should start Cluster Admin. If you are already running the Cluster Admin GUI, exit it and then restart it.

The first window that Cluster Admin displays is the small initial connection pop-up window (see Figure 6). This window lists all of the nodes which are known to Web-Based Admin View. If the new node is not present in this list, then you should recheck your Web-Based Admin configuration and also verify that the new node is up.

To add the new node, select it in the initial connection pop-up. After making your selection, run the CF Wizard by clicking on the *Configure* button (see Figure 8) The CF Wizard will appear, and you can use it to join the existing CF cluster.

The CF Wizard will allow you to configure CF, CIM, and CIP on the new node. After it is run, you should also run the SF Wizard to configure the Shutdown Facility on the new node.

You will also need to do additional configuration work for other PRIME-CLUSTER products you might be using such as CRM, RMS, SIS, GDS, GFS, and so forth.

2.2 CIP configuration file

The CIP configuration file is stored in `/etc/cip.cf` on each node in the cluster. Normally, you can use the GUI to create this file during cluster configuration time. However, there may be times when you wish to manually edit this file.

The format of a CIP configuration file entry is as follows:

cfname CIP_Interface_Info [*CIP_Interface_Info ...*]

The `cip.cf` configuration file typically contains configuration information for all CIP interfaces on all nodes in the cluster. The first field, *cfname*, tells what node the configuration information is for. When a node parses the `cip.cf` file, it can ignore all lines that do not start with its own CF node name. However, other products like RMS also use this file and need to have the entries for all cluster nodes in the file.

The *CIP_Interface_Info* gives all of the IP information needed to configure a single CIP interface. At the minimum, it must consist of an IP address. The address may be specified as either a number in internet dotted-decimal notation or as a symbolic node name. If it is a symbolic node name, it must be specified in `/etc/hosts`. Only Internet Protocol version 4 (IPv4) addresses are supported.

The IP address can also have additional options following it. These options are passed to the configuration command `ifconfig`. They are separated from the IP address and each other by colons (`:`). No spaces can be used around the colons.

For example, the CIP configuration done in Section “Example of creating a cluster” would produce the following CIP configuration file:

```
fuji2   fuji2RMS:netmask:255.255.255.0
fuji3   fuji3RMS:netmask:255.255.255.0
```

Although not shown in this example, the CIP syntax does allow multiple CIP interfaces for a node to be defined on a single line. Alternately, additional CIP interfaces for a node could be defined on a subsequent line beginning with that node's CF node name. The `cip.cf` manual page has more details about the `cip.cf` file.

If you make changes to the `cip.cf` file by hand, you should be sure that the file exists on all nodes, and all nodes are specified in the file. Be sure to update all nodes in the cluster with the new file. Changes to the CIP configuration file will not take effect until CIP is stopped and restarted. If you stop CIP, be sure to stop all applications that use it. In particular, RMS needs to be shut down before CIP is stopped.

To stop CIP, use the following command:

```
# /opt/SMAW/SMAWcf/dep/stop.d/K98cip unload
```

To start or restart CIP, use the following command:

```
# /opt/SMAW/SMAWcf/dep/start.d/S01cip load
```

2.3 Cluster Configuration Backup and Restore (CCBR)

Caution

CCBR only saves PRIMECLUSTER configuration information. It does not replace an external, full backup facility.

CCBR provides a simple method to save the current PRIMECLUSTER configuration information of a cluster node. It also provides a method to restore the configuration information whenever a node update has caused severe trouble or failure, and the update (and any side-effects) must be removed. CCBR provides a node-focused backup and restore capability. Multiple cluster nodes must each be handled separately.

CCBR provides the following commands:

- `cfbackup`(1M)—Saves all information into a directory that is converted to a compressed tar archive file.
- `cfrestore`(1M)—Extracts and installs the saved configuration information from one of the `cfbackup`(1M) compressed tar archives.

After `cfrestore`(1M) is executed, you must reactivate the RMS configuration in order to start RMS. Once the reactivation of the RMS configuration is done, RMS will have performed the following tasks:

- Checked the consistency of the RMS configuration
- Established the detector links for RMS to be able to monitor resources
- Ensured proper communication between cluster nodes
- Created the necessary aliases for the shell commands used in the Wizard Tools. This is done automatically during RMS activation.

Please refer to the PRIMECLUSTER *Reliant Monitor Services (RMS) Configuration and Administration Guide* for details on how to activate RMS Configuration.

To guarantee that the `cfrestore`(1M) command will restore a functional PRIMECLUSTER configuration, it is recommended that there be no hardware or operating system changes since the backup was taken, and that the same versions of the PRIMECLUSTER products are installed.

Because the installation or reinstallation of some PRIMECLUSTER products add kernel drivers, device reconfiguration may occur. This is usually not a problem. However, if Network Interface Cards (NICs) have been installed, removed, replaced, or moved, the device instance numbers (for example, the number `2` in `/dev/hme2`) can change. Any changes of this nature can, in turn, cause a restored PRIMECLUSTER configuration to be invalid.

`cfbackup`(1M) and `cfrestore`(1M) consist of a framework and plug-ins. The framework and plug-ins function as follows:

1. The framework calls the plug-in for the `SMAWcf` package.
2. This plug-in creates and updates the saved-files list, the log files, and error log files.
3. All the other plug-ins for installed PRIMECLUSTER products are called in name sequence.
4. Once all plug-ins have been successfully processed, the backup directory is archived by means of `tar`(1M) and compressed.
5. The backup is logged as complete and the file lock on the log file is released.

The `cfbackup`(1M) command runs on a PRIMECLUSTER node to save all the cluster configuration information. To avoid any problem, this command should be concurrently executed on every cluster node to save all relevant PRIMECLUSTER configuration information. This command must be executed as `root`.

If a backup operation is aborted, no tar archive is created. If the backup operation is not successful for one plug-in, the command processing will abort rather than continue with the next plug-in. `cfbackup`(1M) exits with a status of zero on success and non-zero on failure.

The `cfrestore`(1M) command runs on a PRIMECLUSTER node to restore all previously saved PRIMECLUSTER configuration information from a compressed tar archive. The node must be in single-user mode with CF not loaded. The node must not be an active member of a cluster. The command must be executed as `root`. `cfrestore`(1M) exits with a status of zero on success and non-zero on failure.

It is recommended to reboot once `cfrestore`(1M) returns successfully. If `cfrestore`(1M) aborts, the reason for this failure should be examined carefully since the configuration update may be incomplete.

i You cannot run `cfbackup`(1M) and `cfrestore`(1M) at the same time on the same node.

i Some PRIMECLUSTER information is given to a node when it joins the cluster. The information restored is not used. To restore and to use this PRIMECLUSTER information, the entire cluster needs to be `DOWN`, and the first node to create the cluster must be the node with the restored data. When a node joins an existing, running cluster, the restored configuration is gone because it is the first node in the cluster that determines which restored configuration to use.

The following files and directories that are fundamental to the operation of the `cfbackup`(1M) and `cfrestore`(1M) commands:

- The `/opt/SMAW/ccbr/plugins` directory contains executable CCBR plug-ins. The installed PRIMECLUSTER products supply them.
- The `/opt/SMAW/ccbr/ccbr.conf` file must exist and specifies the value for `CCBRHOME`, the pathname of the directory to be used for saving CCBR archive files. A default `ccbr.conf` file, with `CCBRHOME` set to `/var/spool/SMAW/SMAWccbr` is supplied as part of the `SMAWccbr` package.

  The system administrator can change the `CCBRHOME` pathname at anytime. It is recommended that the system administrator verify that there is enough disk space available for the archive file before setting `CCBRHOME`. The system administrator might need to change the `CCBRHOME` pathname to a file system with sufficient disk space.

  i It is important to remember that re-installing the `SMAWccbr` package will reset the contents of the `/opt/SMAW/ccbr/ccbr.conf` file to the default package settings.

  The following is an example of ccbr.conf:

```
#!/bin/ksh -
#ident "@(#)ccbr.conf   Revision: 12.1  02/05/08 14:45:57"
#
# CCBR CONFIGURATION FILE
#
# set CCBR home directory
#
CCBRHOME=/var/spool/SMAW/SMAWccbr
export CCBRHOME
```

- The `/opt/SMAW/ccbr/ccbr.gen` (generation number) file is used to form the name of the CCBR archive to be saved into (or restored from) the `CCBRHOME` directory. This file contains the next backup sequence number. The generation number is appended to the archive name.

  If this file is ever deleted, `cfbackup`(1M) and/or `cfrestore`(1M) will create a new file containing the value string of `1`. Both commands will use either the generation number specified as a command argument, or the file value if no command argument is supplied. The `cfbackup`(1M) command additionally checks that the command argument is not less than the value of the `/opt/SMAW/ccbr/ccbr.gen` file. If the command argument is less than the value of the `/opt/SMAW/ccbr/ccbr.gen` file, the `cfbackup`(1M) command will use the file value instead.

Upon successful execution, the `cfbackup`(1M) command updates the value in this file to the next sequential generation number. The system administrator can update this file at any time.

- If `cfbackup`(1M) backs up successfully, a compressed tar archive file with the following name will be generated in the `CCBRHOME` directory as follows:

  hostname`_ccbr`*N*`.tar.Z`

  hostname is the nodename and *N* is the number suffix for the generation number.

  For example, in the cluster node `fuji2`, with the generation number `5`, the archive file name is as follows:

  `fuji2_ccbr5.tar.Z`

- Each backup request creates a backup tree directory. The directory is as follows:

  `CCBRHOME/`*nodename*`_ccbr`*N*

  nodename is the node name and *N* is the number suffix for the generation number.

  `CCBROOT` is set to this directory.

  For example, enter the following on the node `fuji2`:

  `fuji2#` **`cfbackup 5`**

  Using the default setting for `CCBRHOME`, the following directory will be created:

  `/var/spool/SMAW/SMAWccbr/fuji2_ccbr5`

  This backup directory tree name is passed as an environment variable to each plug-in.

- The `CCBRHOME/ccbr.log` log file contains startup, completion messages, and error messages. All the messages are time stamped.

- The `CCBROOT/errlog` log file contains specific error information when a plug-in fails. All the messages are time stamped.

- The `CCBROOT/plugin.blog` or `CCBROOT/plugin.rlog` log files contain startup and completion messages from each backup/restore attempt for each plug-in. These messages are time stamped.

Refer to the Chapter “Manual pages” for more information on `cfbackup`(1M) and `cfrestore`(1M).

cfbackup example

The following command backs up and validates the configuration files for all CCBR plug-ins that exist on the system `fuji2`.

```
fuji2# cfbackup
```

CCBR performs the backup automatically and does not require user interaction. Processing has proceeded normally when a message similar to the following appears at the end of the output:

```
04/30/04 09:16:20 cfbackup 11 ended
```

This completes the backup of PRIMECLUSTER.

In the case of an error, the subdirectory `/var/spool/SMAW/SMAWccbr/fuji2_ccbr11` is created.

Refer to the Chapter “Diagnostics and troubleshooting” for more details on troubleshooting CCBR.

cfrestore example

Before doing `cfrestore`(1M), CF needs to be unloaded, the system needs to be in single-user mode, and the disks need to be mounted.

The following files are handled differently during `cfrestore`(1M):

- `root` files—These are the files under the `CCBROOT/root` directory. They are copied from the `CCBROOT/root` file tree to their corresponding places in the system file tree.
- OS files—These files are the operating system files that are saved in the archive but not restored. The system administrator might need to merge the new OS files and the restored OS files to get the necessary changes.

For example, on `fuji2` we entered the following command to restore the configuration to backup 11.

```
fuji2# cfrestore 11
```

The restore process asks you to confirm the restoration and then carries out the process automatically. Processing has proceeded normally when a message similar to the following appears at the end of the output:

```
05/05/04 13:49:19 cfrestore 11 ended
```

This completes the PRIMECLUSTER restore.

3 CF Registry and Integrity Monitor

This chapter discusses the purpose and physical characteristics of the CF registry (CFREG), and it discusses the purpose and implementation of the Cluster Integrity Monitor (CIM).

This chapter discusses the following:

- The Section “CF Registry” discusses the purpose and physical characteristics of the CF synchronized registry.
- The Section “Cluster Integrity Monitor” discusses the purpose and implementation of CIM.

3.1 CF Registry

The CFREG provides a set of CF base product services that allows cluster applications to maintain cluster global data that must be consistent on all of the nodes in the cluster and must live through a clusterwide reboot.

Typical applications include cluster-aware configuration utilities that require the same configuration data to be present and consistent on all of the nodes in a cluster (for example, cluster volume management configuration data).

The data is maintained as named registry entries residing in a data file where each node in the cluster has a copy of the data file. The services will maintain the consistency of the data file throughout the cluster.

A user-level daemon (`cfregd`), runs on each node in the cluster, and is responsible for keeping the data file on the node where it is running synchronized with the rest of the cluster. The `cfregd` process will be the only process that ever modifies the data file. Only one synchronization daemon process will be allowed to run at a time on a node. If a daemon is started with an existing daemon running on the node, the started daemon will log messages that state that a daemon is already running and terminate itself. In such a case, all execution arguments for the second daemon will be ignored.

3.2 Cluster Integrity Monitor

The purpose of the CIM is to allow applications to determine when it is safe to perform operations on shared resources. It is safe to perform operations on shared resources when a node is a member of a cluster that is in a consistent state.

A consistent state is means that all the nodes of a cluster that are members of the CIM set are in a known and safe state. The nodes that are members of the CIM set are specified in the CIM configuration. Only these nodes are considered when the CIM determines the state of the cluster. When a node first joins or forms a cluster, the CIM indicates that the cluster is consistent only if it can determine the status of the other nodes that make up the CIM set and that those nodes are in a safe state.

CIM currently supports Node State Management (NSM) method. The Remote Cabinet Interface (RCI) method is supported for PRIMEPOWER nodes. The CIM reports on a cluster state that a node state is known (`True`), or a node state is unknown (`False`) for the node. `True` and `False` are defined as follows:

`True`—All CIM nodes in the cluster are in a known state.

`False`—One or more CIM nodes in the cluster are in an unknown state.

3.2.1 Configuring CIM

You can perform CIM procedures through the following methods:

- Cluster Admin GUI—This is the preferred method of operation. Refer to the Section “Adding and removing a node from CIM” for the GUI procedures.
- CLI—Refer to the Chapter “Manual pages” for complete details on the CLI options and arguments, some of which are described in this section. For more complete details on CLI options and arguments, refer to the manual page. The commands can also be found in the following directory:

  `/opt/SMAW/SMAWcf/bin`

CLI

The CIM is configured using the command `rcqconfig`(1M) after CF starts. The `rcqconfig`(1M) command is used to set up or to change the CIM configuration. You only need to run this command if you are not using Cluster Admin to configure CIM.

When `rcqconfig`(1M) is invoked, it checks that the node is part of the cluster. When the `rcqconfig`(1M) command is invoked without any option, after the node joins the cluster, it checks if any configuration is present in the `CFReg.database`. If there is none, it returns as error. This is done as part of the GUI configuration process.

`rcqconfig`(1M) configures a quorum set of nodes, among which CF decides the quorum state. `rcqconfig`(1M) is also used to show the current configuration. If `rcqconfig`(1M) is invoked without any configuration changes or with only the `-v` option, `rcqconfig`(1M) will apply any existing configuration to all the nodes in the cluster. It will then start or restart the quorum operation. `rcqconfig`(1M) can be invoked from the command line to configure or to start the quorum.

3.2.2 Query of the quorum state

CIM recalculates the quorum state when it is triggered by some node state change. However you can force the CIM to recalculate it by running `rcqquery`(1M) at any time. Refer to the Chapter “Manual pages” for complete details on the CLI options and arguments.

`rcqquery`(1M) functions as follows:

- Queries the state of quorum and gives the result using the return code. It also gives you readable results if the verbose option is given.
- Returns `True` if the states of all the nodes in the quorum set of nodes are known. If the state of any node is unknown, then it returns `False`.
- Exits with a status of zero when a quorum exists, and it exits with a status of `1` when a quorum does not exist. If an error occurs during the operation, then it exits with any other non-zero value other than `1`.

3.2.3 Reconfiguring quorum

Refer to the Section “Adding and removing a node from CIM” for the GUI procedures.

CLI

The configuration can be changed at any time and is effective immediately. When a new node is added to the quorum set of nodes, the node being added must be part of the cluster so as to guarantee that the new node also has the same quorum configuration. Removing a node from the quorum set can be done without restriction.

When the configuration information is given to the command `rcqconfig`(1M) as arguments, it performs the transaction to `CFREG` to update the configuration information. The rest of the configuration procedure is the same. Until CIM is successfully configured and gets the initial state of the quorum, CIM has to respond with the quorum state of `False` to all queries.

Examples

Display the states of all the nodes in the cluster as follows:

fuji2# **`cftool -n`**

```
Node       Number State      Os         Cpu
fuji2      1      UP        Solaris  Sparc
fuji3      2      UP        Solaris  Sparc
```

Display the current quorum configuration as follows:

fuji2# **`rcqconfig -g`**

Nothing is returned, since all nodes have been deleted from the quorum.

Add new nodes in a quorum set of nodes as follows:

fuji2# **`rcqconfig -a`** fuji2 **`fuji3`**

Display the current quorum configuration parameters as follows:

fuji2# **`rcqconfig -g`**

`QUORUM_NODE_LIST=` fuji2 **`fuji3`**

Delete nodes from a quorum set of nodes as follows:

fuji2# **`rcqconfig -d`** fuji2

Display the current quorum configuration parameters after one node is deleted as follows:

fuji2# **`rcqconfig -g`**

```
QUORUM_NODE_LIST= fuji3
```

Add a new node, `fuji10` (which is not in the cluster), in a quorum set of nodes as follows:

fuji2# **`rcqconfig -a fuji2 fuji3 fuji10`**

```
Cannot add node fuji10 that is not up.
```

Since CF only configured the cluster to consist of `fuji2` and `fuji3`, `fuji10` does not exist. The quorum set remains empty.

fuji2# **`rcqconfig -g`**

Nothing is returned, since no quorum configuration has been done.

4 Cluster resource management

This chapter discusses the Resource Database, which is a synchronized clusterwide database, holding information specific to several PRIMECLUSTER products.

This chapter discusses the following:

- The Section “Overview” introduces cluster resource management.
- The Section “Kernel parameters for Resource Database” discusses the default values of the Solaris kernel which have to be modified when the Resource Database is used.
- The Section “Resource Database configuration” details how to set up the Resource Database for the first time on a new cluster.
- The Section “Registering hardware information” explains how to register hardware information in the Resource Database.
- The Section “Start up synchronization” discusses how to implement a start up synchronization procedure for the Resource Database.
- The Section “Adding a new node” describes how to add a new node to the Resource Database.

4.1 Overview

The cluster Resource Database is a dedicated database used by some PRIME-CLUSTER products. You must configure the Resource Database if you are using GDS, GFS, or GLS. Fujitsu customers should always configure the Resource Database since it is used by many products from Fujitsu.

If you do not need to configure the Resource Database, then you can skip this chapter.

The Resource Database is intended to be used only by PRIMECLUSTER products. It is not a general purpose database which a customer could use for their own applications.

4.2 Kernel parameters for Resource Database

The default values of the Solaris kernel have to be modified when the Resource Database is used. This section lists the kernel parameters that have to be changed. In the case of kernel parameters that have already been set in the file `/etc/system`, the values recommended here should be added. In the case of kernel parameters that have not been defined in the file `/etc/system`, the values recommended here must be added to the default values.

i The values in the `/etc/system` file do not take effect until the system is rebooted.

If an additional node is added to the cluster, or if more disks are added after your cluster has been up and running, it is necessary to recalculate using the new number of nodes and/or disks after the expansion, change the values in `/etc/system`, and then reboot each node in the cluster.

Refer to the PRIMECLUSTER *Installation Guide (Solaris)* for details on meanings and methods of changing kernel parameters.

i The values used for product and user applications operated under the cluster system must also be reflected in kernel parameter values.

Table 1 shows the value of a kernel parameter required to use the resource database.

Solaris OS	**Kernel parameter**	**Value required for Resource Database**
Solaris 9	`semsys:seminfo_semmni`	20
	`semsys:seminfo_semmns`	40
	`semsys:seminfo_semmnu`	40
	`shmsys:shminfo_shmmni`	30
	`shmsys:shminfo_shmmax`	Refer to the section that follows.
Solaris 10	`semsys:seminfo_semmni`	20
	`shmsys:shminfo_shmmni`	30
	`shmsys:shminfo_shmmax`	Refer to the section that follows.

Table 1: Kernel parameter values

The value of `shminfo_shmmax` is calculated in the following way:

1. Remote resources:

   DISKS x (*NODES*+1) x 2

   DISKS is the number of shared disks. For disk array units, use the number of logical units (LUN). For devices other than disk array units, use the number of physical disks.

   NODES is the number of nodes connected to the shared disks.

2. Local resources:

   LOCAL_DISKS: Add up the number of local disks of all nodes in the cluster.

3. Total resources:

   Total resources = (remote resources + local resources) x 2776 + 1048576.

4. Selecting the value:

- Solaris 9 or Solaris 10

  If `shminfo_shmmax` has already been changed for the other products, which means that `/etc/system` has a `shminfo_shmmax` entry, set the largest value among the following three values:
  – Current value of `shminfo_shmmax`
  – Value in Step 3
  – 4194394

  If `shminfo_shmmax` has not been altered from the default (meaning, there is no entry for `shminfo_shmmax` in `/etc/system`) and the result from Step 3 is greater than 8388608 (default value of Solaris OS), set `shminfo_shmmax` to the result of Step 3, otherwise `shminfo_shmmax` is not edited.

In summary, the formula to calculate the total resources is as follows:

Total resources = *(DISKS* x (*NODES*+1) x 2 + *LOCAL_DISKS)* x 2776 + 1048576

```
switch (Solaris OS)
breaksw
case Solaris 9:
case Solaris 10:
   if ( shminfo_shmmax is defined ) then
      if ( Total Resources < 4194394 && 4194394 < Current value )
      then
         shminfo_shmmax =Current value
      else if ( Total Resources < 4194394 && 4194394 > Current
      value  ) then
         shminfo_shmmax =4194394
      else
         shminfo_shmmax =Total Resources
      endif
   else
      if ( Total Resources > Default value of Solaris OS ) then
         shminfo_shmmax =Total Resources
      else
         shminfo_shmmax is not edited
      endif
   endif
breaksw
endsw
```

Example:

To take Figure 23 as an example, the following article describes how to calculate the total resources.

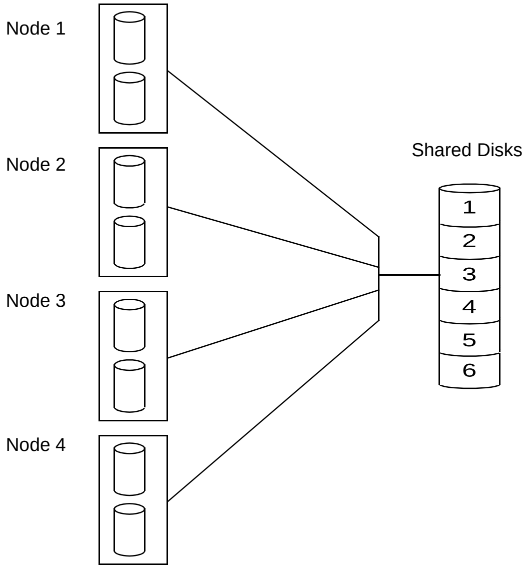


Figure 23: Cluster resource diagram

Referring to Figure 23, calculate the total resources as follows:

1. Remote resources:

```
DISKS=6, NODES=4
remote resources = 6 x (4+1) x 2 = 60
```

2. Local resources:

```
local resources = 2 x 4 = 8
```

3. Total resources:

```
(60+8) X 2776 + 1048576 = 1237344
```

   Since 1237344 is less than 4194394, it is necessary to set 4194394 for `shminfo_shmmax`. If the value in step 3 is greater than 4194394, set the value for `shminfo_shmmax`.

4.3 Resource Database configuration

This section discusses how to set up the Resource Database for the first time on a new cluster. The following procedure assumes that the Resource Database has not previously been configured on any of the nodes in the cluster.

If you need to add a new node to the cluster, and the existing nodes are already running the Resource Database, then a slightly different procedure needs to be followed. Refer to the Section “Adding a new node” for details.

Before you begin configuring the Resource Database, you must first make sure that CIP is properly configured on all nodes. The Resource Database uses CIP for communicating between nodes, so it is essential that CIP is working.

The Resource Database also uses the CIP configuration file `/etc/cip.cf` to establish the mapping between the CF node name and the CIP name for a node. If a particular node has multiple CIP interfaces, then only the first one is used. This will correspond to the first CIP entry for a node in `/etc/cip.cf`. It will also correspond to `cip0` on the node itself.

Because the Resource Database uses `/etc/cip.cf` to map between CF and CIP names, it is critical that this file be the same on all nodes. If you used the Cluster Admin CF Wizard to configure CIP, then this will already be the case. If you created some `/etc/cip.cf` files by hand, then you need to make sure that all nodes are specified and they are the same across the cluster.

In general, the CIP configuration is fairly simple. You can use the Cluster Admin CF Wizard to configure a CIP subnet after you have configured CF. If you use the Wizard, then you will not need to do any additional CIP configuration. See the Section “CF, CIP, and CIM configuration” for more details.

After CIP has been configured, you can configure the Resource Database on a new cluster by using the following procedure. This procedure must be done on all the nodes in the cluster.

1. Log in to the node with system administrator authority.
2. Verify that the node can communicate with other nodes in the cluster over CIP. You can use the `ping`(1M) command to test CIP network connectivity. The file `/etc/cip.cf` contains the CIP names that you should use in the `ping`(1M) command.

   If you are using RMS and you have only defined a single CIP subnetwork, then the CIP names will be of the following form:

   cfname`RMS`

For example, if you have two nodes in your cluster named `fuji2` and `fuji3`, then the CIP names for RMS would be `fuji2RMS` and `fuji3RMS`, respectively. You could then run the following commands:

fuji2# **`ping fuji3RMS`**

fuji3# **`ping fuji2RMS`**

This tests the CIP connectivity.

3. Execute the `clsetup` command. When used for the first time to set up the Resource Database on a node, it is called without any arguments as follows:

   `#` **`/etc/opt/FJSVcluster/bin/clsetup`**

4. Execute the `clgettree` command to verify that the Resource Database was successfully configured on the node, as shown in the following:

   `#` **`/etc/opt/FJSVcluster/bin/clgettree`**

   The command should complete without producing any error messages, and you should see the Resource Database configuration displayed in a tree format.

   For example, on a two-node cluster consisting of `fuji2` and `fuji3`, the `clgettree` command might produce output similar to the following:

```
Cluster 1 cluster
     Domain 2 Domain0
          Shared 7 SHD_Domain0
               Node 3 fuji2 UNKNOWN
               Node 5 fuji3 UNKNOWN
```

If you need to change the CIP configuration to fix the problem, you will also need to run the `clinitreset` command and start the information process over.

The format of `clgettree` is more fully described in its manual page. For the purpose of setting up the cluster, you need to check the following:

- Each node in the cluster should be referenced in a line that begins with the word `Node`.
- The `clgettree` output must be identical on all nodes.

If either of the above conditions are not met, then it is possible that you may have an error in the CIP configuration. Double-check the CIP configuration using the methods described earlier in this section. The actual steps are as follows:

1. Make sure that CIP is properly configured and running.
2. Run `clinitreset` on all nodes in the cluster.

3. Reboot each node.
4. Rerun the `clsetup` command on each node.
5. Use the `clgettree` command to verify the configuration.

4.4 Registering hardware information

> **i** With RCVM, you do not need to register the shared disk unit in the Resource Database.

This section explains how to register hardware information in the Resource Database.

You can register the following hardware in the Resource Database by executing the `clautoconfig` command:

- Shared disk unit
- Network interface card
- Line switching unit

The command automatically detects the information. Refer to the Chapter “Manual pages” for additional details on this command.

4.4.1 Setup exclusive device list

If you have any disk devices that needs to be excluded from automatic resource registration, describe the devices in the `/etc/opt/FJSVcluster/etc/diskinfo` file (exclusive device list) on all nodes.

List all the disks in this exclusive device list that meet the following conditions:

- Disks that should not be used for cluster services
- Disks that should be registered in the resource database in other cluster system

An example of the `/etc/opt/FJSVcluster/etc/diskinfo` file that is setup is as follows:

```
# cat /etc/opt/FJSVcluster/etc/diskinfo
  c1t0d16
  c1t0d17
  c1t0d18
  c1t0d19
  .....
  emcpower63
  emcpower64
  emcpower65
  emcpower66
```

Refer to the Section “Exclusive device list for EMC Symmetrix” if you use the EMC Symmetrix series of RAID devices (Symmetrix) in a PRIMEPOWER/ PRIMECLUSTER environment.

4.4.2 Exclusive device list for EMC Symmetrix

This section describes how to set up an exclusive device list (disk devices that should be excluded from automatic resource registration) when the EMC Symmetrix series of RAID devices (Symmetrix) is used in a PRIMEPOWER/ PRIMECLUSTER environment (refer to the Section "Setup exclusive device list").

You must exclude the following EMC Symmetrix devices from automatic resource registration:

- BCV (Business Continuance Volume) devices
- R2 (SRDF target) devices
- GateKeeper devices
- CKD (Count Key Data) devices
- VCMDB (Volume Configuration Management Data Base) devices used by EMC SAN management software (Volume Logix, ESN Manager, SAN Manager)

Add these devices in an exclusive device list after completing the settings for BCV, GateKeeper and EMC PowerPath. Then, you can perform automatic resource registration.

4.4.2.1 emcpower Devices and native Devices

You can set emcpower devices or native devices that compose emcpower devices as the targets of automatic resource registration.

You should normally set native devices as the targets of automatic resource registration. When you use native devices, there is the benefit of not having to reexecute automatic resource registration when you change a storage device to a higher model. However, for systems in which emcpower devices are already set as the targets of automatic resource registration, continue to use the emcpower devices.

When setting native devices as the targets of automatic resource registration, specify all emcpower devices (`emcpower`<*N*>) and the native devices to be excluded from registration (`c`<*C*>`t`<*T*>`d`<*D*>) in the exclusive device list.

`emcpower`<*0*>
(not a registration target)
- `c`<*2*>`t`<*0*>`d`<*0*>
- c<*3*>t<*0*>d<*0*> (not a registration target)

When setting emcpower devices as the targets of automatic resource registration, do not specify either emcpower devices (`emcpower`<*N*>) or native devices (`c`<*C*>`t`<*T*>`d`<*D*>) in the exception device list.

`emcpower`<*0*>
- `c`<*2*>`t`<*0*>`d`<*0*> (not a registration target)
- c<*3*>t<*0*>d<*0*> (not a registration target)

Where <*C*> is the controller number, <*T*> is the target ID, <*D*> is the disk number, and <*N*> is the emcpower device number.

4.4.2.2 BCV, R2, GateKeeper, CKD

You can differentiate which disk is BCV, R2, GateKeeper, or CKD by executing the `syminq` command provided in SYMCLI. Execute the `syminq` command, and describe all the devices (`c`<*C*>`t`<*T*>`d`<*D*>, `emcpower`<*N*>), indicated as `BCV`, `R2`, `GK`, or `CKD` in the excluded device list. Where <*C*> is the controller number, <*T*> is the target ID, <*D*> is the disk number, and <*N*> is the emcpower device number.

4.4.2.3 VCMDB

VCMDB is not output by executing `syminq`. If you use EMS SAN management software such as Volume Logix, ESN Manager or SAN Manager, check the VCMDB device name with EMC customer support engineers or a system administrator who set up the management software before adding the VCMDB to an exclusive device list.

4.4.2.4 Simplified setup for exclusive device list - clmakediskinfo, clmkdiskinfo

PRIMECLUSTER provides the following sample scripts for simplified setup of an exclusive device list:

- `/etc/opt/FJSVcluster/sys/clmakediskinfo.sample`
- `/etc/opt/FJSVcluster/sys/clmkdiskinfo.sample`

To set native devices as targets of automatic resource registration, use clmakediskinfo. Executing the command shown below creates an exclusive device list that contains emcpower devices, native devices to be excluded from automatic resource registration, as well as the BCV, R2, GateKeeper, and CKD devices.

```
# cp /etc/opt/FJSVcluster/sys/clmakediskinfo.sample
     /mydir/clmakediskinfo

# chmod u+x /mydir/clmakediskinfo

# /mydir/clmakediskinfo -M >
/etc/opt/FJSVcluster/etc/diskinfo <RETURN>
```

To use this script, use the `vi` command and modify the following two parameters (`syminq` and `powermt` command paths) in the script so that they match the execution environment.

```
SYMINQ=/usr/symcli/bin/syminq
POWERMT=/etc/powermt
```

To set emcpower devices as targets of automatic resource registration, use clmkdiskinfo. Executing the command shown below creates an exclusive device list that includes the BCV and GateKeeper devices.

```
# cp /etc/opt/FJSVcluster/sys/clmkdiskinfo.sample
     /mydir/clmkdiskinfo

# syminq | nawk -f /mydir/clmkdiskinfo >
/etc/opt/FJSVcluster/etc/diskinfo <RETURN>
```

If there are other devices to be included in the exclusive device list besides those listed automatically by the executed script, use the `vi` command and add those devices to the list.

If you do not know the path of the `syminq` command, check the SYMCLI installation settings. Normally the path is `/usr/symcli/bin/syminq`.

If you do not know the path of the `powermt` command, check the PowerPath installation settings. Normally the path is `/etc/powermt`.

i Note:

- PowerPath is required to use EMC Symmetrix.
- Set the BCV and R2 devices to be used in the GDS Snapshot proxy configuration as targets of automatic device registration.
  When setting the native devices that configure the BCV and R2 devices as targets of automatic resource registration, specify the emcpower devices (`emcpower`<*N*>) and the native devices (`c`<*C*>`t`<*T*>`d`<*D*>) to be excluded from registration in the exclusive device list.
  When setting the BCV and R2 devices themselves as targets of automatic resource registration, do not include the BCV and R2 devices (`emcpower`<*N*>) or the native devices (`c`<*C*>`t`<*T*>`d`<*D*>) in the exclusive device list.
  For details of GDS Snapshot, see the PRIMECLUSTER *Global Disk Service Configuration and Administration Guide*.
- If BCV is not added to an exclusive device list, you need to cancel or split the BCV pair before working on automatic resource registration.
- If the R2 device of the SRDF pair is not added to an exclusive device list, split the SRDF pair before working on automatic resource registration.

4.4.3 Automatic resource registration

This section explains how to register the detected hardware in the Resource Database

The registered network interface card should be displayed in the plumb-up state as a result of executing the `ifconfig`(1M) command.

Do not modify the volume name registered in VTOC using the `format`(1M) command after automatic resource registration. The volume name is required when the shared disk units are automatically detected.

The following prerequisites should be met:

- The Resource Database setup is done.
- Hardware is connected to each node.
- All nodes are started in the multi-user mode.

Take the following steps to register hardware in the Resource Database. This should be done on an arbitrary node in a cluster system.

1. Log in with system administrator access privileges.
2. Execute the `clautoconfig` command, using the following full path:

   `# /etc/opt/FJSVcluster/bin/clautoconfig -r`
3. Confirm registration.

   Execute the `clgettree` command for confirmation as follows:

   `# /etc/opt/FJSVcluster/bin/clgettree`

```
Cluster 1 cluster0
      Domain 2 domain0
              Shared 7 SHD_domain0
                      SHD_DISK 9 shd001 UNKNOWN
                         DISK 11 c1t1d0 UNKNOWN node0
                         DISK 12 c2t2d0 UNKNOWN node1
                      SHD_DISK 10 shd002 UNKNOWN
                         DISK 13 c1t1d1 UNKNOWN node0
                         DISK 14 c2t2d1 UNKNOWN node1
              Node 3 node0 ON
                      Ethernet 20 hme0 UNKNOWN
                      DISK 11 c1t1d0 UNKNOWN
                      DISK 13 c1t1d1 UNKNOWN node0
              Node 5 node1 ON
                      Ethernet 21 hme0 UNKNOWN
                      DISK 12 c2t2d0 UNKNOWN
                      DISK 14 c2t2d1 UNKNOWN
```

Reference

When deleting the resource of hardware registered by automatic registration, the following commands are used. Refer to the manual page for details of each command.

- `cldeldevice`—Deletes the shared disk resource
- `cldelrsc`—Deletes the network interface card resource
- `cldelswursc`—Deletes the line switching unit resource

4.5 Start up synchronization

A copy of the Resource Database is stored locally on each node in the cluster. When the cluster is up and running, all of the local copies are kept in sync. However, if a node is taken down for maintenance, then its copy of the Resource Database may be out of date by the time it rejoins the cluster. Normally, this is not a problem. When a node joins a running cluster, then its copy of the Resource Database is automatically downloaded from the running cluster. Any stale data that it may have had is thus overwritten.

There is one potential problem. Suppose that the entire cluster is taken down before the node with the stale data had a chance to rejoin the cluster. Then suppose that all nodes are brought back up again. If the node with the stale data comes up long before any of the other nodes, then its copy of the Resource Database will become the master copy used by all nodes when they eventually join the cluster.

To avoid this situation, the Resource Database implements a start up synchronization procedure. If the Resource Database is not fully up and running anywhere in the cluster, then starting the Resource Database on a node will cause that node to enter into a synchronization phase. The node will wait up to `StartingWaitTime` seconds for other nodes to try to bring up their own copies of the Resource Database. During this period, the nodes will negotiate among themselves to see which one has the latest copy of the Resource Database. The synchronization phase ends when either all nodes have been accounted for or `StartingWaitTime` seconds have passed. After the synchronization period ends, the latest copy of the Resource Database that was found during the negotiations will be used as the master copy for the entire cluster.

The default value for `StartingWaitTime` is 60 seconds.

This synchronization method is intended to cover the case where all the nodes in a cluster are down, and then they are all rebooted together. For example, some businesses require high availability during normal business hours, but power their nodes down at night to reduce their electric bill. The nodes are then powered up shortly before the start of the working day. Since the boot time for each node may vary slightly, the synchronization period of up to `StartingWaitTime` ensures that the latest copy of the Resource Database among all of the booting nodes is used.

Another important scenario in which all nodes may be booted simultaneously involves the temporary loss and then restoration of power to the lab where the nodes are located.

However, for this scheme to work properly, you must verify that all nodes in the cluster have boot times that differ by less than `StartingWaitTime` seconds. Furthermore, you might need to modify the value of `StartingWaitTime` to a value that is appropriate for your cluster.

Modify the value of `StartingWaitTime` as follows:

1. Start up all of the nodes in your cluster simultaneously. It is recommended that you start the nodes from a cold power on. Existing nodes are not required to reboot when a new node is added to the cluster.

2. After the each node has come up, look in `/var/adm/messages` for message number `2200`. This message is output by the Resource Database when it first starts. For example, enter the following command:

   ```
   # grep 2200 /var/adm/messages
   Feb 23 19:00:41 fuji2 dcmmond[407]: [ID 888197 daemon.notice]
   FJSVcluster: INFO: DCM: 2200: Cluster configuration
   management facility initialization started.
   ```

   Compare the timestamps for the messages on each node and calculate the difference between the fastest and the slowest nodes. This will tell you how long the fastest node has to wait for the slowest node.

3. Check the current value of `StartingWaitTime` by executing the `clsetparam` command on any of the nodes. For example, enter the following command:

   `#` **`/etc/opt/FJSVcluster/bin/clsetparam -p`** StartingWaitTime

   The output for our example shows that `StartingWaitTime` is set to 60 seconds.

4. If there is a difference in start up times found in Step 2, the `Starting-WaitTime`, or if the two values are relatively close together, then you should increase the `StartingWaitTime` parameter. You can do this by running the `clsetparam` command on any one node in the cluster. For example, enter the following command:

   `#` **`/etc/opt/FJSVcluster/bin/clsetparam -p`** StartingWaitTime 300

   This sets the `StartingWaitTime` to 300 seconds.

When you change the `StartingWaitTime` parameter, it is not necessary to stop the existing nodes. the new parameter will be effective for all nodes at the next reboot. Refer to the Chapter “Manual pages” for more details on the possible values for `StartingWaitTime`.

4.5.1 Start up synchronization and the new node

After the Resource Database has successfully been brought up in the new node, then you need to check if the `StartingWaitTime` used in start up synchronization is still adequate. If the new node boots much faster or slower than the other nodes, then you may need to adjust the `StartingWaitTime` time.

4.6 Adding a new node

If you have a cluster where the Resource Database is already configured, and you would like to add a new node to the configuration, then you should follow the procedures in this section. You will need to make a configuration change to the currently running Resource Database and then configure the new node itself. The major steps involved are listed below:

1. Back up the currently running Resource Database. A copy of the backup is used in a later step to initialize the configuration on the new node. It also allows you to restore your configuration to its previous state if a serious error is encountered in the process.
2. Reconfigure CF and CIP to include the new nodes and initialize.
3. Reconfigure the currently running Resource Database so it will recognize the new node.
4. Initialize the Resource Database on the new node.
5. Verify that the `StartingWaitTime` is sufficient for the new node, and modify this parameter if necessary.

Figure 24 shows these steps as a flow chart.

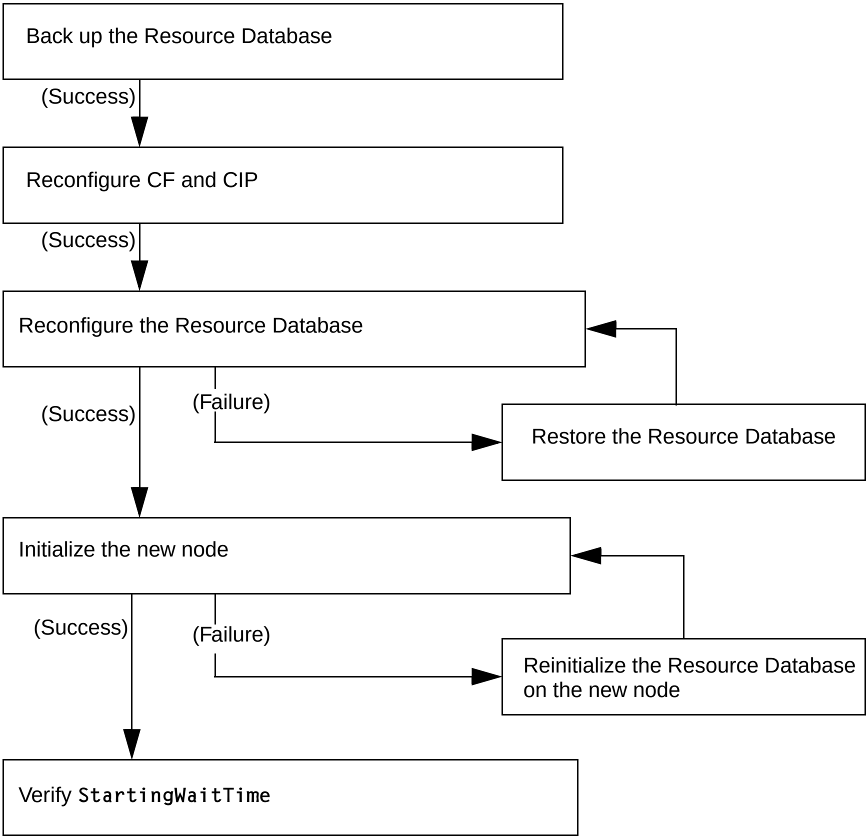


Figure 24: Adding a new node

The sections that follow describe each step in more detail.

4.6.1 Backing up the Resource Database

Before you add a new node to the Resource Database, you should first back up the current configuration. The backup will be used later to help initialize the new node. It is also a safeguard. If the configuration process is unexpectedly interrupted by a panic or some other serious error, then you may need to restore the Resource Database from the backup.

> **i** The configuration process itself should not cause any panics. However, if some non-PRIMECLUSTER software panics or if the SF/SCON causes a power cycle because of a CF cluster partition, then the Resource Database configuration process could be so severely impacted that a restoration from the backup would be needed.

> **i** The restoration process requires all nodes in the cluster to be in single user mode.

Since the Resource Database is synchronized across all of its nodes, the backup can be done on any node in the cluster where the Resource Database is running. The steps for performing the backup are as follows:

1. Log onto any node where the Resource Database is running with system administrator authority.

2. Run the command `clbackuprdb` to back the Resource Database up to a file. The syntax is as follows:

   `/etc/opt/FJSVcluster/bin/clbackuprdb -f` *file*

   For example:

   `#` **`/etc/opt/FJSVcluster/bin/clbackuprdb -f /`***mydir***`/backup_rdb`**

   `clbackuprdb` stores the Resource Database as a compressed tar file. Thus, in the above example, the Resource Database would be stored in `/`*mydir*`/backup_rdb.tar.*`. * represents the extension of the type of tar compression (`Z` or `gz`).

   Make sure that you do not place the backup in a directory whose contents are automatically deleted upon reboot (for example, `/tmp`).

   > **i** The hardware configuration must not change between the time a backup is done and the time that the restore is done. If the hardware configuration changes, you will need to take another backup. Otherwise, the restored database would not match the actual hardware configuration, and new hardware resources would be ignored by the Resource Database.

4.6.2 Reconfiguring the Resource Database

After you have backed up the currently running Resource Database, you will need to reconfigure the database to recognize the new node. Before you do the reconfiguration, however, you need to perform some initial steps.

After these initial steps, you should reconfigure the Resource Database. This is done by running the `clsetup` command on any of the nodes which is currently running the Resource Database. Since the Resource Database is synchronized across all of its nodes, the reconfiguration takes effect on all nodes. The steps are as follows:

1. Log in to any node where the Resource Database is running. Log in with system administrator authority.
2. If this node is not the same one where you made the backup, then copy the backup to this node. Then run the `clsetup` command with the `-a` and `-g` options to reconfigure the database. The syntax in this case is as follows:

   `/etc/opt/FJSVcluster/bin/clsetup -a` *cfname* `-g` *file*

   cfname is the CF name of the new node to be added, and *file* is the name of the backup file without the `.tar.*` suffix. * represents the extension of the type of tar compression (`Z` or `gz`).

   For example, suppose that you want to add a new node whose CF name is `fuji4` to a cluster. If the backup file on an existing node is named /*mydir*/`rdb.tar.Z`, then the following command would cause the Resource Database to be configured for the new node:

   `#` **`cd /etc/opt/FJSVcluster/bin/`**

   `#` **`./clsetup -a fuji4 -g /`*mydir*`/rdb`**.tar.Z

   If `clsetup` is successful, then you should immediately make a new backup of the Resource Database. This backup will include the new node in it. Be sure to save the backup to a place where it will not be lost upon a system reboot.

   If an unexpected failure such as a panic occurs, then you may need to restore the Resource Database from an earlier backup. See the Section "Restoring the Resource Database" for details.

3. To verify if the reconfiguration was successful, run the `clgettree` command. Make sure that the new node is displayed in the output for that command. If it is not present, then recheck the CIP configuration to see if it omitted the new node. If the CIP configuration is in error, then you will need to do the following to recover:

   a) Correct the CIP configuration on all nodes. Make sure that CIP is running with the new configuration on all nodes.

   b) Restore the Resource Database from backup.

   c) Rerun the `clsetup` command to reconfigure the Resource Database.

4.6.3 Configuring the Resource Database on the new node

After the Resource Database has been reconfigured on the existing nodes in the cluster, you are ready to set up the Resource Database on the new node itself.

The first step is to verify the CIP configuration on the new node. The file `/etc/cip.cf` should reference the new node. The file should be the same on the new node as it is on existing nodes in the cluster. If you used the Cluster Admin CF Wizard to configure CF and CIP for the new node, then CIP should already be properly configured.

You should also verify that the existing nodes in the cluster can ping the new node using the new node's CIP name. If the new node has multiple CIP subnetworks, then recall that the Resource Database only uses the first one that is defined in the CIP configuration file.

After verifying that CIP is correctly configured and working, then you should do the following:

1. Log in to the new node with system administrator authority.

2. Copy the latest Resource Database backup to the new node. This backup was made in Step 2 of the second list in the Section “Reconfiguring the Resource Database”.

3. Run the command `clsetup` with the `-s` option. The syntax for this case is as follows:

   `/etc/opt/FJSVcluster/bin/clsetup -s` *file*

   file is the name of the backup file.

If we continue our example of adding `fuji4` to the cluster and we assume that the backup file `rdb.tar.Z` was copied to */mydir*, then the command would be as follows:

```
# /etc/opt/FJSVcluster/bin/clsetup -s /mydir/rdb.tar.Z
```

If the new node unexpectedly fails before the `clsetup` command completes, then you should execute the `clinitreset` command. After `clinitreset` completes, you must reboot the node and then retry the `clsetup` command which was interrupted by the failure.

If the `clsetup` command completes successfully, then you should run the `clgettree` command to verify that the configuration has been set-up properly. The output should include the new node. It should also be identical to output from `clgettree` run on an existing node.

If the `clgettree` output indicates an error, then recheck the CIP configuration. If you need to change the CIP configuration on the new node, then you will need to do the following on the new node after the CIP change:

a) Run `clinitreset`.

b) Reboot.

c) Rerun the `clsetup` command described above.

4.6.4 Adjusting StartingWaitTime

After the Resource Database has successfully been brought up in the new node, then you need to check if the `StartingWaitTime` used in startup synchronization is still adequate. If the new node boots much faster or slower than the other nodes, then you may need to adjust the `StartingWaitTime` time. Refer to the Section “Start up synchronization” for further information.

4.6.5 Restoring the Resource Database

The procedure for restoring the Resource Database is as follows:

1. Copy the file containing the Resource Database to all nodes in the cluster.

2. Log in to each node in the cluster and shut it down with the following command:

```
# /usr/sbin/shutdown -y -i0
```

3. Reboot each node to single user mode with the following command:

   `{0} ok` **`boot -s`**

   i The restore procedure requires that all nodes in the cluster must be in single user mode.

4. Mount the local file systems on each node with the following command:

   `#` **`mountall -l`**

5. Restore the Resource Database on each node with the `clrestorerdb` command. The syntax is:

   `#` **`clrestorerdb -f`** *file*

   file is the backup file with the `.tar.Z` suffix omitted.

   For example, suppose that a restoration was being done on a two-node cluster consisting of nodes `fuji2` and `fuji3`, and that the backup file was copied to /*mydir*/`backup_rdb.tar.Z` on both nodes. The command to restore the Resource Database on `fuji2` and `fuji3` would be as follows:

   fuji2# **`cd /etc/opt/FJSVcluster/bin/`**

   fuji2# **`./clrestorerdb -f /`*****mydir*****`/backup_rdb.tar.Z`**

   fuji3# **`cd /etc/opt/FJSVcluster/bin/`**

   fuji3# **`./clrestorerdb -f /`*****mydir*****`/backup_rdb.tar.Z`**

6. After Steps 1 through 5 have been completed on all nodes, then reboot all of the nodes with the following command:

   `#` **`/usr/sbin/shutdown -y -i6`**

5 GUI administration

This chapter covers the administration of features in the Cluster Foundation (CF) portion of Cluster Admin.

This chapter discusses the following:

- The Section “Overview” introduces the Cluster Admin GUI.
- The Section “Starting Cluster Admin GUI and logging in” describes logging in and shows the first windows you will see.
- The Section “Main CF table” describes the features of the main table.
- The Section “CF route tracking” details the CF route tracking GUI interface.
- The Section “Node details” explains how to get detailed information.
- The Section “Displaying the topology table” discusses the topology table, which allows you to display the physical connections in the cluster.
- The Section “Starting and stopping CF” describes how to start and stop CF.
- The Section “Marking nodes DOWN” details how to mark a node DOWN.
- The Section “Using PRIMECLUSTER log viewer” explains how to use the PRIMECLUSTER log viewer, including how to view and search `syslog` messages.
- The Section “Displaying statistics” discusses how to display statistics about CF operations.
- The Section “Heartbeat monitor” describes how to monitor the percentage of heartbeats that are being received by CF.
- The Section “Adding and removing a node from CIM” describes how to add and remove a node from CIM.
- The Section “Unconfigure CF” explains how to use the GUI to unconfigure CF.
- The Section “CIM Override” discusses how to use the GUI to override CIM, which causes a node to be ignored when determining a quorum.

5.1 Overview

CF administration is done by means of the Cluster Admin GUI. The following sections describe the CF Cluster Admin GUI options.

5.2 Starting Cluster Admin GUI and logging in

The first step is to start Web-based Admin View by entering the following URL in a java-enabled browser:

http://*Management_Server*:8081/Plugin.cgi

In this example, if `fuji2` is a management server, enter the following:

http://fuji2:8081/Plugin.cgi

This brings up the Web-Based Admin View main window (see Figure 25).

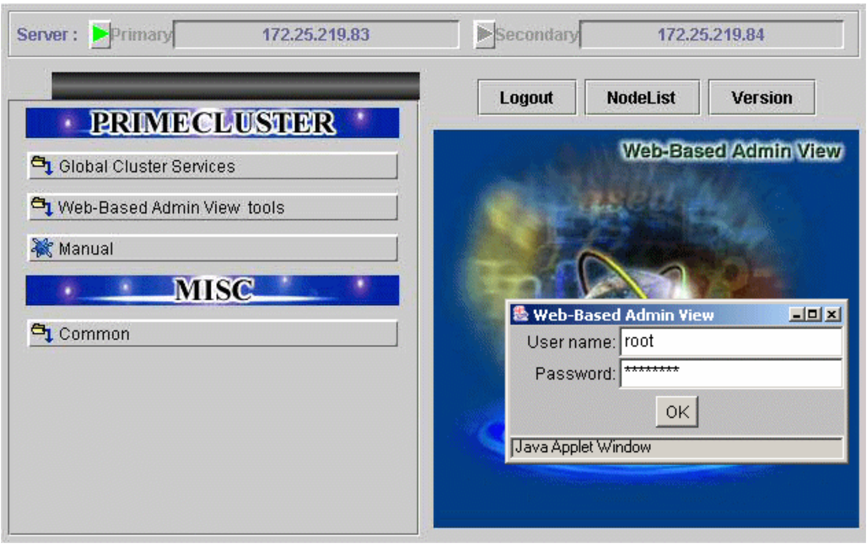


Figure 25: Cluster Admin start-up window

Enter a user name in the *User name* field and the password and click on *OK*.

Use the appropriate privilege level while logging in. There are three privilege levels: *root* privileges, *administrative* privileges, and *operator* privileges.

With the root privileges, you can perform all actions including configuration, administration and viewing tasks. With administrative privileges, you can view as well as execute commands but cannot make configuration changes. With the operator privileges, you can only perform viewing tasks.

In this example we are using `root` and not creating user groups.

Click on the *Global Cluster Services* button and the *Cluster Admin* button appears (see Figure 26).

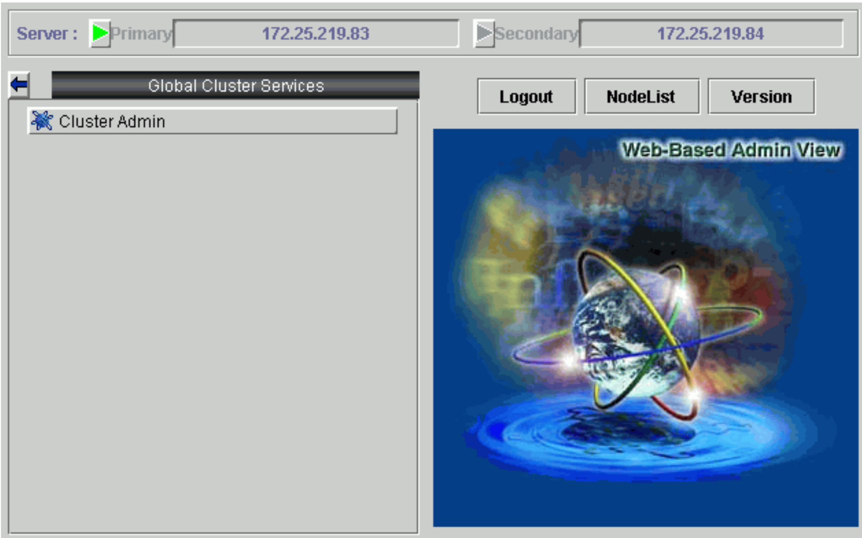


Figure 26: Cluster Admin top window

Click on the *Cluster Admin* button.

The *Choose a node for initial connection* window appears (see Figure 27).

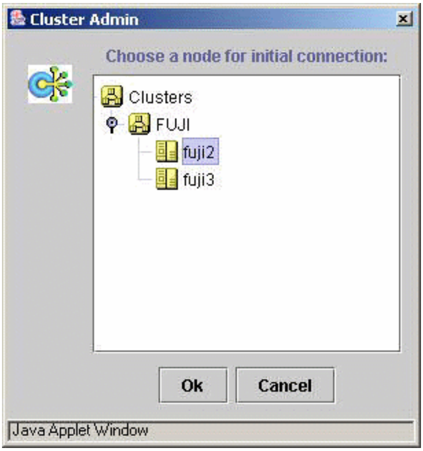


Figure 27: Initial connection choice window

Select a node and click on *Ok*.

The Cluster Admin main window appears (see Figure 28).

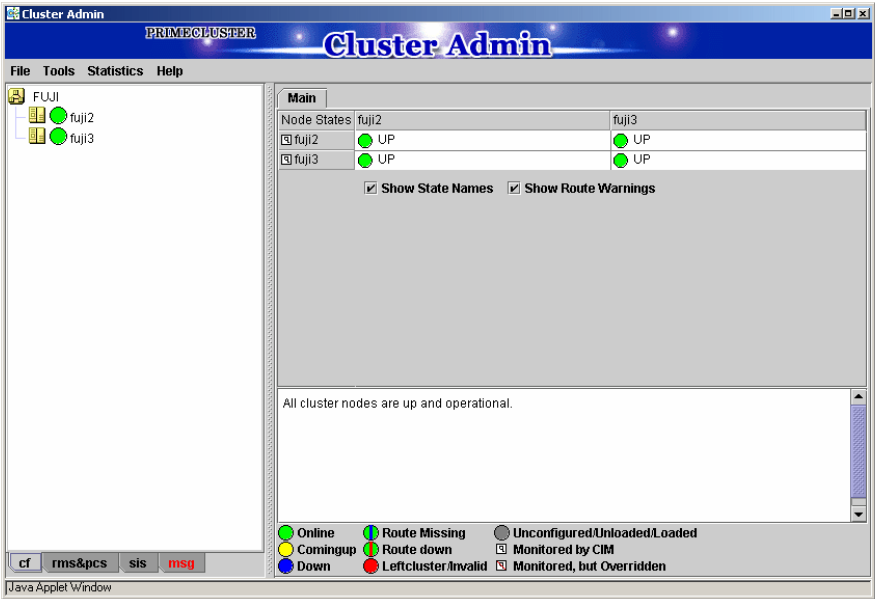


Figure 28: Cluster Admin main window

By default, the *cf* tab is selected and the CF main window is presented. Use the appropriate privilege level while logging in.The tab for RMS will appear as *rms&pcs* when PCS is installed and as *rms* in configurations where PCS is not installed.

Both of the terms **UP** and **Online** are represented by green circles. These terms describe the same state and are interchangeable.

5.3 Main CF table

When the GUI is first started, or after the successful completion of the configuration wizard, the main CF table will be displayed in the right panel. A tree showing the cluster nodes will be displayed in the left panel. An example of this display is shown in Figure 28.

The tree displays the local state of each node, but does not give information about how that node considers other nodes. If two or more nodes disagree about the state of a node, one or more colored exclamation marks appear next to the node. Each exclamation mark represents the node state of which another node considers that node to be.

The table in the right panel is called the main CF table. The column on the left of the table lists the CF states of each node of the cluster as seen by the other nodes in the cluster. For instance, the cell in the second row and first column is the state of `fuji3` as seen by the node `fuji2`.

There is an option at the bottom of the table to toggle the display of the state names. This is on by default. If this option is turned off, and there is a large number of nodes in the cluster, the table will display the node names vertically to allow a larger number of nodes to be seen.

There are two types of CF states. Local states are the states a node can consider itself in. Remote states are the states a node can consider another node to be in. Table 2 lists the local states.

CF state	Description
`UNLOADED`	The node does not have a CF driver loaded.
`LOADED`	The node has a CF driver loaded, but is not running.
`COMINGUP`	The node is in the process of starting and should be UP soon.
`UP`	The node is up and running normally.
`INVALID`	The node has an invalid configuration and must be reconfigured.
`UNKNOWN`	The GUI has no information from this node. This can be temporary, but if it persists, it probably means the GUI cannot contact that node.
`UNCONFIGURED`	The node is unconfigured.

Table 2: Local states

Table 3 lists the remote states.

CF state	Description
UP	The node is up and part of this cluster.
DOWN	The node is down and not in the cluster.
UNKNOWN	The reporting node has no opinion on the reported node.
LEFTCLUSTER	The node has left the cluster unexpectedly, probably from a crash. To ensure cluster integrity, it will not be allowed to rejoin until marked DOWN.

Table 3: Remote states

5.4 CF route tracking

If a node is UP, but it has one or more DOWN routes, the green circle in the main CF table will have a red line through it (see Figure 29).

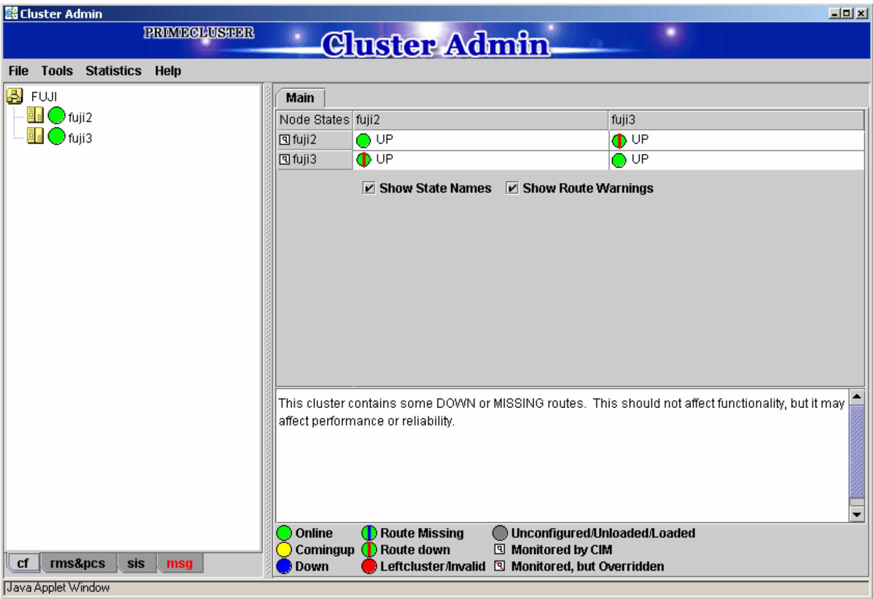


Figure 29: CF route DOWN

In this example, one of the network interfaces on `fuji2` has been unplugged. Cluster Admin, therefore, shows that a route is `DOWN`. Since `fuji3` cannot contact `fuji2` over that interface, it also shows that there is a route down on `fuji2`. To see which routes are `DOWN`, click on the node in the left-panel tree and look at the route table.

If CF starts with one or more interfaces missing, then the green circle in the main CF table will have a blue line through it (see Figure 30).

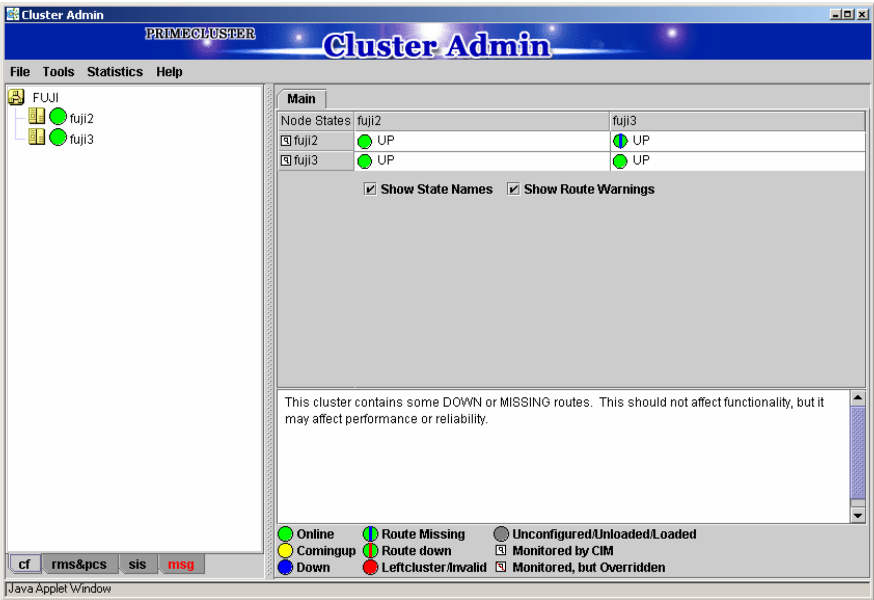


Figure 30: CF interface missing

In Figure 30, `fuji3` has a broken connection to `fuji2`, and Cluster Admin indicates that a route is missing.

In our example, clicking on `fuji2` in the left-panel tree shows that there is no route from `fuji2` to the `hme3` interface on `fuji3` (see Figure 31).

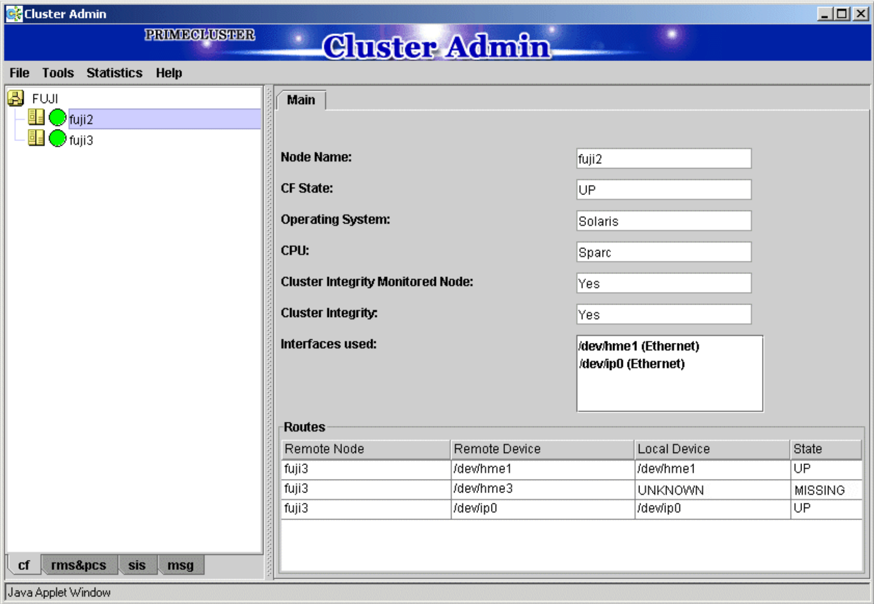


Figure 31: CF route table

5.5 Node details

To get detailed information on a cluster node, left-click on the node in the left tree. This replaces the main table with a display of detailed information. (To bring the main table back, left-click on the cluster name in the tree.)

The panel displayed is similar to the display in Figure 32.

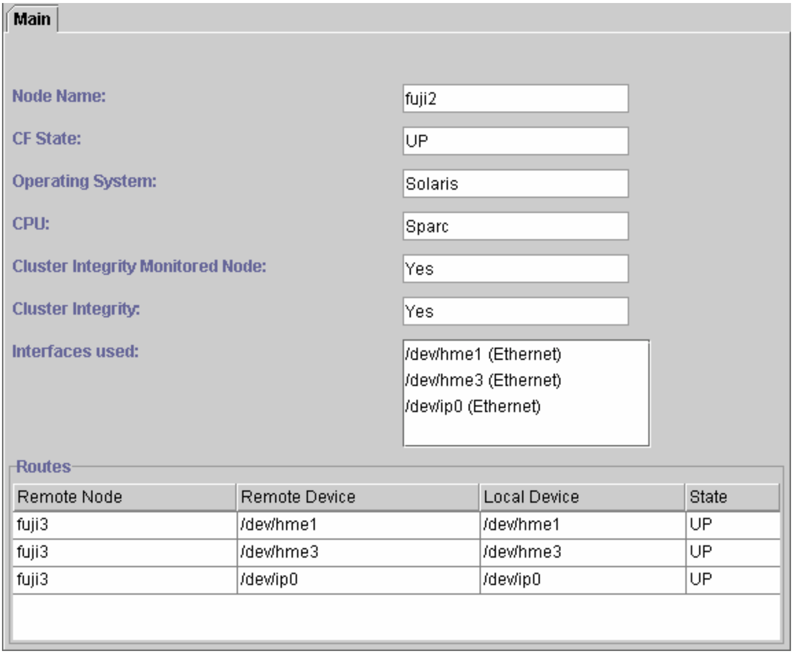


Figure 32: CF node information

Shown are the node's name, its CF state(s), operating system, platform, and the interfaces configured for use by CF. The states listed will be all of the states the node is considered to be in. For instance, if the node considers itself `UNLOADED` and other nodes consider it `DOWN`, `DOWN`/`UNLOADED` will be displayed.

The bottom part of the display is a table of all of the routes being used by CF on this node. It is possible for a node to have routes go down if a network interface or interconnect fails, while the node itself is still accessible.

5.6 Displaying the topology table

To examine and diagnose physical connectivity in the cluster, select *Tools -> Topology*. This menu option will produce a display of the physical connections in the cluster. This produces a table with the nodes shown along the left side and the interconnects of the cluster shown along the top. Each cell of the table lists the interfaces on that node connected to the interconnect. There is also a checkbox next to each interface showing if it is being used by CF. This table makes it easy to locate cabling errors or configuration problems at a glance.

An example of the topology table is shown in Figure 33.

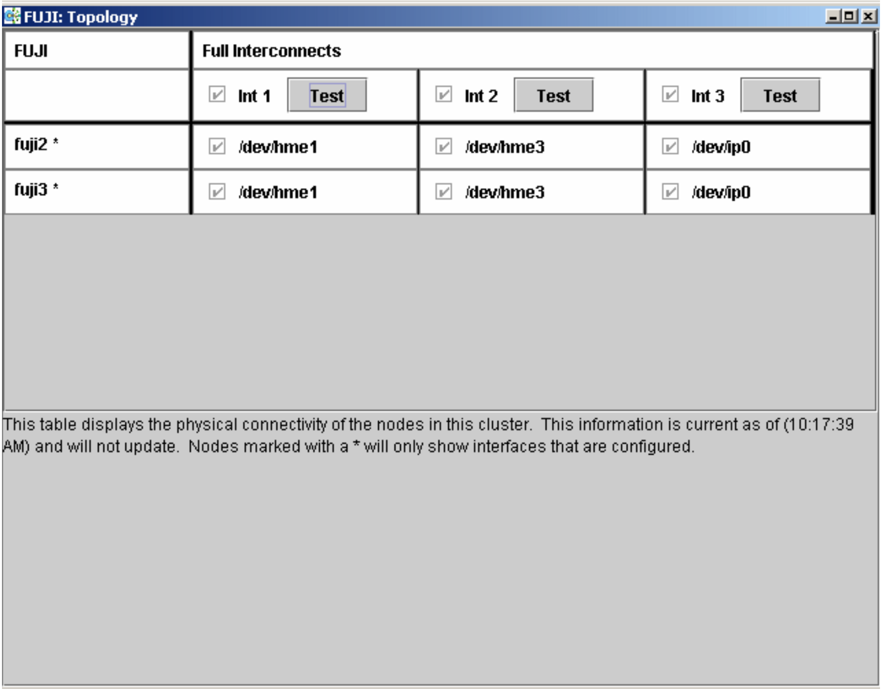


Figure 33: CF topology table

Pressing the *Test* button launches the Response Time monitor.

This tool allows you to see the response time for any combination of two nodes on that interconnect (see Figure 34).

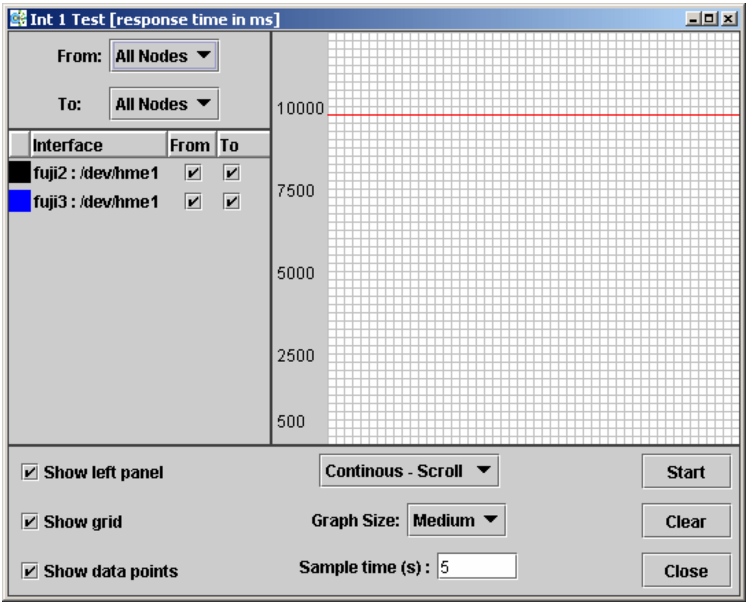


Figure 34: Response Time monitor

The Y axis is the response time for CF pings in milliseconds and the X axis is a configurable period. The red line is the upper limit of the response time before CF will declare nodes to be in the `LEFTCLUSTER` state.

The controls to the left of the graph determine the nodes for which the graph displays data as follows:

- Set the selection boxes at the top to a specific node name, or to *All Nodes*.
- Select the check boxes next to the node names to specify specific nodes.

The controls on the left of the bottom panel control how the graphing and information collection is done as follows:

- Check the *Show left panel* check box to hide the left panel to provide more room for the graph.
- Check the *Show grid* check box to turn the grid on and off.
- Check the *Show data points* check box to display a simple line graph.

The controls in the middle of the bottom panel are as follows:

- The top drop-down menu controls how the graph is drawn. The following options are available:
  - *Continuous-Scroll*—Creates a continuous graph, so that when there are more data points than space, the graph scrolls.
  - *Continuous-Clear*—Graphs continuously until the graph is full, and then it starts a new graph.
  - *Single Graph*— Draws a single graph only.
- *Graph size*—Allows you to control how many data points are drawn.
- *Sample time*—Controls how often data points are taken.
- The buttons on the lower right control starting and stopping of the graph, clearing it, and closing the graph window.

The buttons on the right of the bottom panel are as follows:

- *Start*/*Stop*—Starts or stops the Response Time Monitor.
- *Clear*—Clears the data and starts a new graph.
- *Close*—Closes the Response Time Monitor and returns you to the CF Main screen.

i The Response Time Monitor is a tool for expert users such as consultants or skilled customers. Its output must be interpreted carefully. The Response Time Monitor uses user-space CF pings to collect its data. If the CF traffic between nodes in a cluster is heavy, then the Response Time Monitor may show slow response times, even if the cluster and the interconnects are working properly. Likewise, if a user does CF pings from the command line while the Response Time Monitor is running, then the data may be skewed.

For best results, the Response Time Monitor should be run at times when CF traffic is relatively light, and the CF nodes are only lightly loaded.

5.7 Starting and stopping CF

There are two ways that you can start or stop CF from the GUI. The first is to simply right-click on a particular node in the tree in the left-hand panel. A state sensitive pop-up menu for that node will appear. If CF on the selected node is in a state where it can be started (or stopped), then the menu choice *Start CF* (or *Stop CF*) will be offered. Figure 35 shows the content-sensitive menu pop-up when you select *Start CF*.

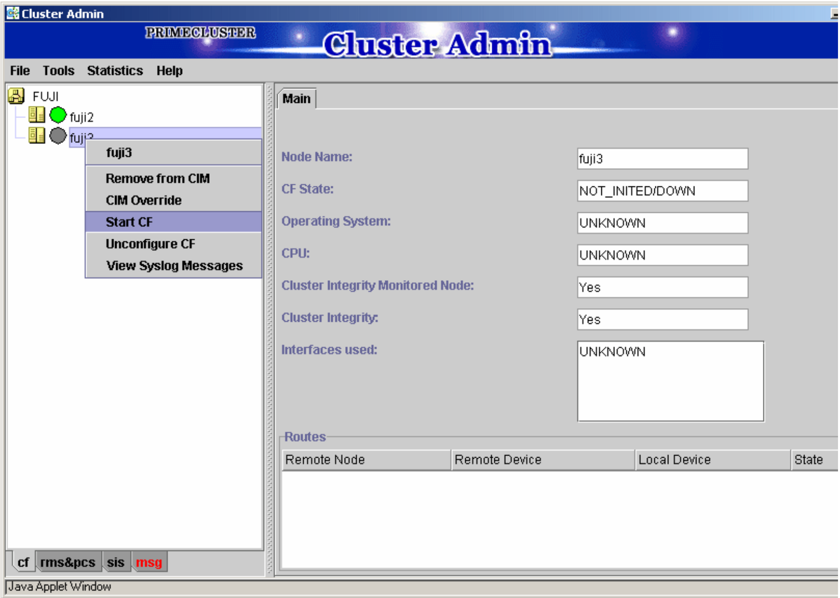


Figure 35: Starting CF

You can also go to the *Tools* pull-down menu and select either *Start CF* or *Stop CF* (not shown). A pop-up listing all the nodes where CF may be started or stopped will appear. You can then select the desired node to carry out the appropriate action.

The CF GUI gets its list of CF nodes from the node used for the initial connection window as shown in Figure 27. If CF is not up and running on the initial connection node, then the CF GUI will not display the list of nodes in the tree in the left panel.

Because of this, when you want to stop CF on multiple nodes (including the initial node) by means of the GUI, ensure that the initial connection node is the last one on which you stop CF.

5.7.1 Starting CF

If CF is stopped on the initial connection node, the Cluster Admin main window appears with the CF options of *Load driver* or *Unconfigure* (see Figure 36). The CF state must be `UNLOADED` or `LOADED` to start CF on a node.

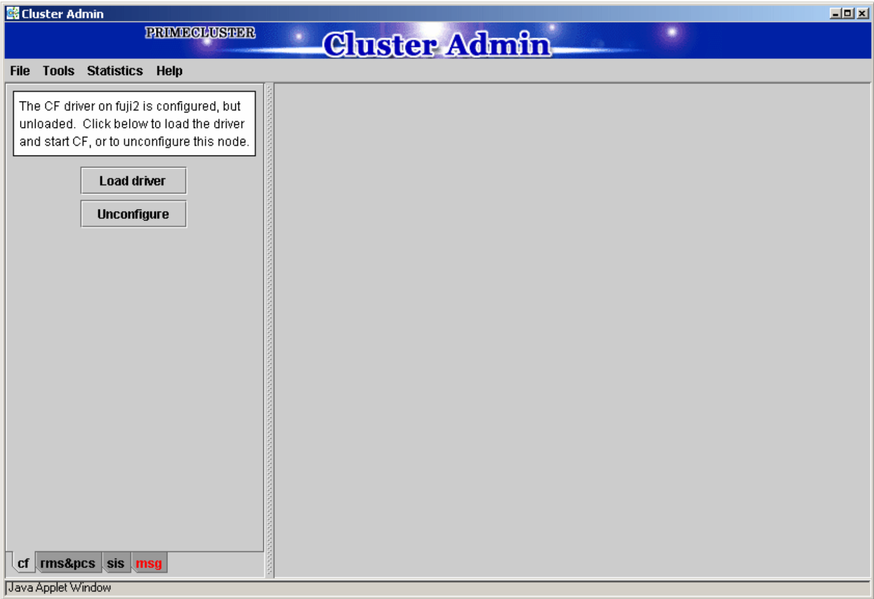


Figure 36: CF configured but not loaded

Click on the *Load driver* button to start the CF driver with the existing configuration.

The Start CF services popup appears (see Figure 37). By default all CF services that have been installed on that node are selected to be started. The contents of this list may vary due according to the installed products.

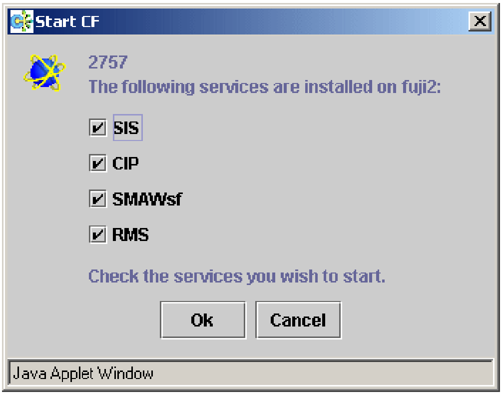


Figure 37: Start CF services pop-up

You may exclude CF services from startup by clicking on the selection check box for each service that you do not want to start. This should be done by experts only.

Click on the *Ok* button and a status popup appears with the results of each service start operation (see Figure 38).

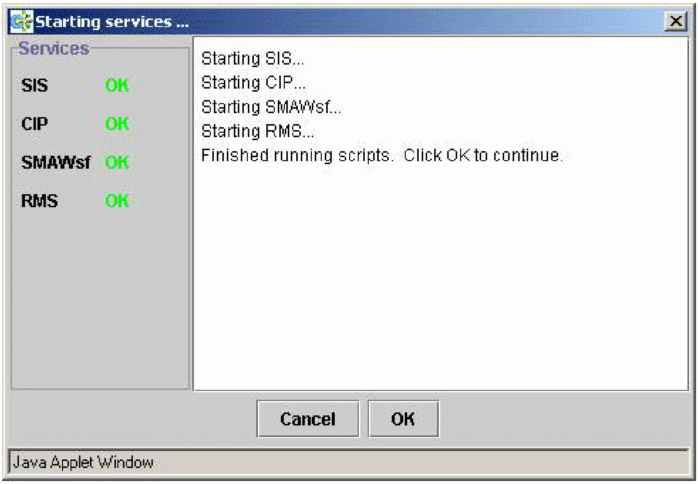


Figure 38: Start CF services status window

Click on the *Ok* button to return to the Cluster Admin main window.

5.7.2 Stopping CF

Right-click on a CF node name and select *Stop CF* (see Figure 39).

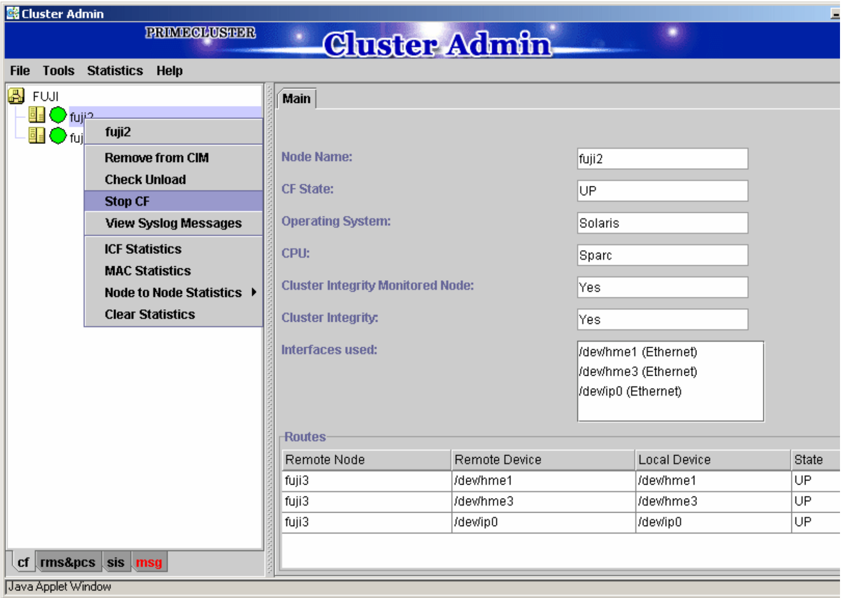


Figure 39: Stop CF

A confirmation pop-up appears (see Figure 40). Choose *Yes* to continue.

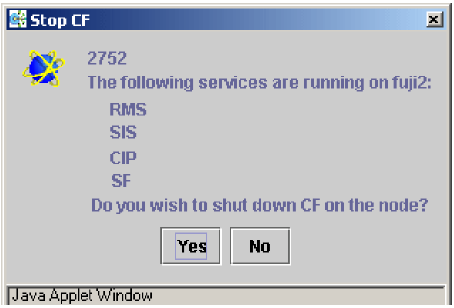


Figure 40: Stopping CF

Before stopping CF, all services that run over CF on that node should first be shut down. When you invoke *Stop CF* from the GUI, it will use the CF dependency scripts to see what services are still running. It will print out a list of these in a pop-up and ask you if you wish to continue. If you do continue, it will then run the dependency scripts to shut down these services. If any service does not shutdown, then the *Stop CF* operation will fail.

i The dependency scripts currently include only PRIMECLUSTER products. If third-party products, for example Oracle RAC, are using PAS or CF services, then the GUI will not know about them. In such cases, the third-party product should be shut down before you attempt to stop CF.

To stop CF on a node, the node's CF state must be `UP`, `COMINGUP`, or `INVALID`.

5.8 Marking nodes DOWN

If a node is shut down normally, it is considered `DOWN` by the remaining nodes. If it leaves the cluster unexpectedly, it will be considered `LEFTCLUSTER`. It is important to mark a node `DOWN` as SOON as possible to allow normal cluster operation for the remaining nodes. The menu option *Tools->Mark Node Down* allows nodes to be marked as `DOWN`.

i Marking a node DOWN should be only done if the node is actually down (inoperable or inoperative); otherwise, this could cause data corruption.

To do this, select *Tools->Mark Node Down*. This displays a dialog of all of the nodes that consider another node to be `LEFTCLUSTER`. Clicking on one of them displays a list of all the nodes that node considered `LEFTCLUSTER`. Select one and then click *OK*. This clears the `LEFTCLUSTER` status on that node.

Refer to the Chapter “LEFTCLUSTER state” for more information on the `LEFTCLUSTER` state.

5.9 Using PRIMECLUSTER log viewer

The CF log messages for a given node may be displayed by right-clicking on the node in the tree and selecting *View CF Messages*.

Alternately, you may go to the *Tools* menu and select *View CF Messages*. This brings up a pop-up where you can select the node whose `syslog` messages you would like to view.

When invoked from within CF, the PRIMECLUSTER log viewer only displays CF `syslog` messages. To view messages from other products, select the *Products* button in the *Product Filter* window pane (see Figure 41).

Figure 41 shows an example of the PRIMECLUSTER log viewer.

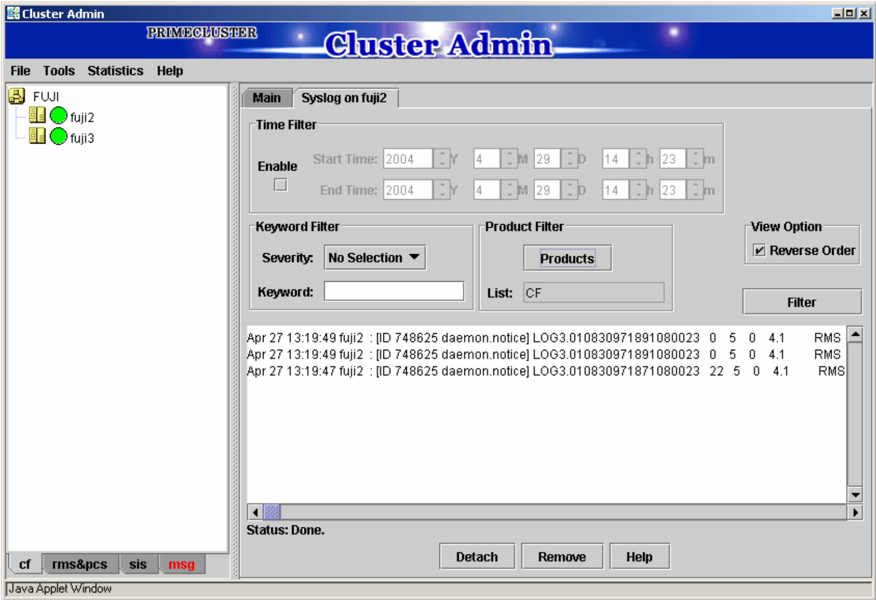


Figure 41: PRIMECLUSTER log viewer

The `syslog` messages appears in the right-hand panel. If you click on the *Detach* button on the bottom, then the `syslog` window appears as a separate window.

Figure 42 shows the detached PRIMECLUSTER log viewer window.

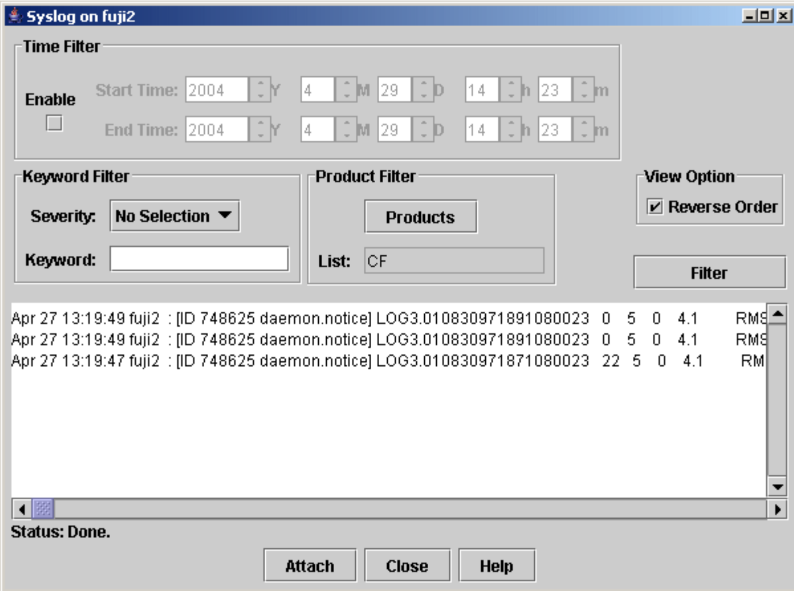


Figure 42: Detached PRIMECLUSTER log viewer

The PRIMECLUSTER log viewer has search filters based on date/time/keyword and severity levels.

The *Reverse Order* checkbox is selected by default. This option reverses the order of the messages. To disable this feature, deselect the checkbox.

5.9.1 Search based on time filter

To perform a search based on a start and end time, click the check box for *Enable*, specify the start and end times for the search range, and click on the *Filter* button (see Figure 43).

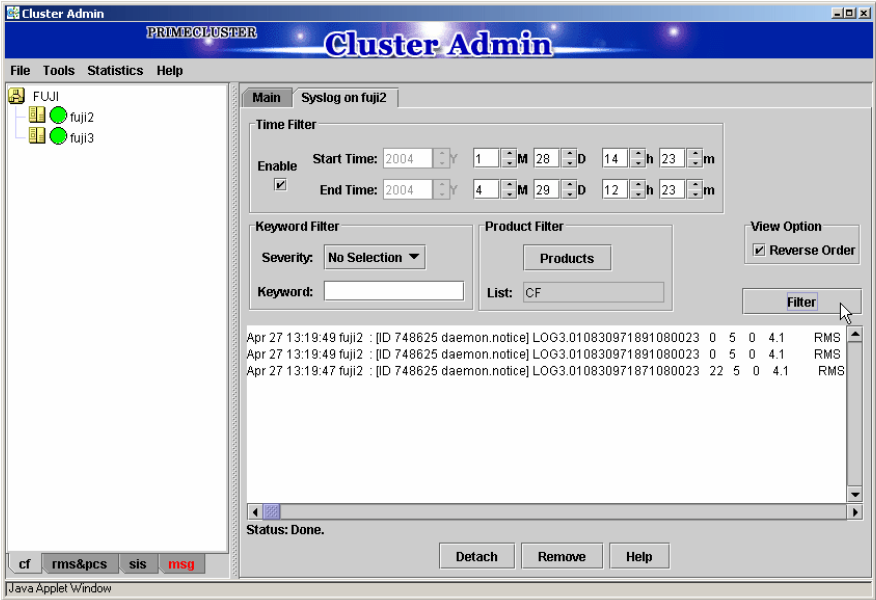


Figure 43: Search based on date/time

5.9.2 Search based on keyword

To perform a search based on a keyword, enter a keyword and click on the *Filter* button (see Figure 44).

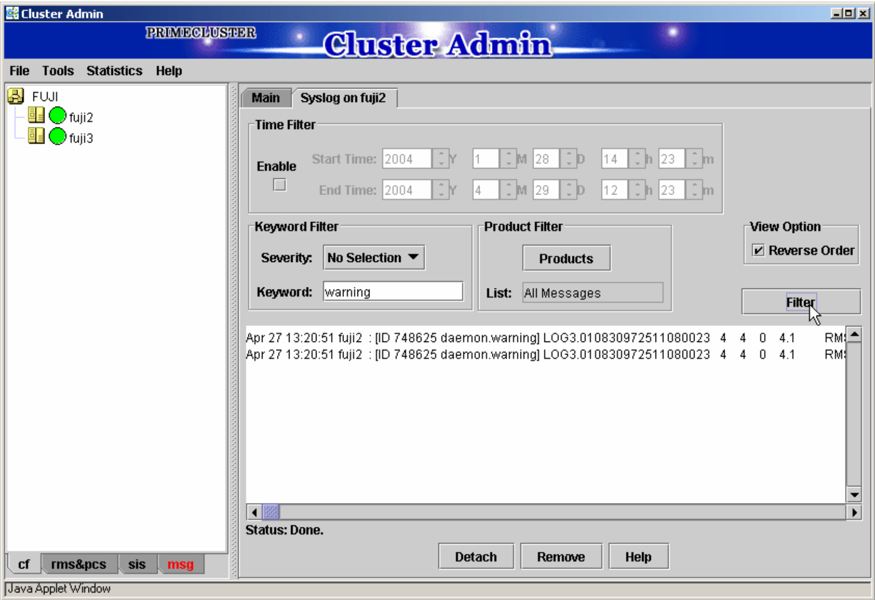


Figure 44: Search based on keyword

5.9.3 Search based on severity levels

To perform a search based severity levels, click on the *Severity* pull-down menu. You can choose from the severity levels shown in Table 4 and click on the *Filter* button. Figure 45 shows the log for a search based on severity level.

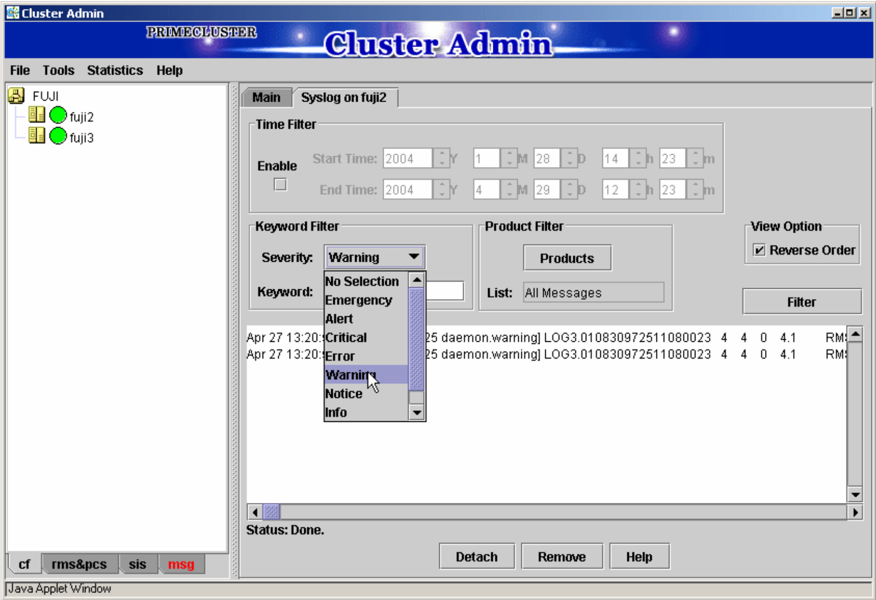


Figure 45: Search based on severity

Severity level	**Severity description**
Emergency	Systems cannot be used
Alert	Immediate action is necessary
Critical	Critical condition
Error	Error condition
Warning	Warning condition
Notice	Normal but important condition
Info	For information
Debug	Debug message

Table 4: PRIMECLUSTER log viewer severity levels

5.10 Displaying statistics

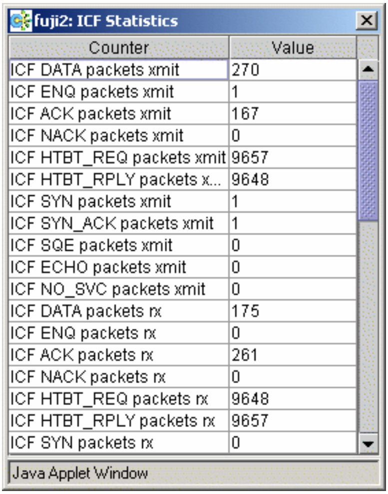
CF can display various statistics about its operation. There are three types of statistics available:

- ICF
- MAC
- Node to Node

To view the statistics for a particular node, right-click on that node in the tree and select the desired type of statistic.

Alternately, you can go to the *Statistics* menu and select the desired statistic. This will bring up a pop-up where you can select the node whose statistics you would like to view. The list of nodes presented in this pop-up will be all nodes whose states are `UP` as viewed from the login node.

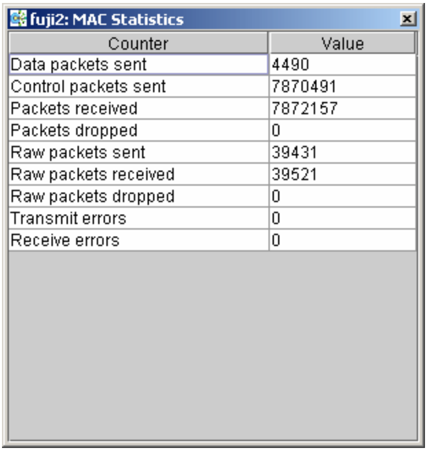
Figure 46 shows the display of ICF Statistics.



Counter	Value
ICF DATA packets xmit	270
ICF ENQ packets xmit	1
ICF ACK packets xmit	167
ICF NACK packets xmit	0
ICF HTBT_REQ packets xmit	9657
ICF HTBT_RPLY packets x...	9648
ICF SYN packets xmit	1
ICF SYN_ACK packets xmit	1
ICF SQE packets xmit	0
ICF ECHO packets xmit	0
ICF NO_SVC packets xmit	0
ICF DATA packets rx	175
ICF ENQ packets rx	0
ICF ACK packets rx	261
ICF NACK packets rx	0
ICF HTBT_REQ packets rx	9648
ICF HTBT_RPLY packets rx	9657
ICF SYN packets rx	0

Figure 46: ICF statistics

Figure 47 shows the display of MAC Statistics,



Counter	Value
Data packets sent	4490
Control packets sent	7870491
Packets received	7872157
Packets dropped	0
Raw packets sent	39431
Raw packets received	39521
Raw packets dropped	0
Transmit errors	0
Receive errors	0

Figure 47: MAC statistics

To display node to node statistics, choose *Node to Node Statistics* and click on the desired node (see Figure 48).

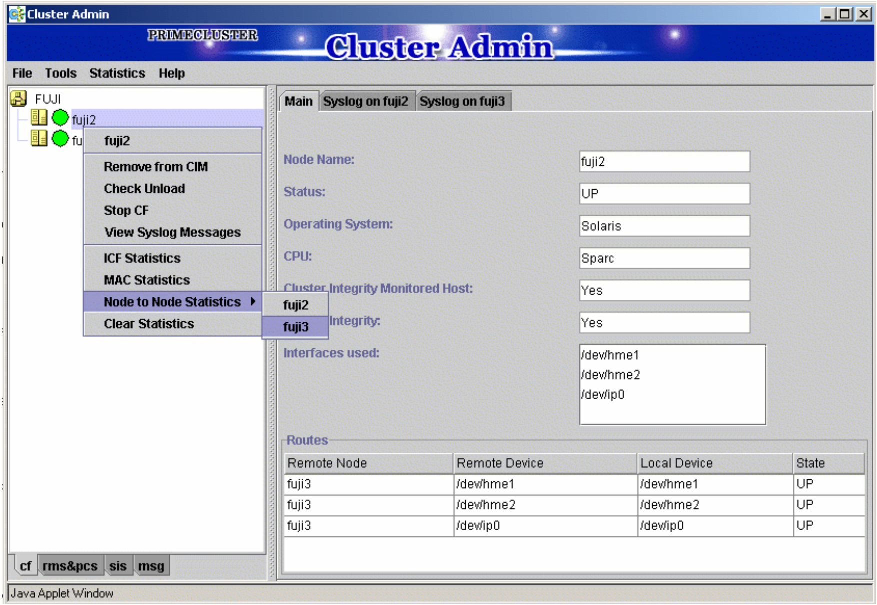
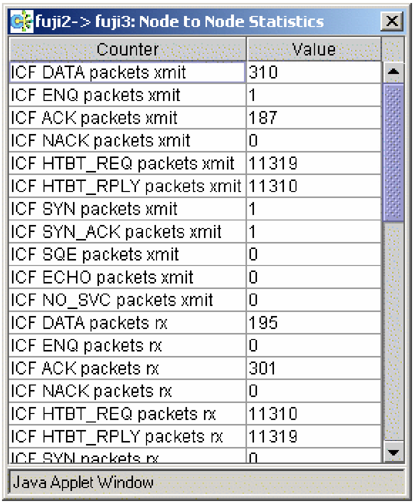


Figure 48: Selecting a node for node to node statistics

The window for Node to Node Statistics appears (see Figure 49).



Counter	Value
ICF DATA packets xmit	310
ICF ENQ packets xmit	1
ICF ACK packets xmit	187
ICF NACK packets xmit	0
ICF HTBT_REQ packets xmit	11319
ICF HTBT_RPLY packets xmit	11310
ICF SYN packets xmit	1
ICF SYN_ACK packets xmit	1
ICF SQE packets xmit	0
ICF ECHO packets xmit	0
ICF NO_SVC packets xmit	0
ICF DATA packets rx	195
ICF ENQ packets rx	0
ICF ACK packets rx	301
ICF NACK packets rx	0
ICF HTBT_REQ packets rx	11310
ICF HTBT_RPLY packets rx	11319
ICF SYN packets rx	0

Figure 49: Node to Node statistics

The statistics counters for a node can be cleared by right-clicking on a node and selecting *Clear Statistics* from the command pop-up. The *Statistics* menu also offers the same option.

5.11 Heartbeat monitor

To display the Heartbeat monitor, go to the *Statistics* menu and select *Heartbeat Monitor* (see Figure 50).

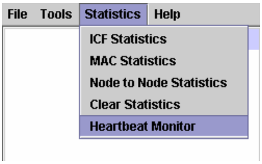


Figure 50: Selecting the Heartbeat monitor

The Heartbeat monitor allows you to monitor the percentage of heartbeats that are being received by CF over time. On a healthy cluster, this is normally close to 100 percent.

The Y axis is the percentage of heartbeats that have been successfully received and the X axis is a configurable time interval (see Figure 51).

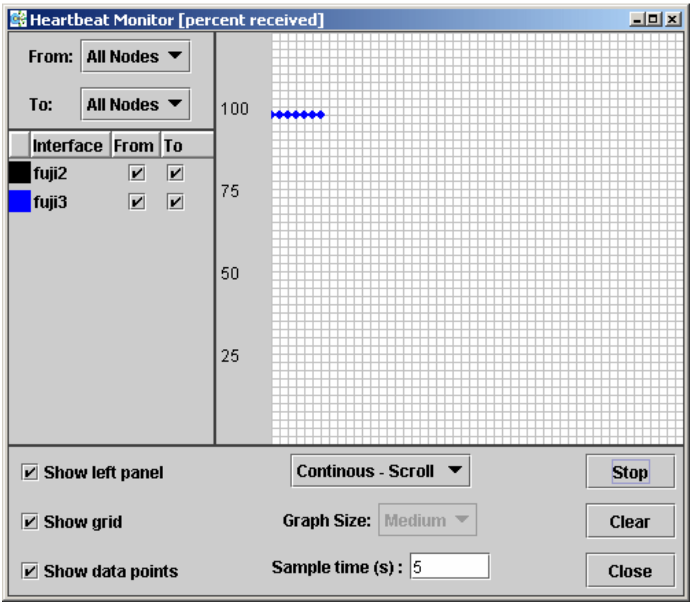


Figure 51: Heartbeat monitor

The controls on the left panel determine which data the graph shows as follows:

- The selection boxes at the top can be set to an individual node, or to *All Nodes*.
- The check boxes below the selection boxes allow the enabling and disabling of specific nodes.

The controls on the left of the bottom panel control how the graphing and information collection is done as follows:

- The *Show left panel* check box hides the left panel to provide more room for the graph.
- The *Show grid* check box turns the grid on and off.
- The *Show data points* check box can be turned off to display a simple line graph.

The controls in the bottom panel are as follows:

- The drop-down menu below the graph controls how the graph is drawn. The following options are available:
  - *Continuous-Scroll*—creates a continuous graph, so that when there are more data points than space, the graph scrolls.
  - *Continuous-Clear*—graphs continuously, but when the graph is full, clears it and starts a new graph.
  - *Single Graph*— creates a single graph only.
- *Graph size*—allows you to control how many data points are drawn.
- *Sample time*—controls how often data points are taken.
- The buttons on the lower right control starting and stopping of the graph, clearing it, and closing the graph window.

5.12 Adding and removing a node from CIM

To add a node to CIM, click on the *Tools* pull-down menu. Select *Cluster Integrity* and *Add to CIM* from the expandable pull-down menu (see Figure 52).

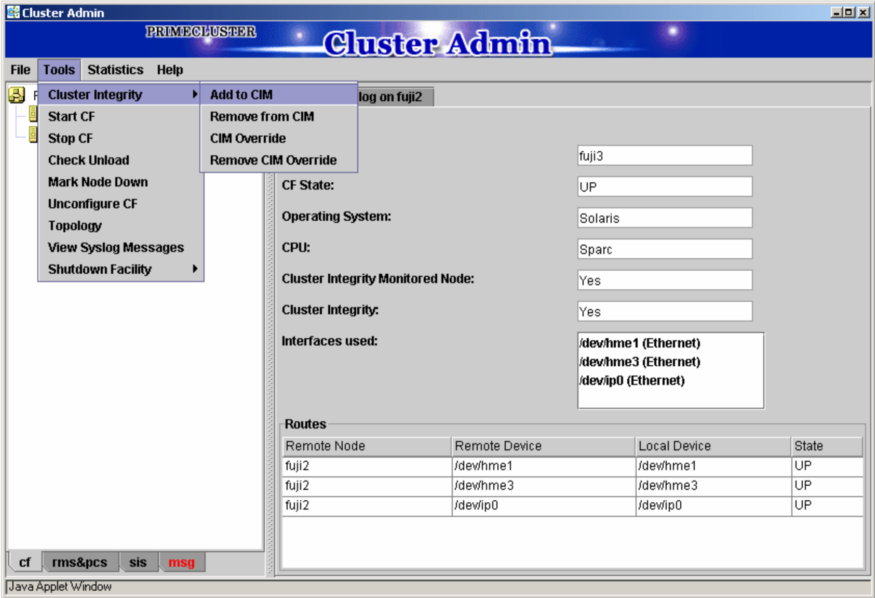


Figure 52: CIM options

The *Add to CIM* pop-up display appears. Choose the desired CF node and click on *Ok* (see Figure 53).

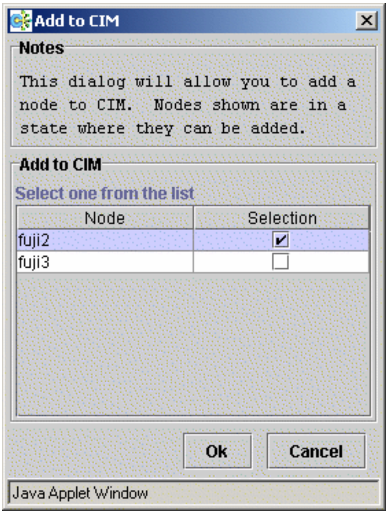


Figure 53: Add to CIM

To remove a node from CIM by means of the *Tools* pull-down menu, select *Cluster Integrity* and *Remove from CIM* from the expandable pull-down menu. Choose the CF node to be removed from the pop-up and click on *Ok*. A node can be removed at any time.

Refer to the Section “Cluster Integrity Monitor” for more details on CIM.

5.13 Unconfigure CF

To unconfigure a CF node, first stop CF on that node. Then, from the *Tools* pull-down menu, click on *Unconfigure CF*.

The *Unconfigure CF* pop-up display appears. Select the check box for the CF node to unconfigure, and click on *Ok* (see Figure 54).

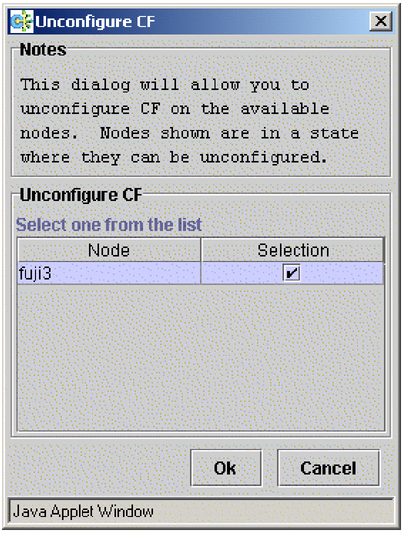


Figure 54: Unconfigure CF

The unconfigured node will no longer be part of the cluster. However, other cluster nodes will still show that node as `DOWN` until they are rebooted.

5.14 CIM Override

The CIM Override option causes a node to be ignored when determining a quorum. A node cannot be overridden if its CF state is `UP`. To select a node for CIM Override, right-click on a node and choose *CIM Override* (see Figure 55).

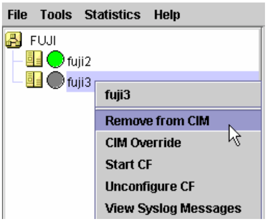


Figure 55: CIM Override

A confirmation pop-up appears (see Figure 56).

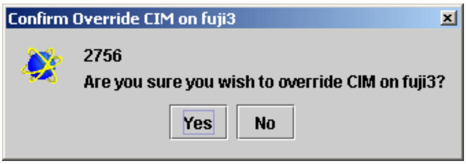


Figure 56: CIM Override confirmation

Click *Yes* to confirm.

Setting CIM override is a temporary action. It may be necessary to remove it manually again. This can be done by right-clicking on a node and selecting *Remove CIM Override* from the menu (see Figure 56).

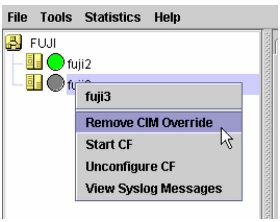


Figure 57: Remove CIM Override

CIM override is automatically removed when a node rejoins the cluster.

6 LEFTCLUSTER state

This chapter defines and describes the `LEFTCLUSTER` state.

This chapter discusses the following:

- The Section “Description of the LEFTCLUSTER state” describes the `LEFTCLUSTER` state in relation to the other states.
- The Section “Recovering from LEFTCLUSTER” discusses the different ways a `LEFTCLUSTER` state is caused and how to clear it.

Occasionally, while CF is running, you may encounter the `LEFTCLUSTER` state, as shown by running the `cftool -n` command. A message will be printed to the console of the remaining nodes in the cluster. This can occur under the following circumstances:

- Broken interconnects—All cluster interconnects going to another node (or nodes) in the cluster are broken.
- Panicked nodes—A node panics.
- Node in kernel debugger—A node is left in the kernel debugger for too long and heartbeats are missed.
- Entering the firmware monitor OBP—Will cause missed heartbeats and will result in the `LEFTCLUSTER` state.
- Reboot—Shutting down a node with the `reboot` command.

  i Nodes running CF should normally be shut down with the `shutdown` command or with the `init` command. These commands will run the rc scripts that will allow CF to be cleanly shut down on that node. If you run the `reboot` command, the rc scripts are not run, and the node will go down while CF is running. This will cause the node to be declared to be in the `LEFTCLUSTER` state by the other nodes.

If SF is fully configured and running on all cluster nodes, it will try to resolve the `LEFTCLUSTER` state automatically. If SF is not configured and running, or the SF fails to clear the state, the state has to be cleared manually. This section explains the `LEFTCLUSTER` state and how to clear this state manually.

6.1 Description of the LEFTCLUSTER state

Each node in a CF cluster keeps track of the state of the other nodes in the cluster. For example, the other node's state may be `UP`, `DOWN`, or `LEFTCLUSTER`.

`LEFTCLUSTER` is an intermediate state between `UP` and `DOWN`, which means that the node cannot determine the state of another node in the cluster because of a break in communication.

For example, consider the three-node cluster shown in Figure 58.

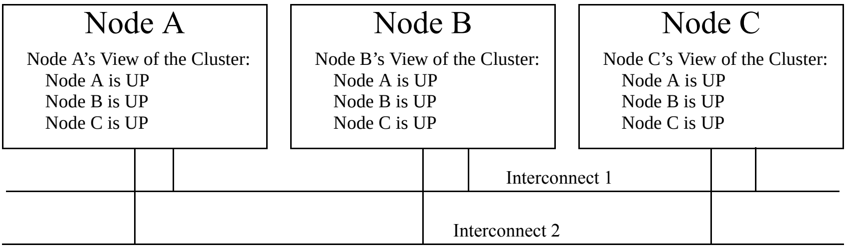


Figure 58: Three-node cluster with working connections

Each node maintains a table of what states it believes all the nodes in the cluster are in.

Now suppose that there is a cluster partition in which the connections to Node C are lost. The result is shown in Figure 59.

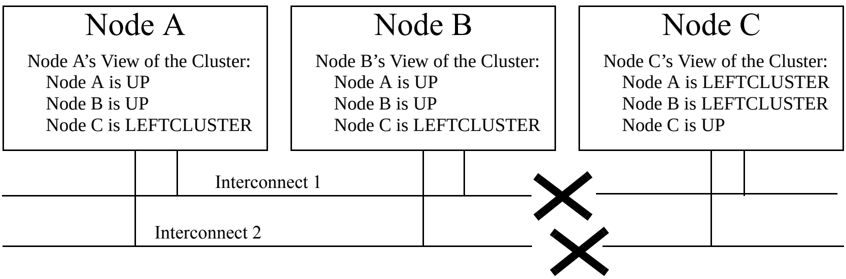


Figure 59: Three-node cluster where connection is lost

Because of the break in network communications, Nodes A and B cannot be sure of Node C's true state. They therefore update their state tables to say that Node C is in the `LEFTCLUSTER` state. Likewise, Node C cannot be sure of the true states of Nodes A and B, so it marks those nodes as being in the `LEFTCLUSTER` in its state table.

i `LEFTCLUSTER` is a state that a particular node believes other nodes are in. It is never a state that a node believes that it is in. For example, in Figure 59, each node believes that it is `UP`.

The purpose of the `LEFTCLUSTER` state is to warn applications which use CF that contact with another node has been lost and that the state of such a node is uncertain. This is very important for RMS.

For example, suppose that an application on Node C was configured under RMS to fail over to Node B if Node C failed. Suppose further that Nodes C and B had a shared disk to which this application wrote.

RMS needs to make sure that the application is, at any given time, running on either Node C or B but not both, since running it on both would corrupt the data on the shared disk.

Now suppose for the sake of argument that there was no `LEFTCLUSTER` state, but as soon as network communication was lost, each node marked the node it could not communicate with as `DOWN`. RMS on Node B would notice that Node C was `DOWN`. It would then start an instance of the application on Node C as part of its cluster partition processing. Unfortunately, Node C isn't really `DOWN`. Only communication with it has been lost. The application is still running on Node C. The applications, which assume that they have exclusive access to the shared disk, would then corrupt data as their updates interfered with each other.

The `LEFTCLUSTER` state avoids the above scenario. It allows RMS and other application using CF to distinguish between lost communications (implying an unknown state of nodes beyond the communications break) and a node that is genuinely down.

When SF notices that a node is in the `LEFTCLUSTER` state, it contacts the previously configured Shutdown Agent and requests that the node which is in the `LEFTCLUSTER` state be shut down. With PRIMECLUSTER, a weight calculation determines which node or nodes should survive and which ones should be shut down. SF has the capability to arbitrate among the shutdown requests and shut down a selected set of nodes in the cluster, such that the subcluster with the largest weight is left running and the remaining subclusters are shutdown.

In the example given, Node C would be shut down, leaving Nodes A and B running. After the SF software shuts down Node C, SF on Nodes A and B clear the `LEFTCLUSTER` state such that Nodes A and B see Node C as `DOWN`. Refer to the Chapter “Shutdown Facility” for details on configuring SF and shutdown agents.

i Note that a node cannot join an existing cluster when the nodes in that cluster believe that the node is in the `LEFTCLUSTER` state.

6.2 Recovering from LEFTCLUSTER

If SF is not running on all nodes, or if SF is unable to shut down the node which left the cluster, and the `LEFTCLUSTER` condition occurs, then the system administrator must manually clear the `LEFTCLUSTER` state. The procedure for doing this depends on how the `LEFTCLUSTER` condition occurred.

6.2.1 Caused by a panic/hung node

The `LEFTCLUSTER` state may occur because a particular node panicked or hung. In this case, the procedure to clear `LEFTCLUSTER` is as follows:

1. Make sure the node is really down. If the node panicked and came back up, proceed to Step 2. If the node is in the debugger, exit the debugger. The node will reboot if it panicked, otherwise shut down the node, called the *offending node* in the following discussion.
2. While the offending node is down, use Cluster Admin to log on to one of the surviving nodes in the cluster. Invoke the CF GUI and select *Mark Node Down* from the *Tools* pull-down menu, then mark the offending node as `DOWN`. This may also be done from the command line by using the following command:

   ```
   # cftool -k
   ```
3. Bring the offending node back up. It will rejoin the cluster as part of the reboot process.

6.2.2 Caused by staying in the kernel debugger too long

In Figure 60, Node C was placed in the kernel debugger too long so it appears as a hung node. Nodes A and B decided that Node C's state was `LEFTCLUSTER`.

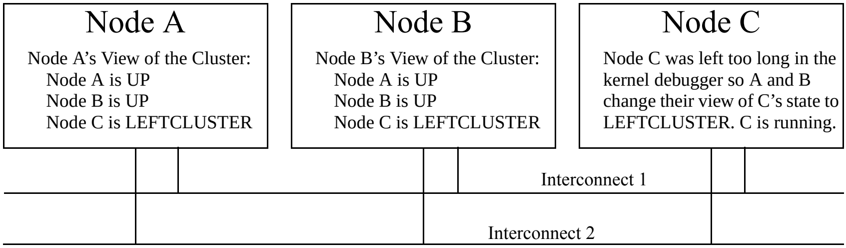


Figure 60: Node C placed in the kernel debugger too long

To recover from this situation, you would need to do the following:

1. Shut down Node C.
2. While Node C is down, start up the Cluster Admin on Node A or B. Use *Mark Node Down* from the *Tools* pull-down menu in the CF portion of the GUI to mark Node C `DOWN`.
3. Bring Node C back up. It will rejoin the cluster as part of its reboot process.

6.2.3 Caused by a cluster partition

A cluster partition refers to a communications failure in which all CF communications between sets of nodes in the cluster are lost. In this case, the cluster itself is effectively partitioned into sub-clusters.

To manually recover from a cluster partition, you must do the following:

1. Decide which of the sub-clusters you want to survive. Typically, you will chose the sub-cluster that has the largest number of nodes in it or the one where the most important hardware is connected or the most important application is running.
2. Shut down all of the nodes in the sub-cluster which you don't want to survive.
3. While the nodes are down, use the Cluster Admin GUI to log on to one of the surviving nodes and run the CF portion of the GUI. Select *Mark Node Down* from the *Tools* menu to mark all of the shut down nodes as `DOWN`.
4. Fix the network break so that connectivity is restored between all nodes in the cluster.
5. Bring the nodes back up. They will rejoin the cluster as part of their reboot process.

For example, consider Figure 61.

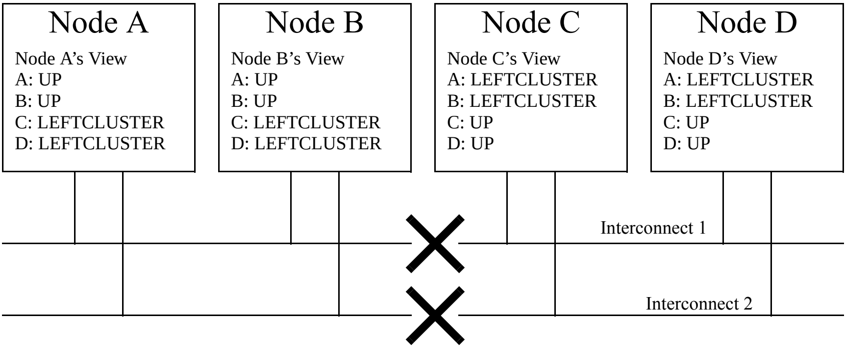


Figure 61: Four-node cluster with cluster partition

In Figure 61, a four-node cluster has suffered a cluster partition. Both of its CF interconnects (Interconnect 1 and Interconnect 2) have been severed. The cluster is now split into two sub-clusters. Nodes A and B are in one sub-cluster while Nodes C and D are in the other.

To recover from this situation, in instances where SF fails to resolve the problem, you would need to do the following:

1. Decide which sub-cluster you want to survive. In this example, let us arbitrarily decide that Nodes A and B will survive.
2. Shut down all of the nodes in the other sub-cluster, here Nodes C and D.
3. While Nodes C and D are down, run the Cluster Admin GUI on either Node A or Node B. Start the CF portion of the GUI and go to *Mark Node Down* from the *Tools* pull-down menu. Mark Nodes C and D as `DOWN`.
4. Fix the interconnect break on Interconnect 1 and Interconnect 2 so that both sub-clusters will be able to communicate with each other again.
5. Bring Nodes C and D back up.

6.2.4 Caused by reboot

The `LEFTCLUSTER` state may occur because a particular node (called the offending node) has been rebooted improperly. If a node is rebooted using the normal reboot commands like `init`(1M) or `shutdown`(1M), the `LEFTCLUSTER` state should not occur.

The `LEFTCLUSTER` state will occur if you reboot the offending node with commands like `uadmin`(1M) or `reboot`(1M). In this case the procedure to clear the `LEFTCLUSTER` state is as follows:

1. Make sure the offending node is rebooted in multi-user mode.
2. Use Cluster Admin to log on to one of the surviving nodes in the cluster. Invoke the CF GUI by selecting *Mark Node Down* from the *Tools* pull-down menu. Mark the offending node as *DOWN*.
3. The offending node will rejoin the cluster automatically.

7 CF topology table

This chapter discusses the CF topology table as it relates to the CF portion of the Cluster Admin GUI.

This chapter discusses the following:

- The Section “Basic layout” discusses the physical layout of the topology table.
- The Section “Selecting devices” discusses how the GUI actually draws the topology table.
- The Section “Examples” shows various network configurations and what their topology tables would look like.

The CF topology table is part of the CF portion of the Cluster Admin GUI. The topology table may be invoked from the *Tools->Topology* menu item in the GUI (refer to the Section “Displaying the topology table” in the Chapter “GUI administration”). It is also available during CF configuration in the CF Wizard in the GUI.

The topology table is designed to show the network configuration from perspective of CF. It shows what devices are on the same interconnects and can communicate with each other.

The topology table only considers Ethernet devices. It does not include any IP interconnects that might be used for CF, even if CF over IP is configured.

Displayed devices

The topology table is generated by doing CF pings on all nodes in the cluster and then analyzing the results. `cfconfig -l` causes the driver to be loaded by pushing its modules on all possible Ethernet devices on the system, regardless of whether or not they are configured for use with CF. This allows CF pings to be done on all Ethernet devices on all nodes in the cluster. Thus, all Ethernet devices show up in the topology table.

`cfconfig -L` causes CF to push CF modules only on the Ethernet devices which are configured for use with CF. The `-L` option offers several advantages. On systems with large disk arrays, it means that CF driver load time is reduced. On PRIMEPOWER systems with dynamic hardware reconfiguration, Ethernet controllers that are not used by CF can be moved more easily between partitions. Because of these advantages, the `rc` scripts that load CF use the `-L` option.

However, the -L option restricts the devices which are capable of sending or receiving CF pings to only configured devices. CF has no knowledge of other Ethernet devices on the system. Thus, when the topology table displays devices for a node where CF has been loaded with the -L option, it only displays devices that have been configured for CF.

It is possible that a running cluster might have a mixture of nodes where some were loaded with -l and others were loaded with -L. In this case, the topology table would show all Ethernet devices for nodes loaded with -l, but only CF configured devices for nodes loaded with -L. The topology table indicates which nodes have been loaded with the -L option by adding an asterisk (*) after the node's name.

When a cluster is totally unconfigured, the CF Wizard will load the CF driver on each node using the -l option. This allows all devices on all nodes to be seen. After the configuration is complete, the CF Wizard will unload the CF driver on the newly configured nodes and reload it with -L. This means that if the topology table is subsequently invoked on a running cluster, only configured devices will typically be seen.

If you are using the CF Wizard to add a new CF node into an existing cluster where CF is already loaded, then the Wizard will load the CF driver on the new node with -l so all of its devices can be seen. However, it is likely that the already configured nodes will have had their CF drivers loaded with -L, so only configured devices will show up on these nodes.

The rest of this chapter discusses the format of the topology table. The examples implicitly assume that all devices can be seen on each node. Again, this would be the case when first configuring a CF cluster.

7.1 Basic layout

The basic layout of the topology table is shown in Table 5.

FUJI	**Full interconnects**		**Partial interconnects**		**Unconnected devices**
	Int 1	**Int 2**	**Int 3**	**Int 4**	
`fuji2`	`hme0 hme2`	`hme1`	`hme3`	`hme5`	`hme4 hme6`
`fuji3`	`hme0`	`hme2`	missing	`hme1`	
`fuji4`	`hme1`	`hme2`	`hme3`	missing	`hme4`

Table 5: Basic layout for the CF topology table

The upper-left-hand corner of the topology table gives the CF cluster name. Below it, the names of all of the nodes in the cluster are listed.

The CF devices are organized into three major categories:

- Full interconnects—Have working CF communications to each of the nodes in the cluster.
- Partial interconnects—Have working CF communications to at least two nodes in the cluster, but not to all of the nodes.
- Unconnected devices—Have no working CF communications to any node in the cluster.

If a particular category is not present, it will be omitted from the topology table. For example, if the cluster in Table 5 had no partial interconnects, then the table headings would list only full interconnects and unconnected devices (as well as the left-most column giving the clustername and node names).

Within the full interconnects and partial interconnects category, the devices are further sorted into separate interconnects. Each column under an `Int` number heading represents all the devices on an interconnect. (The column header *Int* is an abbreviation for *Interconnect*.) For example, in Table 5, there are two full interconnects listed under the column headings of `Int 1` and `Int 2`.

Each row for a node represents possible CF devices for that node.

Thus, in Table 5, Interconnect 1 is a full interconnect. It is attached to `hme0` and `hme2` on fuji2. On fuji3, it is attached to `hme0`, and on fuji4, it is attached to `hme1`.

Since CF runs over Ethernet devices, the `hmen` devices in Table 5 represent the Ethernet devices found on the various systems. The actual names of these devices will vary depending on the type of Ethernet controllers on the system. For nodes whose CF driver was loaded with `-L`, only configured devices will be shown.

It should be noted that the numbering used for the interconnects is purely a convention used only in the topology table to make the display easier to read. The underlying CF product does not number its interconnects. CF itself only knows about CF devices and point-to-point routes.

If a node does not have a device on a particular partial interconnect, then the word `missing` will be printed in that node's cell in the partial interconnects column. For example, in Table 5, fuji3 does not have a device for the partial interconnect labeled `Int 3`.

7.2 Selecting devices

The basic layout of the topology table is shown in Table 5. However, when the GUI actually draws the topology table, it puts check boxes next to all of the interconnects and CF devices as shown in Table 6.

FUJI	**Full interconnects**		**Partial interconnects**		**Unconnected devices**
	☒ **Int 1**	☒ **Int 2**	☐ **Int 3**	☐ **Int 4**	
`fuji2`	☒ `hme0` ☐ `hme2`	☒ `hme1`	☐ `hme3`	☐ `hme5`	☐ `hme4` ☐ `hme6`
`fuji3`	☒ `hme0`	☒ `hme2`	missing	☐ `hme1`	
`fuji4`	☒ `hme1`	☒ `hme2`	☐ `hme3`	missing	☐ `hme4`

Table 6: Topology table with check boxes shown

The check boxes show which of the devices were selected for use in the CF configuration. (In the actual topology table, check marks appear instead of x’s.)

When the topology table is used outside of the CF Wizard, these check boxes are read-only. They show what devices were previously selected for the configuration. In addition, the unchecked boxes (representing devices which were not configured for CF) will not be seen for nodes where `-L` was used to load CF.

When the topology table is used within the CF Wizard, then the check boxes may be used to select which devices will be included in the CF configuration. Clicking on the check box in an Int *number* heading will automatically select all devices attached to that interconnect. However, if a node has multiple devices connected to a single interconnect, then only one of the devices will be selected.

For example, in Table 6, `fuji2` has both `hme0` and `hme2` attached to Interconnect 1. A valid CF configuration allows a given node to have only one CF device configured per interconnect. Thus, in the CF Wizard, the topology table will only allow `hme0` or `hme2` to be selected for `fuji2`. In the above example, if `hme2` were selected for `fuji2`, then `hme0` would automatically be unchecked.

If the CF Wizard is used to add a new node to an existing cluster, then the devices already configured in the running cluster will be displayed as read-only in the topology table. These existing devices may not be changed without unconfiguring CF on their respective nodes.

7.3 Examples

The following examples show various network configurations and what their topology tables would look like when the topology table is displayed in the CF Wizard on a totally unconfigured cluster. For simplicity, the check boxes are omitted.

Example 1

In this example, there is a three-node cluster with three full interconnects (see Figure 62).

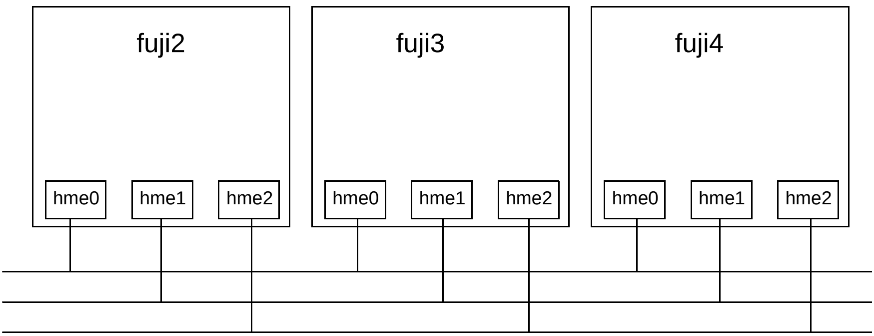


Figure 62: A three-node cluster with three full interconnects

The resulting topology table for Figure 62 is shown in Table 7.

FUJI	**Full interconnects**		
	Int 1	**Int 2**	**Int 3**
`fuji2`	`hme0`	`hme1`	`hme2`
`fuji3`	`hme0`	`hme1`	`hme2`
`fuji4`	`hme0`	`hme1`	`hme2`

Table 7: Topology table for 3 full interconnects

Since there are no partial interconnects or unconnected devices, those columns are omitted from the topology table.

Example 2

In this example, `fuji2`'s Ethernet connection for `hme1` has been broken (see Figure 63).

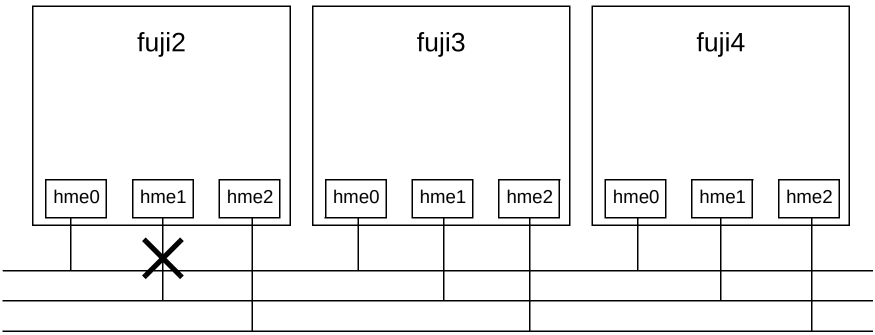


Figure 63: Broken Ethernet connection for hme1 on fuji2

The resulting topology table for Figure 63 is shown in Table 8.

FUJI	**Full interconnects**		**Partial interconnects**	**Unconnected devices**
	Int 1	**Int 2**	**Int 3**	
`fuji2`	`hme0`	`hme2`	missing	`hme1`
`fuji3`	`hme0`	`hme2`	`hme1`	
`fuji4`	`hme0`	`hme2`	`hme1`	

Table 8: Topology table with broken Ethernet connection

In Table 8, `hme1` for fuji2 now shows up as an unconnected device. Since one of the interconnects is missing a device for fuji2, the Partial Interconnect column now shows up. Note that the relationship between interconnect numbering and the devices has changed between Table 7 and Table 8. In Table 7, for example, all `hme1` devices were on `Int 2`. In Table 8, the `hme1` devices for Nodes B and C are now on the partial interconnect `Int 3`. This change in numbering illustrates the fact that the numbers have no real significance beyond the topology table.

Example 3

This example shows a cluster with severe networking or cabling problems in which no full interconnects are found.

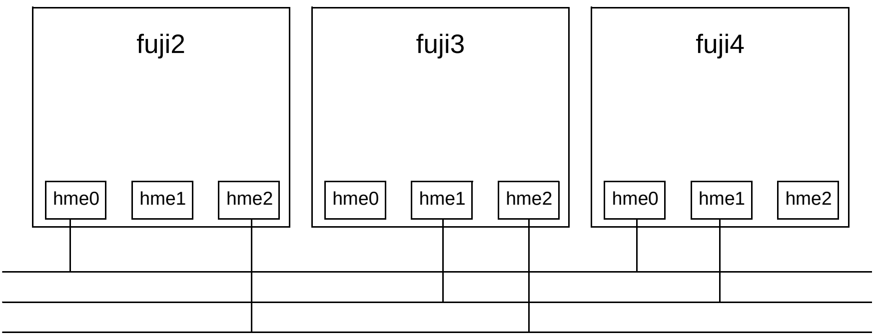


Figure 64: Cluster with no full interconnects

The resulting topology table for Figure 64 is shown in Table 9.

FUJI	**Partial interconnects**			**Unconnected devices**
	Int 1	**Int 2**	**Int 3**	
fuji2	hme0	missing	hme2	hme1
fuji3	missing	hme1	hme2	hme0
fuji4	hme0	hme1	missing	hme2

Table 9: Topology table with no full interconnects

In Table 9, the full interconnects column is omitted since there are none. Note that if this configuration were present in the CF Wizard, the wizard would not allow you to do configuration. The wizard requires that at least one full interconnect must be present.

8 Shutdown Facility

This chapter describes the components and advantages of PRIMECLUSTER Shutdown Facility (SF) and provides administration information.

i Certain product options are region-specific. For information on the availability a specific Shutdown Agent (SA), contact your local customer-support service representative.

This chapter discusses the following:

- The Section “Overview” describes the components of SF.
- The Section “Available SAs and MAs” describes the available agents for use by the SF.
- The Section “SF split-brain handling” describes the methods for resolving split cluster situations.
- The Section “Configuring the Shutdown Facility” describes the configuration of SF and its agents.
- The Section “SF administration” provides information on administering SF.
- The Section “Logging” describes the log files used by SF and its agents.

8.1 Overview

The SF provides the interface for managing the shutdown of cluster nodes when error conditions occur. The SF also advises other PRIMECLUSTER products of the successful completion of node shutdown so that recovery operations can begin.

The SF is made up of the following major components:

- The Shutdown Daemon (SD)
- One or more Shutdown Agents (SA)
- Monitoring Agent (MA)
- `sdtool`(1M) command

Shutdown Daemon

The SD is started at system boot time and is responsible for the following:

- Monitoring the state of all cluster nodes
- Monitoring the state of all registered SAs
- Reacting to indications of cluster node failure and verifying or managing node elimination
- Resolving split-brain conditions
- Advising other PRIMECLUSTER products of node elimination completion

The SD uses SAs to perform most of its work with regard to cluster node monitoring and elimination. In addition to SA's, the SD interfaces with the Cluster Foundation layer's ENS system to receive node failure indications and to advertise node elimination completion.

Shutdown Agents

The SA’s role is to attempt to shut down a remote cluster node in a manner in which the shutdown can be guaranteed. Some of the SAs are shipped with the SF product, but may differ based on the architecture of the cluster node on which SF is installed. SF allows any PRIMECLUSTER service layer product to shut down a node whether RMS is running or not.

An SA is responsible for shutting down, and verifying the shutdown of a cluster node. Each SA uses a specific method for performing the node shutdown such as:

- `SA_scon` uses the cluster console running the SCON software.
- `SA_pprcip` and `SA_pprcir` use the RCI interface available on PRIME-POWER nodes.
- `SA_rccu` uses the RCCU or XSCF units on PRIMEPOWER nodes to perform console break panics.
- `SA_wtinps` uses an NPS unit.
- `SA_rps` uses an RPS unit.
- `SA_xscfp` and `SA_xscfr` use XSCF to panic or reset a PRIMEPOWER with XSCF machine.

The Section “Available SAs and MAs” discuss SAs in more detail.

If more than one SA is used, the first SA in the configuration is used as the primary SA. SD always uses the primary SA. The other secondary SAs are used as fall back SAs only if the primary SA fails for some reason.

Monitoring Agent

In addition to functioning as an SA, an MA provides the following functions:

- Monitors the state of the remote node
- Notifies the SD of a failure in the event of an unexpected system panic and shutoff

sdtool command

The `sdtool`(1M) utility is the command line interface for interacting with the SD. With it the administrator can:

- Start and stop the SD (although this is typically done with an RC script run at boot time)
- View the current state of the SA's
- Force the SD to reconfigure itself based on new contents of its configuration file
- Dump the contents of the current SF configuration
- Enable/disable SD debugging output
- Eliminate a cluster node

> **i** Although the `sdtool`(1M) utility provides a cluster node elimination capability, the preferred method for controlled shutdown of a cluster node is the `/usr/sbin/shutdown` command.

8.2 Available SAs and MAs

This section describes the following set of supported SAs and MAs:

- RCI—Remote Cabinet Interface
- XSCF—eXtended System Control Facility
- NPS—Network Power Switch
- SCON—Single Console

- RCCU—Remote Console Control Unit
- RPS—Remote Power Switch

Table 10 lists the available SAs and indicates whether they also function as MAs.

SA	MA	Name	Hardware
SCON	no	SA_scon	PRIMEPOWER
RCI	yes	SA_pprcip, SA_pprcir	PRIMEPOWER
RCCU	yes	SA_rccu	PRIMEPOWER
NPS	no	SA_wtinps	Any
RPS	no	SA_rps	Any
XSCF	yes	SA_xscfp, SA_xscfr, SA_rccu	PRIMEPOWER with XSCF

Table 10: Available SAs and MAs

8.2.1 RCI

The RCI SA provides a shutdown method only for the PRIMEPOWER clusters on all PRIMEPOWER platforms.

There are two kinds of RCI SAs:

- SA_pprcip—Provides a shutdown mechanism by panicking the node through RCI.
- SA_pprcir—Provides a shutdown mechanism by resetting the node through RCI.

Setup and configuration

Hardware setup of the RCI is performed only by qualified support personnel. Contact them for more information, In addition, you can refer to the manual shipped with the unit and to any relevant PRIMECLUSTER Release Notices for more details on configuration.

The RCI Monitoring Agent only discontinues monitoring the node when an RCI error is detected, so the monitoring function is not disrupted on the other nodes. Further, the RCI Monitoring Agent enables the other nodes to monitor each other, and eliminates the failed node if anode failure is detected.

How to check the RCI Monitoring Agent when an RCI error is detected

Check the Shutdown Facility on all the nodes as follows:

```
# /opt/SMAW/bin/sdtool -s
```

Resolve failures as follows:

- An RCI error is detected before the Shutdown Facility is started.

  If `InitFailed` is displayed for `Init State` of the `Agent SA_pprcip.so` and `SA_pprcir.so` on any one of cluster nodes, an RCI transmission failure occurred between the node and the other nodes. This node is excluded from monitoring and elimination.

  For example, an RCI transmission failure occurred between `fuji2`, where the `sdtool` command was executed, and the other nodes in the following:

  fuji2# **/opt/SMAW/bin/sdtool -s**

```
Cluster Host    Agent          SA State      Shut State   Test State   InitState
------------    -----          --------      ----------   ----------   ---------
fuji2           SA_pprcip.so   Idle          Unknown      Unknown      InitFailed
fuji3           SA_pprcir.so   Idle          Unknown      Unknown      InitFailed
fuji4           SA_pprcip.so   Idle          Unknown      Unknown      InitFailed
fuji5           SA_pprcir.so   Idle          Unknown      Unknown      InitFailed
fuji6           SA_pprcip.so   Idle          Unknown      Unknown      InitFailed
fuji7           SA_pprcir.so   Idle          Unknown      Unknown      InitFailed
```

  Refer to `/var/adm/messages` and take corrective action according to the error message instructions.

- [If an RCI error is detected before the RCI Monitoring Agent is started]

  If `Unknown` or `TestFailed` is displayed for `Test State` of the `Agent SA_pprcip.so` and `SA_pprcir.so` on any one of the nodes, an RCI transmission failure occurred between the node and the other nodes. This node is excluded from monitoring and elimination.

  For example, an RCI transmission failure occurred between `fuji2`, where the `sdtool` command was executed, and `fuji3` in the following:

  fuji2# **/opt/SMAW/bin/sdtool -s**

```
Cluster Host    Agent          SA State    Shut State   Test State   Init State
------------    -----          --------    ----------   ----------   ----------
fuji2           SA_pprcip.so   Idle        Unknown      TestWorked   InitWorked
fuji2           SA_pprcir.so   Idle        Unknown      TestWorked   InitWorked
fuji3           SA_pprcip.so   Idle        Unknown      TestFailed   InitWorked
fuji3           SA_pprcir.so   Idle        Unknown      TestFailed   InitWorked
fuji4           SA_pprcip.so   Idle        Unknown      TestWorked   InitWorked
fuji4           SA_pprcir.so   Idle        Unknown      TestWorked   InitWorked
```

Refer to /var/adm/messages and take corrective action according to the error message instructions.

When RCI transmission failures are detected, the node which uses the failed transmission route is excluded from monitoring and elimination until the Shutdown Facility is restarted.

If nodes use the same RCI address, the No.7004 error message is output, and the RCI Monitoring Agent daemon is abnormally terminated.

If you turn off a node for maintenance, the No.7003 error message appears on the other nodes. Take corrective action after the node is started after maintenance.

The RCI log files are as follows:

```
/var/opt/SMAWsf/log/SA_pprcip.log
/var/opt/SMAWsf/log/SA_pprcir.log
```

8.2.2 XSCF

XSCF (eXtended System Control Facility) is a console MA that is supported only on PRIMEPOWER machines where XSCF is mounted. Refer to the *XSCF (eXtended System Control Facility) User's Guide* for complete details on XSCF.

The different types of XSCF SAs provide shutdown mechanisms as follows:

- `SA_xscfp`—panics the node through the XSCF shell
- `SA_xscfr`—resets the node through XSCF shell
- `SA_rccu`—sends a control break signal over the node's console

Setup and configuration

If you use XSCF as a console, you need to confirm the following:

- The standard console is the SCF-LAN port.
- Only the Read console port is enabled in XSCF telnet ports.
- The XSCF shell port (hereafter referred to as control port) is enabled in the XSCF telnet ports.
- The group ID of a user account to log on to the control port is root.

Refer to the *XSCF (eXtended System Control Facility) User's Guide* for complete details on how to configure XSCF.

> **i** After Shutdown Facility startup, it can take up to 30 seconds for the console Monitoring Agent to detect hardware failures such as RCCU or XSCF errors, a disconnected cable, and other errors like incorrect IP addresses.

The XSCF log files are as follows:

`/var/opt/SMAWsf/log/SA_xscfp.log`

`/var/opt/SMAWsf/log/SA_xscfr.log`

`/var/opt/SMAWsf/log/SA_rccu.log`

8.2.3 NPS

The Network Power Switch (NPS) SA is `SA_wtinps`. This SA provides a node shutdown function using the Western Telematic Inc. Network Power Switch (WTI NPS) unit to power-cycle selected nodes in the cluster.

Setup and configuration

The WTI NPS unit must be configured according to the directions in the manual shipped with the unit. At the very least, an IP address must be assigned to the unit and a password must be enabled. Make sure that the cluster node’s power plugs are plugged into the NPS box and that the `command confirmation` setting on the NPS box is set to `on`.

It is advisable to have the NPS box on a robust LAN connected directly to the cluster nodes.

The boot delay of every configured plug in the NPS box should be set to 10 seconds.

> **i** If you want to set the boot delay to any other value, make sure that the “timeout value” for the corresponding `SA_wtinps` agent should be set such that it is greater than this boot delay value by at least 10 seconds. To set this value, use the detailed configuration mode for SF.

> **i** If more than a single plug is assigned to a single node (which means that more than one plug will be operated per `/on`, `/off`, `/boot` command), the “boot delay” of these plugs must be assigned to a value larger than 10 seconds, otherwise timeouts may occur. The timeout value of the corresponding `SA_wtinps` should be set as follows:
>
> `timeout = boot_delay + (* 2 * no of plugs) + 10`

The NPS log file is as follows:

`/var/opt/SMAWsf/log/SA_wtinps.log`

8.2.4 SCON

The Single Console (SCON) SA, `SA_scon`, provides an alternative SA for PRIMECLUSTER. SCON performs necessary node elimination tasks, coordinated with console usage.

Setup and configuration

To use the `SA_scon` SA, a system console (external to the cluster nodes) should be fully configured with the SCON product. Refer to the Chapter “System console” for details on the setup and configuration of SCON.

`SA_scon` is one of the SAs called by the Shutdown Facility when performing node elimination. The `SA_scon` process running on the cluster node communicates with the SCON running on the cluster console to request that a cluster node be eliminated. To communicate with the cluster console, the `SA_scon` SA must be properly configured.

The SCON log file is as follows:

`/var/opt/SMAWsf/log/SA_scon.log`

8.2.5 RCCU

The Remote Console Control Unit (RCCU) SA, `SA_rccu`, provides a SA using the RCCU. It also functions as an MA.

Setup and configuration

The RCCU unit must be configured according to the directions in the manual shipped with the unit. The RCCU unit should be assigned an IP address and name, so that the cluster nodes can connect to it over the network. All the RCCU ports that will be connected to the cluster nodes console lines should be configured according to the instructions given in the manual.

> **i** Node elimination by the RCCU MA is done by sending a control break signal over the node's console line.

> **i** After Shutdown Facility startup, it can take up to 30 seconds for the console Monitoring Agent to detect hardware failures such as RCCU or XSCF errors, a disconnected cable, and other errors like incorrect IP addresses.

The RCCU log file is as follows:

`/var/opt/SMAWsf/log/SA_rccu.log`

8.2.6 RPS

The Remote Power Switch (RPS) SA, `SA_rps`, provides a node shutdown function using the RPS unit.

Setup and configuration

The RPS must be configured according to the directions in the RPS manuals. The optional software `SMAWrps` must be installed and working for power off and power on commands. The nodes must be connected to plugs with the plug-IDs given in the appropriate host entry.

The RPS log file is as follows:

`/var/opt/SMAWsf/log/SA_rps.log`

8.3 SF split-brain handling

The PRIMECLUSTER product provides the ability to gracefully resolve split-brain situations as described in this section.

8.3.1 Administrative LAN

Split-brain processing makes use of Administrative LAN. For details on setting up such a LAN, see the PRIMECLUSTER *Installation Guide (Solaris)*. The use of Admin LAN is optional, however the use of an Administrative LAN is recommended for faster and more accurate split-brain handling.

8.3.2 SF split-brain handling

A *split-brain* condition is one in which one or more cluster nodes have stopped receiving heartbeats from one or more other cluster nodes, yet those nodes have been determined to still be running. Each of these distinct sets of cluster nodes is called a sub-cluster, and when a split-brain condition occurs the Shutdown Facility has a choice to make as to which sub-cluster should remain running.

Only one of the sub-clusters in a split-brain condition can survive. The SF determines which sub-cluster is most important and allows only that sub-cluster to remain. SF determines the importance of each subcluster by calculating the total node weight and application weight of each subcluster. The subcluster with the greatest total weight survives.

Node weights are defined in the SF configuration file `rcsd.cfg`. Typically, you use Cluster Admin's SF Wizard to set the node weights.

Application weights are defined in RMS. Each RMS `userApplication` object can have a `ShutdownPriority` defined for it. The value of the `ShutdownPriority` is that application's weight. RMS calculates the total application weight for a particular node by adding up the weights of all applications that are `Online` on that node. If an application is switched from one node to another, its weight will be transferred to the new node.

SF combines the values for the RMS `ShutdownPriority` attributes and the SF weight assignments to determine how to handle a split-brain condition.

8.3.2.1 RMS ShutdownPriority attribute

RMS supports the ability to set application importance in the form of a `ShutdownPriority` value for each `userApplication` object defined within the RMS configuration. These values are combined for all `userApplication` objects that are `Online` on a given cluster node to represent the total application weight of that node. When a `userApplication` object is switched from one node to another, the value of that `userApplication` object's `ShutdownPriority` is transferred to the new node.

The higher the value of the `ShutdownPriority` attribute, the more important the application.

8.3.2.2 Shutdown Facility weight assignment

The Shutdown Facility supports the ability to define node importance in the form of a weight setting in the configuration file. This value represents a node weight for the cluster node.

The higher the node weight value, the more important the node.

> **i** Although SF takes into consideration both SF node weights and RMS application weights while performing split-brain handling, it is recommended to use only one of the weights for simplicity and ease of use. When both weights are used, split-brain handling results are much more complex.
>
> It is recommended that you follow the guidelines in the Section "Configuration notes" for help you with the configuration.

8.3.2.3 Disabling split-brain handling

Some applications require a fast failover; however, SF split-brain handling can cause a failover delay. For such applications, it is recommended that you disable the split-brain handling in the `SMAWsf` software.

To disable split-brain handing, the */etc/opt/SMAW/SMAWsf/nsbm.cfg* file must be present consistently on all cluster hosts and readable by the root user. The contents of this file does not matter; however, it must be present or absent consistently on all cluster hosts.

8.3.3 Runtime processing

Spit-brain handling may be performed by one of the following elements of the Shutdown Facility:

- The cluster console running the SCON software
- The Shutdown Facility internal algorithm

Both methods use the node weight calculation to determine which sub-cluster is of greater importance. The total node weight is equal to the value of the defined Shutdown Facility node weight added to the total application weight of the `Online` applications for this node as calculated within RMS.

> **i** Refer to the Section “Split-brain resolution manager selection” for details on how PRIMECLUSTER determines whether to use SF or SCON to handle a split-brain condition.

SCON algorithm

When the SCON is selected as the split-brain resolution manager, SF passes the node weight to the `SA_scon` SA which in turn passes a shutdown request to the SCON.

All cluster nodes send shutdown requests to the SCON containing the name of the node requesting the shutdown, its node weight, and the name of the node to shutdown. These shutdown requests are passed to the SCON over an administrative network (which may or may not be the same network identified as `admIP` within the SF configuration file). The SCON collects these requests and determines which sub-cluster is the heaviest and proceeds to shut down all other nodes not in the heaviest sub-cluster.

The SCON evaluation algorithm gathers all incoming shutdown requests during a configurable time interval and checks them for symmetry. This is to distinguish how to resolve the algorithm between the following situations:

1. For every shutdown request from node A to node B, there is also another request from node B to shutdown node A. In this case, no machine has really died. In this case, SF is up and running on all machines, but communication inside the cluster is damaged (split-brain condition).
2. There are unsymmetrical shutdown requests; therefore, it is unclear if there are real breakdowns or if there are communication losses inside the cluster and to the SCON.

In the first case, where no machine has really died, an algorithm determines the best-remaining subcluster by finding all cliques in a graph and then takes either the largest cluster or the cluster with the highest priority. (A clique in a graph is a completely connected subgraph, which means that every node in the subcluster can see every other node in the subcluster.)

If there are unsymmetrical requests, SCON shuts down the machine that has the highest number of requests for its shutdown—and then the one with the highest number of remaining requests and so on—and thus ends up with high probability of a best-remaining subcluster.

SF internal algorithm

When the SF is selected as the split-brain resolution manager, the SF uses the node weight internally.

The SF on each cluster node identifies which cluster nodes are outside its sub-cluster and adds each one of them to an internal shutdown list. This shutdown list, along with the local nodes node weight, is advertised to the SF instances running on all other cluster nodes (both in the local sub-cluster and outside the local sub-cluster) via the `admIP` network defined in the SF configuration file. After the SFs on each cluster node receive the advertisements, they each calculate the heaviest sub-cluster. The heaviest sub-cluster shuts down all lower weight sub-clusters.

In addition to handling well-coordinated shutdown activities defined by the contents of the advertisements, the SF internal algorithm will also resolve split-brain if the advertisements fail to be received. If the advertisements are not received then the split-brain will still be resolved, but it may take a bit more time as some amount of delay will have to be incurred.

The split-brain resolution done by the SF in situations where advertisements have failed depends on a variable delay based on the inverse of the percentage of the available cluster weight the local sub-cluster contains. The more weight it contains the less it delays. After the delay expires (assuming the sub-cluster has not been shut down by a higher-weight sub-cluster) the SF in the sub-cluster begins shutting down all other nodes in all other sub-clusters.

If a sub-cluster contains greater than 50 percent of the available cluster weight, then the SF in that sub-cluster will immediately start shutting down all other nodes in all other sub-clusters.

8.3.4 Split-brain resolution manager selection

The selection of the method to use for split-brain resolution (SCON or SF) depends on site-specific conditions. This is done automatically at startup.

SCON is selected as the split-brain resolution manager if SCON is the only SA for your cluster.

For all other situations, SF is selected as the split-brain resolution manager.

> **i** If SF is selected as the split-brain resolution manager, SCON should be configured not to do split-brain processing. This can be done by changing the `rmshosts.method` file. Refer to the Section “rmshosts.method file” for more information.

This selection cannot be changed manually after startup.

8.3.5 Configuration notes

When configuring the Shutdown Facility, RMS, and defining the various weights, the administrator should consider what the eventual goal of a split-brain situation should be.

Typical scenarios that are implemented are as follows:

- Largest Sub-cluster Survival (LSS)
- Specific Hardware Survival (SHS)
- Specific Application Survival (SAS)

The weights applied to both cluster nodes and to defined applications allow considerable flexibility in defining what parts of a cluster configuration should survive a split-brain condition. Using the settings outlined below, administrators can advise the Shutdown Facility about what should be preserved during split-brain resolution.

Largest Sub-cluster Survival

In this scenario, the administrator does not care which physical nodes survive the split, just that the maximum number of nodes survive. If RMS is used to control applications, it will move the applications to the surviving cluster nodes after split-brain resolution has succeeded.

This scenario is achieved as follows:

- By means of Cluster Admin, set the SF node weight values to `1`. `1` is the default value for this attribute, so new cluster installations may simply ignore it.
- By means of the RMS Wizard Tools, set the RMS attribute `ShutdownPriority` of all `userApplications` to `0`. `0` is the default value for this attribute, so if you are creating new applications you may simply ignore this setting.

As can be seen from the default values of both the SF weight and the RMS `ShutdownPriority`, if no specific action is taken by the administrator to define a split-brain resolution outcome, LSS is selected by default.

Specific Hardware Survival

In this scenario, the administrator has determined that one or more nodes contain hardware that is critical to the successful functioning of the cluster as a whole.

This scenario is achieved as follows:

- Using Cluster Admin, set the SF node weight of the cluster nodes containing the critical hardware to values more than double the combined value of cluster nodes not containing the critical hardware.
- Using PCS or the RMS Wizard Tools, set the RMS attribute `ShutdownPriority` of all `userApplications` to `0`. `0` is the default value for this attribute so if you are creating new applications you may simply ignore this setting.

As an example, in a four-node cluster in which two of the nodes contain critical hardware, set the SF weight of those critical nodes to `10` and set the SF weight of the non-critical nodes to `1`. With these settings, the combined weights of both non-critical nodes will never exceed even a single critical node.

Specific Application Survival

In this scenario, the administrator has determined that application survival on the node where the application is currently `Online` is more important than node survival. This can only be implemented if RMS is used to control the application(s) under discussion. This can get complex if more than one application is deemed to be critical and those applications are running on different cluster nodes. In some split-brain situations, all applications will not survive and will need to be switched over by RMS after the split-brain has been resolved.

This scenario is achieved as follows:

- Using Cluster Admin, set the SF node weight values to `1`. `1` is the default value for this attribute, so new cluster installations may simply ignore it.
- Using PCS or the RMS Wizard Tools, set the RMS attribute `ShutdownPriority` of the critical applications to more than double the combined values of all non-critical applications, plus any SF node weight.

As an example, in a four-node cluster there are three applications. Set the SF weight of all nodes to `1`, and set the `ShutdownPriority` of the three applications to `50`, `10`, `10`. This would define that the application with a `ShutdownPriority` of `50` would survive no matter what, and further that the sub-cluster containing the node on which this application was running would survive the split no matter what. To clarify this example, if the cluster nodes were A, B, C and D all with a weight of `1`, and `App1`, `App2` and `App3` had `ShutdownPriority` of `50`, `10` and `10` respectively, even in the worst-case split that node D with `App1` was split from nodes A, B and C which had applications `App2` and `App3` the weights of the sub-clusters would be D with `51` and A,B,C with `23`. The heaviest sub-cluster (D) would win.

8.4 Configuring the Shutdown Facility

This section describes how to use Cluster Admin and the CLI to configure the Shutdown Facility (SF).

The setting of Shutdown Facility is different in dependence on the hardware model. Confirm the model of hardware, and set an appropriate Shutdown Agent.

- For PRIMEPOWER 250 or 450:

  RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break)
  or
  RCI (Panic, Reset) and RCCU

- For PRIMEPOWER 200, 400, 600, 650 or 850:

  RCI (Panic, Reset) and RCCU

- For PRIMEPOWER 800, 900, 1000, 1500, 2000 or 2500:

  RCI (Panic, Reset)

For the setting and the function of Shutdown Facility and Monitoring Agent, refer to “3.3.1.8 PRIMECLUSTER SF” of the PRIMECLUSTER *Concepts Guide* or Chapter “Shutdown Facility”.

> i For the setting of the Shutdown Facility of SPARC Enterprise M4000, M5000, M8000 or M9000, refer to “5.1.2 Configuring the Shutdown Facility” of the PRIMECLUSTER *Installation and Administration Guide*.
>
> SPARC Enterprise T1000, T2000, T5120 or T5220 cannot set the Shutdown Facility by the SF Configuration Wizard. For the setting of the Shutdown Facility of SPARC Enterprise T1000, T2000, T5120 or T5220, refer to “5.1.2 Configuring the Shutdown Facility” of the PRIME-CLUSTER *Installation and Administration Guide*.

8.4.1 Invoking the Configuration Wizard

This section describes how to use Cluster Admin to configure SF.

Use the *Tools* pull-down menu to select *Shutdown Facility*, and then choose *Configuration Wizard* to invoke the SF Configuration Wizard (see Figure 65).

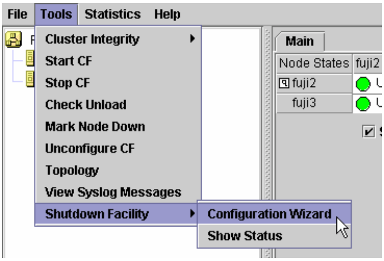


Figure 65: Starting the SF Configuration Wizard

Select the mode for configuration (see Figure 66). You can either choose the *Easy configuration* mode or the *Detailed configuration* mode. *Easy configuration* mode provides the most commonly used configurations. *Detailed configuration* provides complete flexibility in configuration. It is recommended that you use the *Easy configuration* mode.

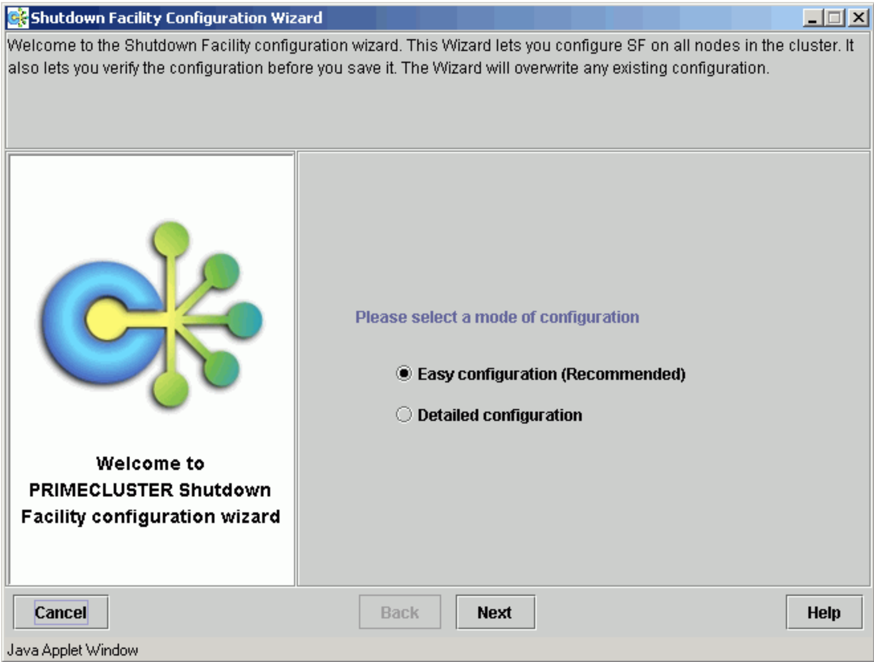


Figure 66: Selecting the SF configuration mode

Choose the *Easy configuration* selection as shown in Figure 66 and click *Next*.

The window for selecting Shutdown Agents appears (see Figure 67).

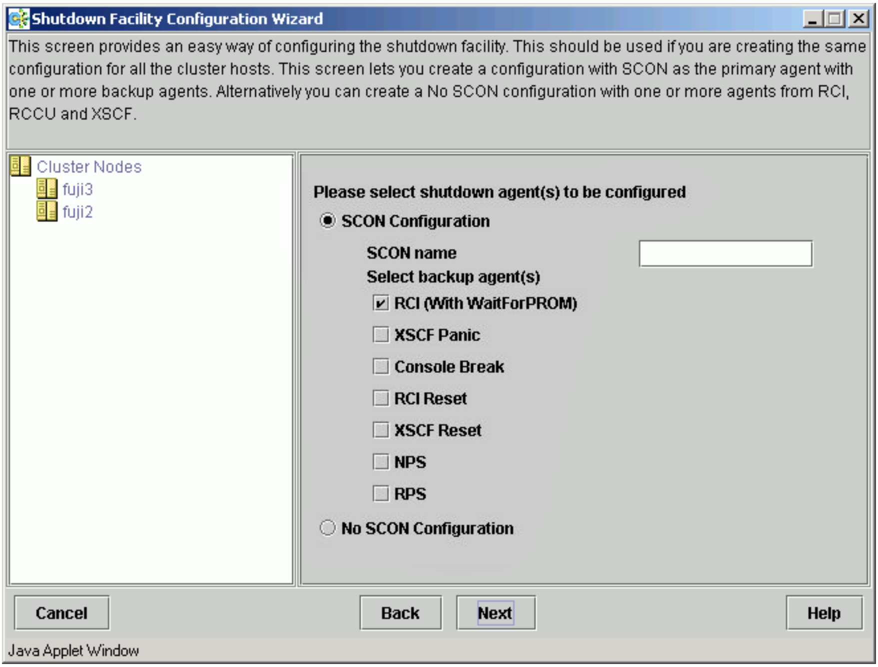


Figure 67: Easy mode of SF SCON configuration

You can either select SCON as the primary SA and one or more backup agents, or you can configure a no SCON configuration with one or more backup agents.

i If you choose *SCON Configuration*, the *SCON name* field has to be filled with the name of the system console.

In a SCON configuration, if you choose *Console Break* as well as *RCI (With WaitForPROM)*, you see an error message (see Figure 68).

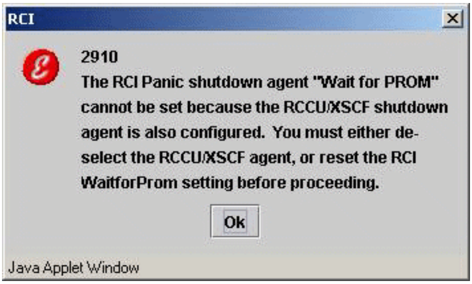


Figure 68: RCI Panic error message

Click *Ok*, and you return to the previous window. The window is the same except the *RCI Panic* option has changed from *RCI Panic (With WaitForPROM)* to just *RCI Panic* (see Figure 69).

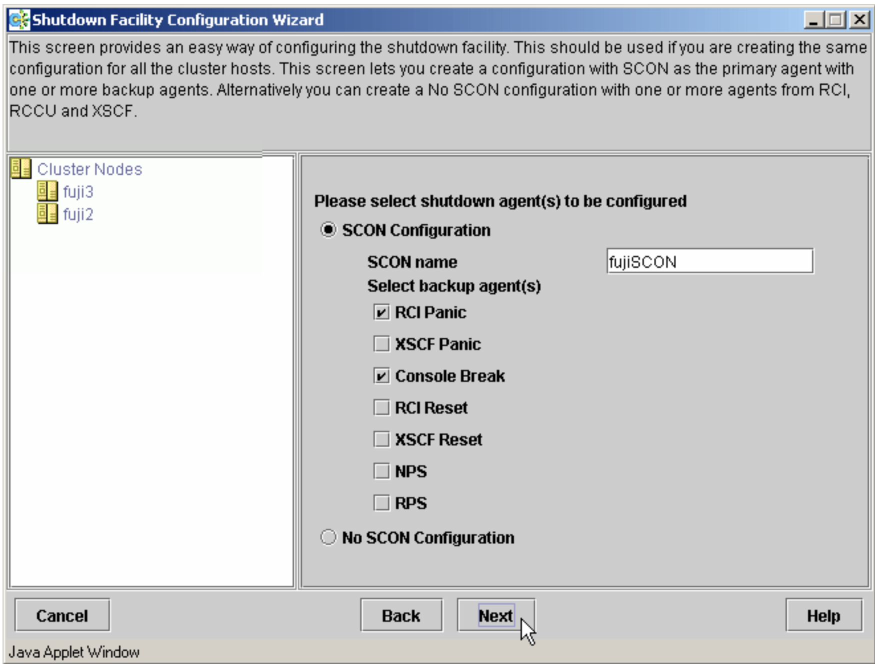


Figure 69: RCI Panic option without WaitForPROM in a SCON configuration

If you click *Next*, you will see the window with the *Wait for PROM* checkbox (see Figure 70).

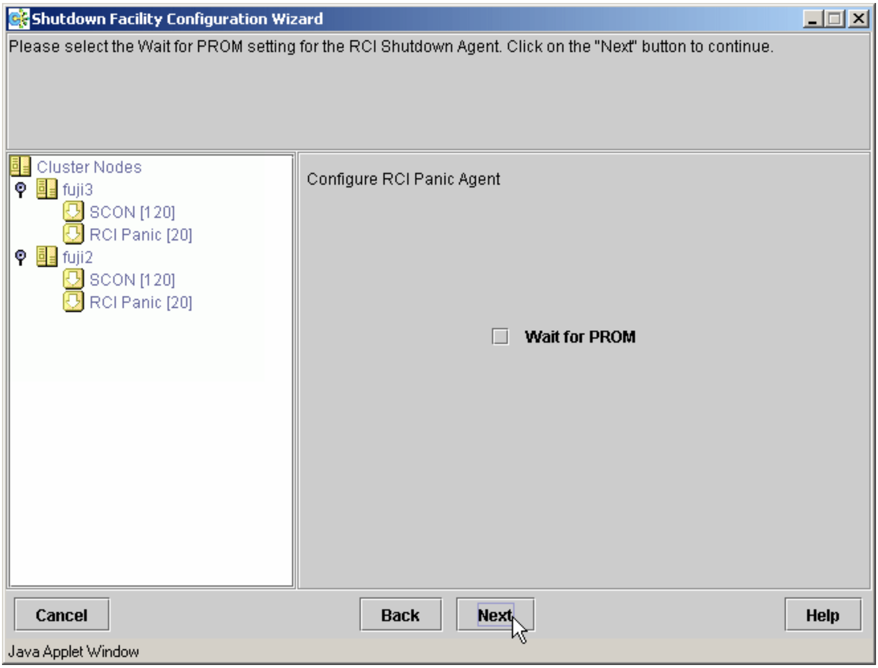


Figure 70: Wait For PROM checkbox

If you select *Wait for PROM*, you will see the error message shown in Figure 68; however, if you leave the checkbox unchecked, you will continue to the console break option window (see Figure 72).

You can also configure a no SCON configuration with one or more backup agents (see Figure 71). Notice that the *RCI Panic* option does not have *with WaitForPROM* in the label.

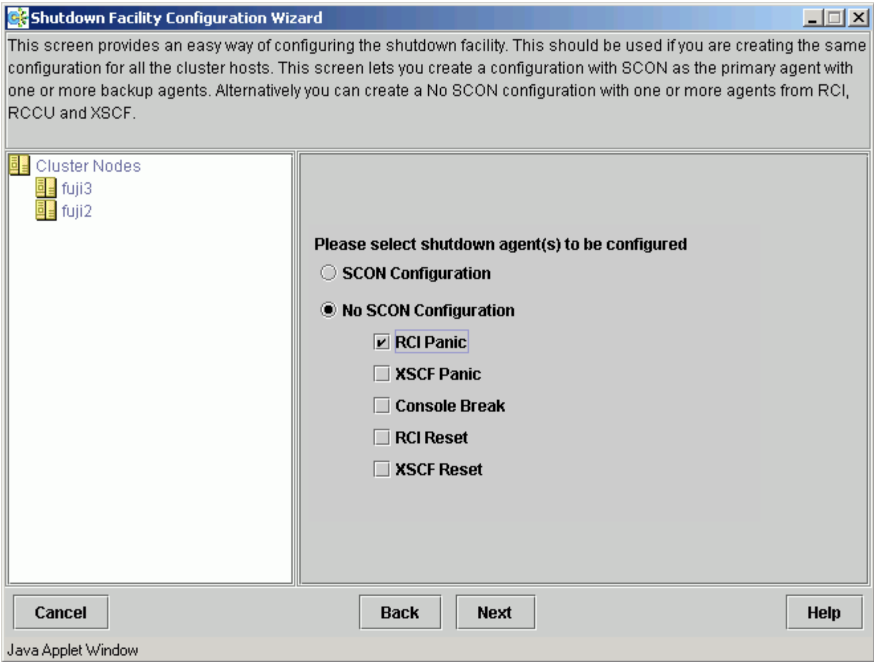


Figure 71: Easy mode of SF No SCON configuration

Choose the appropriate selection as shown in Figure 67 or Figure 71 and click *Next*. If you choose *XSCF Panic*, *XSCF Reset*, *NPS*, or *RPS* as backup agents, you will be taken to the individual SA's configuration windows, which are Figure 80, Figure 81, Figure 82, and Figure 83 respectively.

To configure `WaitForPROM` in a no SCON configuration, select *RCI Panic* and click *Next*. The window with the *Wait For PROM* checkbox appears (see Figure 71). Click on the *Wait For PROM* checkbox and select *Next*. No further configuration is necessary.

If you chose *Console Break*, then the window to choose between *XSCF* and *RCCU* appears (see Figure 72). Selecting either of these options takes you to either Figure 80 or Figure 81, depending on your selection.

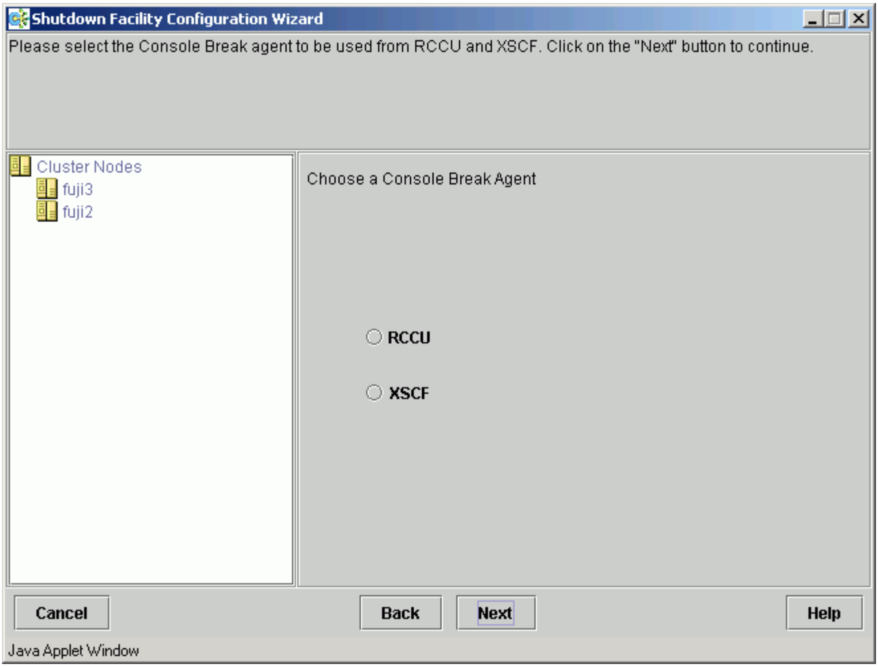


Figure 72: Console Break options

After you are done configuring individual SAs (if any), you are taken to the window for finishing the configuration (see Figure 85).

If you choose *Detailed configuration* in Figure 66 and click *Next*, a figure such as Figure 73 appears.Choose *Create* and click *Next*.

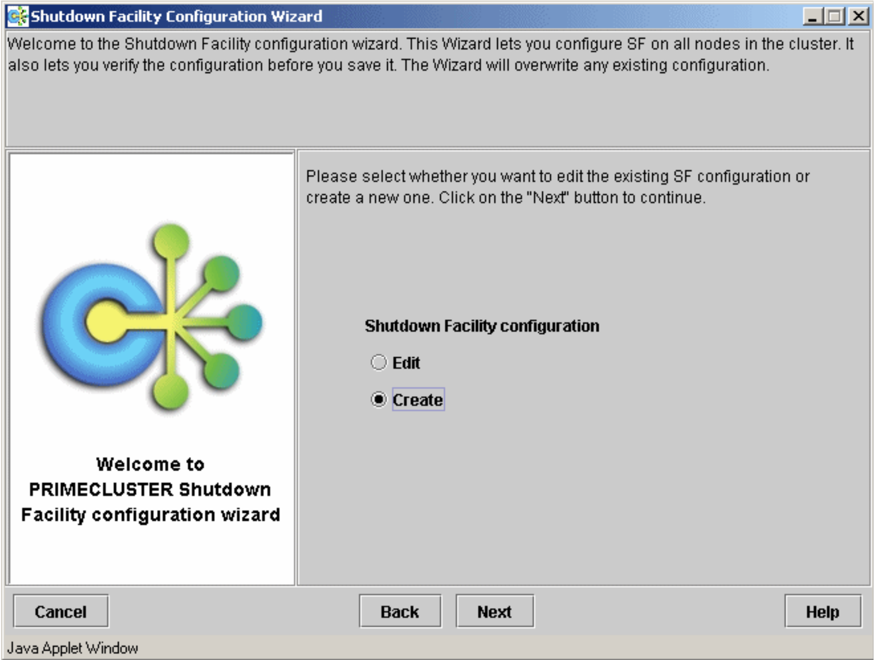


Figure 73: Creating the SF configuration

Select a configuration with the same set of SAs for all the nodes or different SAs for the individual nodes as shown in Figure 74. Click *Next*.

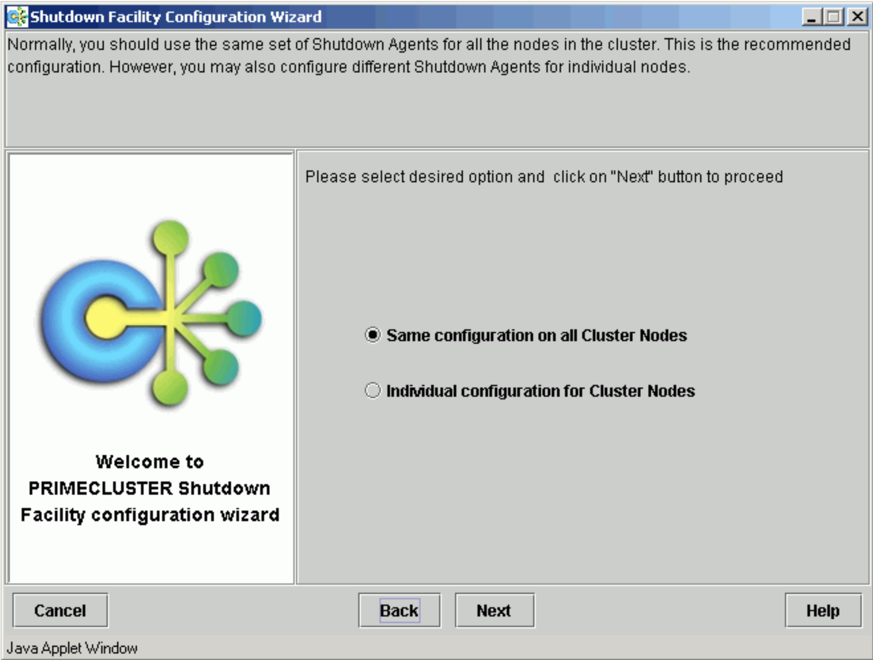


Figure 74: Choosing a common configuration for all nodes

If you choose *Same configuration on all Cluster Nodes* and click *Next*, a window such as Figure 76 appears. If you choose *Individual configuration for Cluster Nodes*, then a window such as Figure 75 appears. In this case, you can configure SF individually at a later time for each of the nodes or groups of nodes.

Currently, it is recommended that you have the same configuration on all cluster nodes.

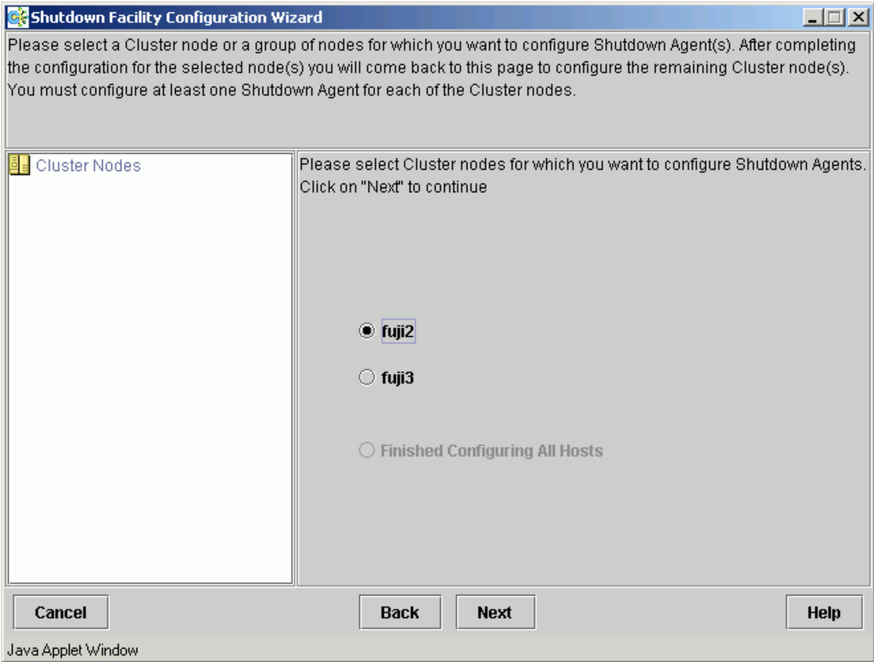


Figure 75: Selecting nodes to configure Shutdown Agents

Choose the cluster node that you want to configure and click *Next*. Note that the left panel in the window displays the cluster nodes and will progressively show the SAs configured for each node.

If you choose *Same configuration on all Cluster Nodes* in Figure 74 and clicked *Next*, a window such as Figure 76 appears.

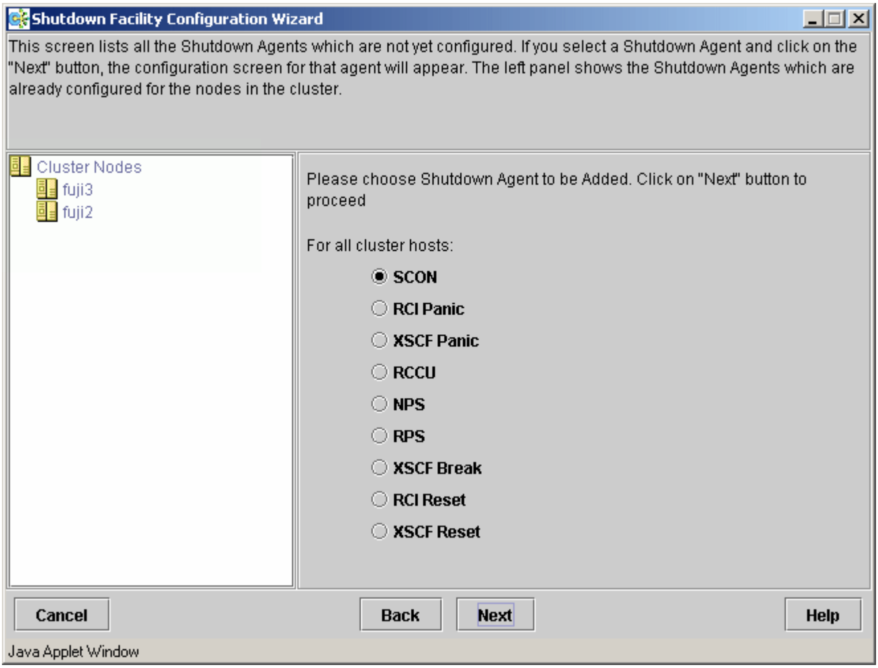


Figure 76: Choose Shutdown Agent to be added

Choose an SA from the given list and click on the *Next* button. From here you will be taken to the individual SA's configuration window, depending on your selection.

If you choose *RCI Panic*, the window with the *Wait For PROM* checkbox appears (see Figure 71). Click on the *Wait For PROM* checkbox and select *Next*. No further configuration is necessary. If you choose *RCI Reset*, no further configuration is required.

If you select *SCON* from the list and click on the *Next* button, the window to configure the SCON SA appears (see Figure 77).

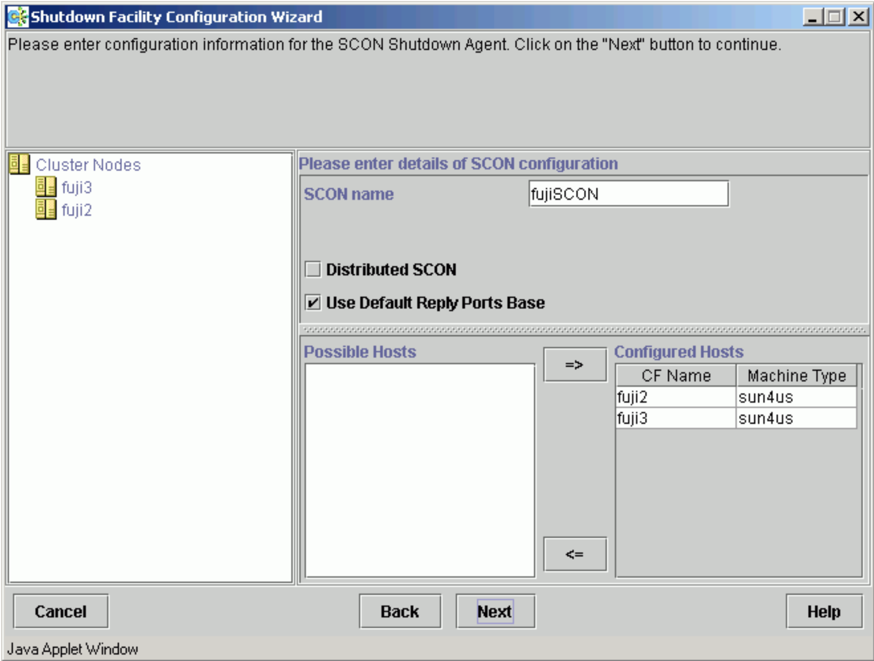


Figure 77: Details for SCON Shutdown Agent

You can click *Distributed SCON* to configure distributed SCON (see Figure 78).

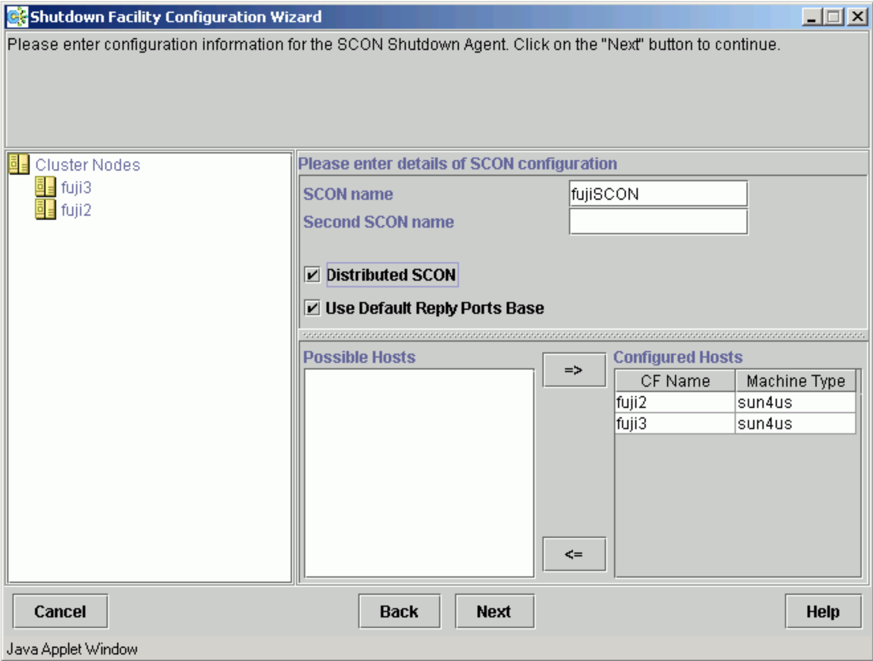


Figure 78: Configuring the SCON Shutdown Agent

Distributed SCON is currently limited to two consoles.

If you choose *RCCU* and uncheck the *Use defaults* check box, the window for configuring RCCU appears as shown (see Figure 79). Enter the details for each cluster node, namely *RCCU-Name*, *User-Name*, *Password1*, *Confirm*, *Password2(admin)*, and *Confirm*. Then click the *Next* button.

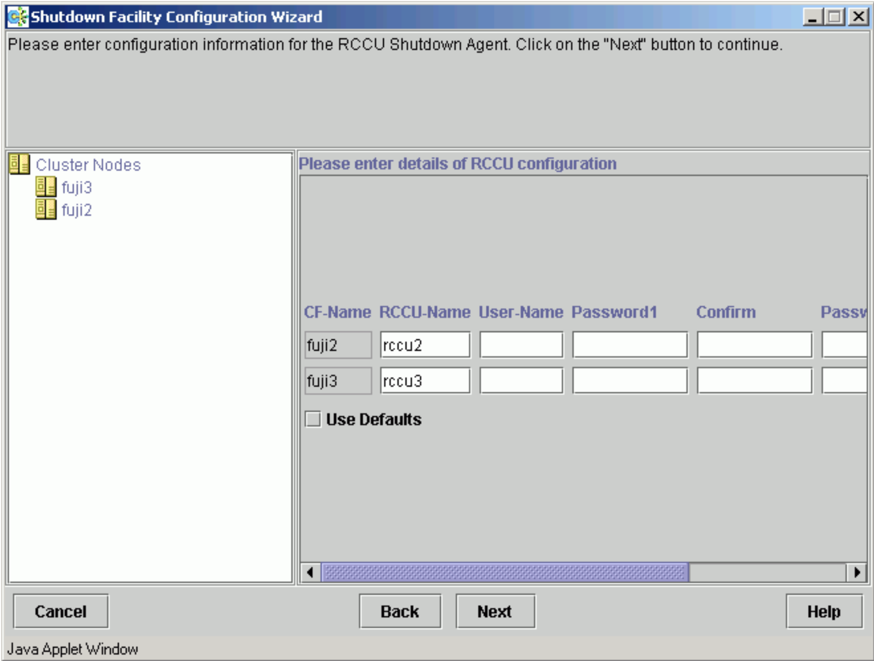


Figure 79: Configuring RCCU

If *Use Defaults* is checked, the default values are used (see Figure 80).

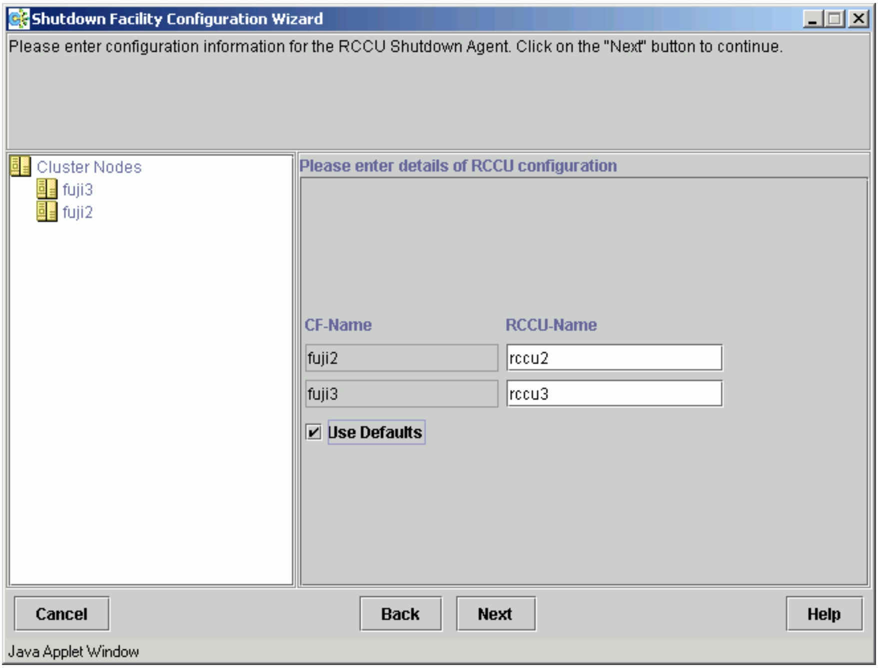


Figure 80: RCCU default values

If you choose *XSCF Break*, *XSCF Panic*, or *XSCF Reset*, the window for configuring the XSCF Console Break agent appears (see Figure 81). Enter the details for each cluster node, namely *XSCF-name*, *User-Name*, *Password*, and *Confirm*. Then click the *Next* button.

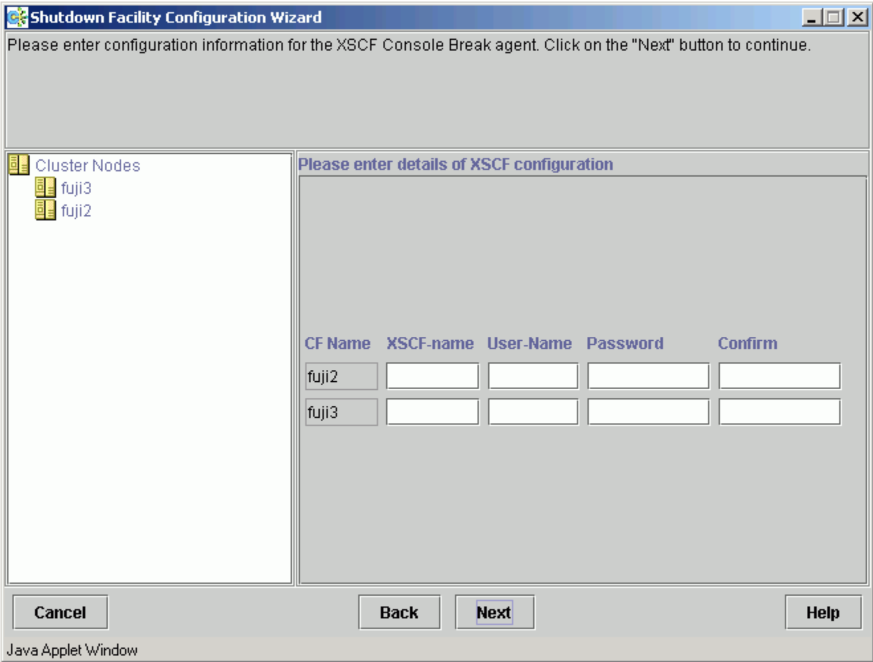


Figure 81: Configuring XSCF

Figure 82 is the window in which to enter the *NPS Shutdown Agent* details. Enter *NPS Name*, *Password*, *Confirm*, and choose the *Action*. For *Action*, you can choose the value *cycle* or *leave-off*. Then click *Next*.

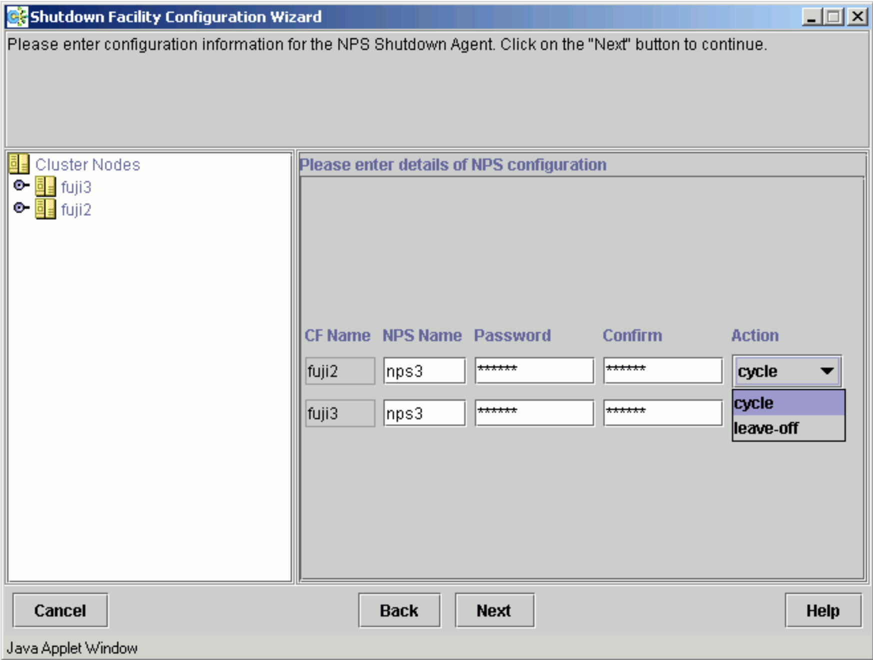


Figure 82: Configuring the NPS Shutdown Agent

The action is, by default, *cycle*, which means that the node is power cycled after shutdown.

If you choose RPS, the window shown in Figure 83 appears. Enter the details for each of the cluster nodes; namely, the IP address of the RPS unit, *User*, *Password*, and *Action*. Then click the *Next* button.

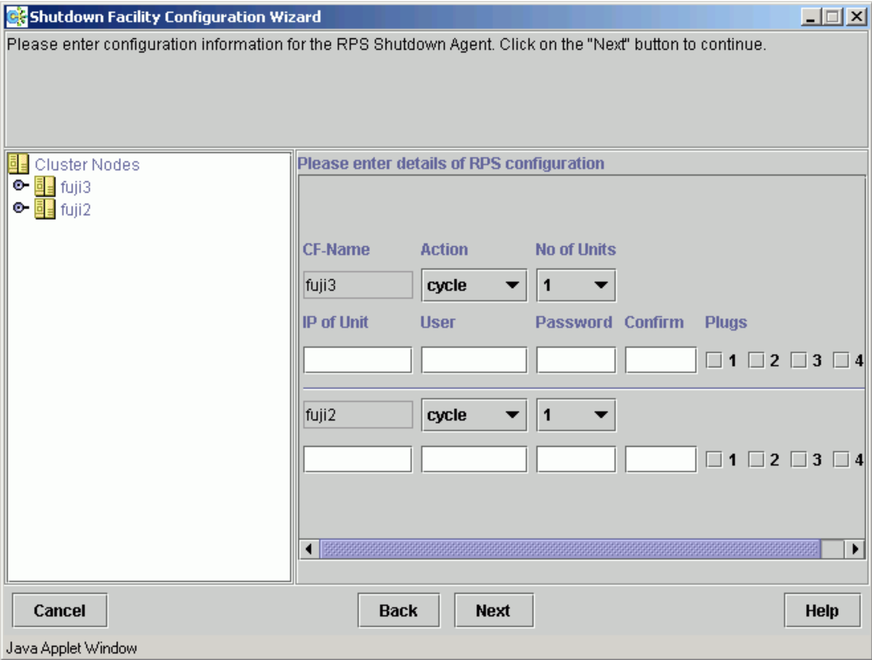


Figure 83: Configuring the RPS Shutdown Agent

You can continue to *Add*, *Delete*, or *Edit* the SAs as shown in Figure 84. If there are no more SAs to add, then the *Add* option is greyed out.

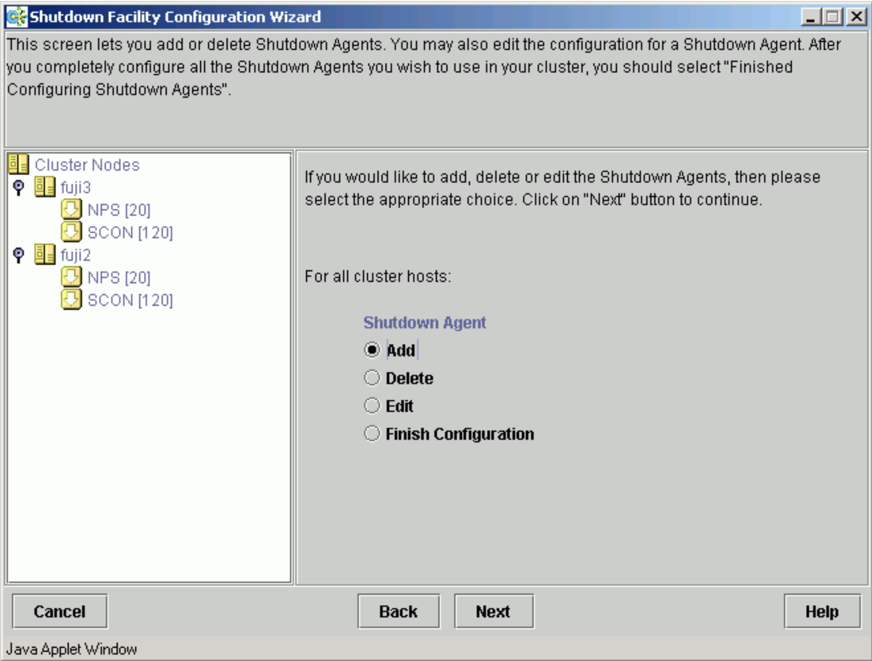


Figure 84: Adding, deleting, editing Shutdown Agents

If you have finished, select *Finish Configuration* and click on *Next* (see Figure 85).

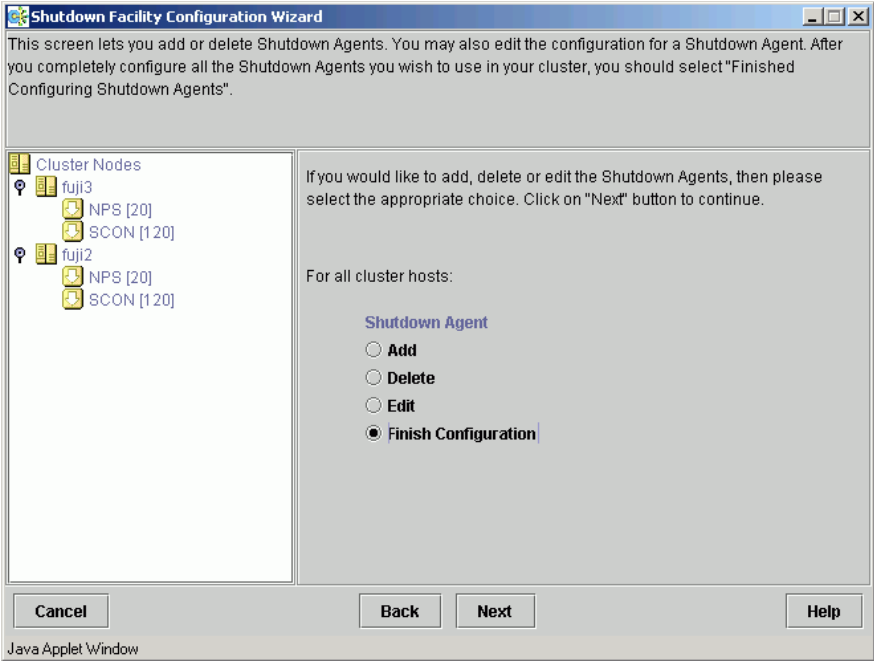


Figure 85: Finishing configuration

Next use the *UP* or *DOWN* buttons to arrange the order of the SAs (see Figure 86). The SA on the top of the list is the primary SA and will be invoked first if SF needs to eliminate a node. Click on *DEFAULT* to use the recommended order for the SAs. Click on *Next*.

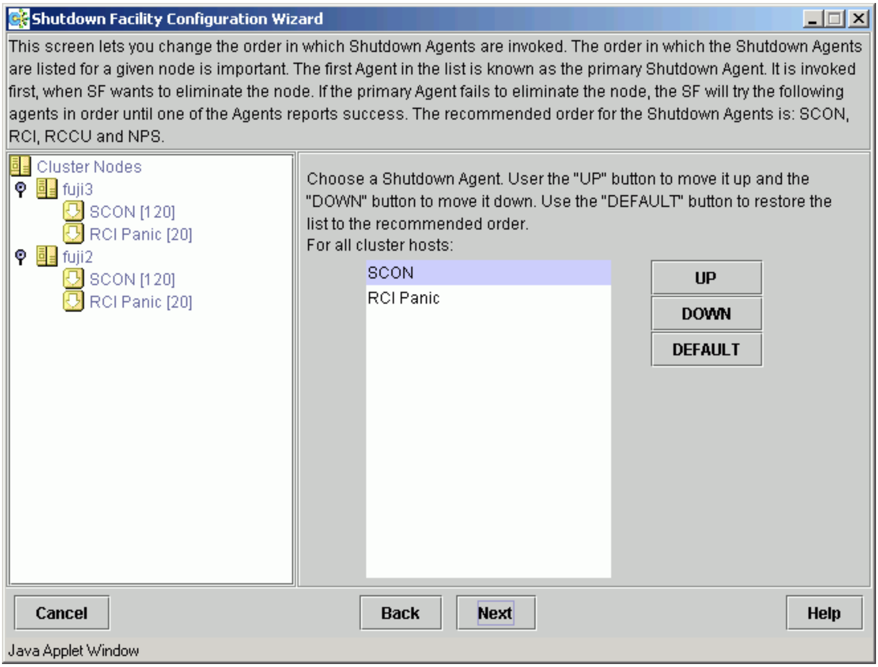


Figure 86: Changing the Shutdown Agent order

The following window lets you enter the timeout values for the configured SAs for each node (see Figure 87). Enter timeout values for all nodes and for each SA or click on the *Use Defaults* button. Select *Next* to go to the next window.

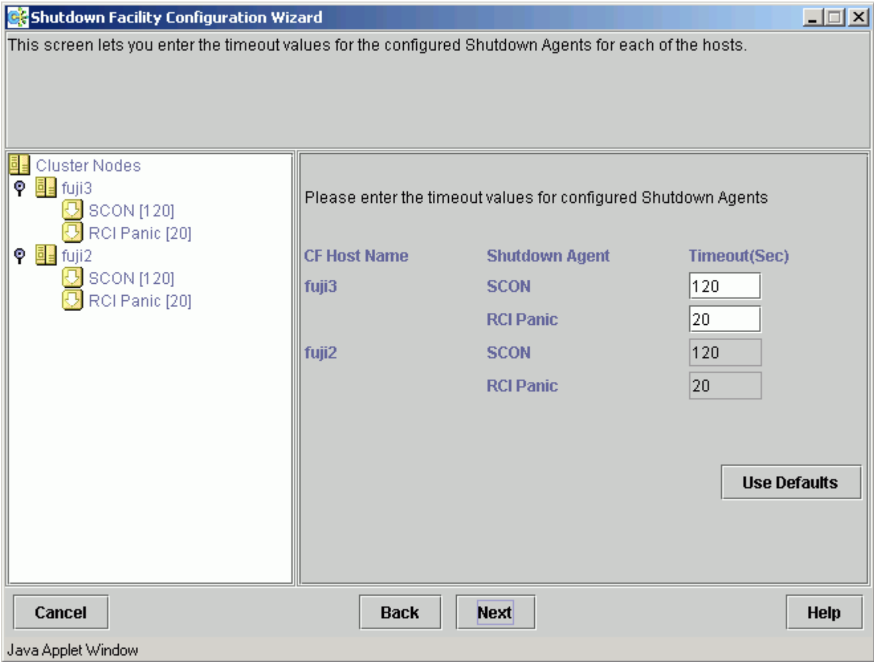


Figure 87: Specifying timeout values

The window for entering node weights and administrative IP addresses appears (see Figure 88). Node weights should be an integer value greater than `0`. You can select the *Admin IP* from the list of choices or enter your own. Enter node weights and *Admin IP* addresses for all CF nodes.

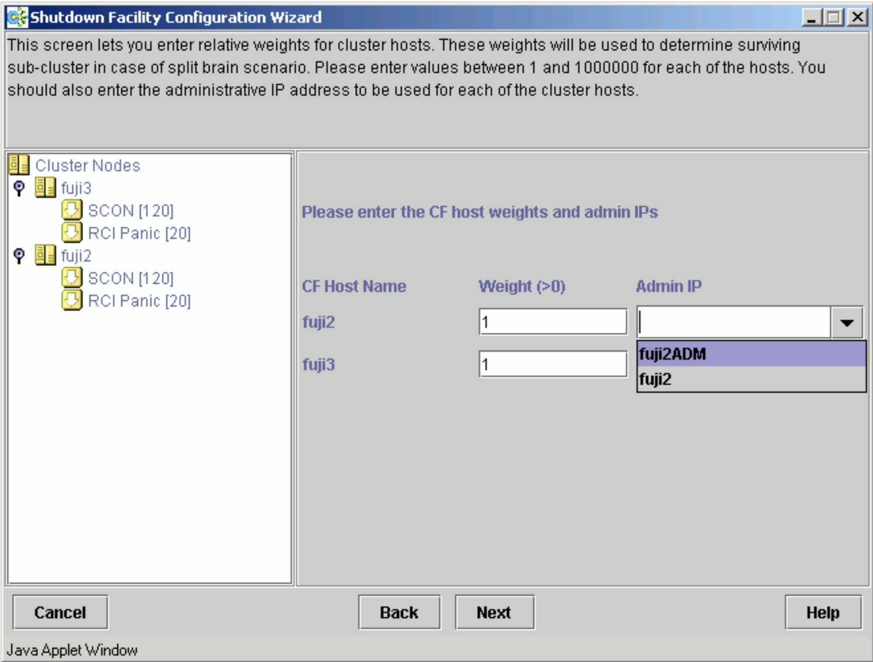


Figure 88: Entering node weights and administrative IP addresses

For our cluster we will give each node an equal node weight of `1` (refer to the Section “SF split-brain handling” for more details on node weights).

Set the *Admin IP* fields to the CF node’s interface on the Administrative LAN. By convention, these IP interfaces are named *node*`ADM`. although this is not mandatory. If you don’t have an Administrative LAN, then enter the address to the public LAN. Click on *Next*.

The list of configuration files, created or edited, by the Wizard are shown in Figure 89. Click *Next* to save the configuration files or click *Back* to change the configuration.

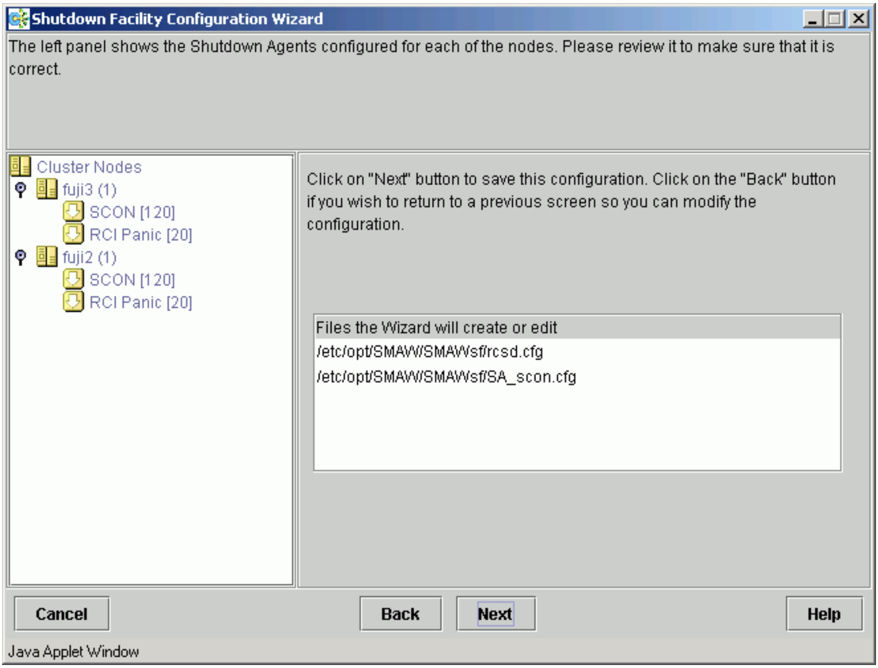


Figure 89: Confirming configuration file changes

Choose *Yes* in the confirmation popup to save the configuration (see Figure 90).

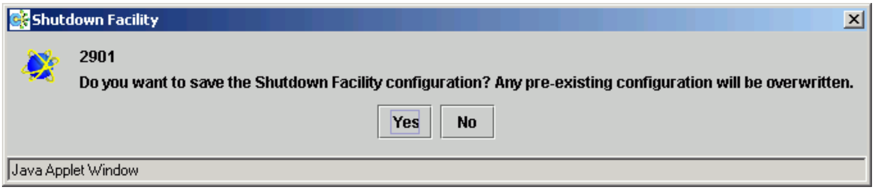


Figure 90: Saving SF configuration

The window displaying the configuration status of the shutdown agents appears (see Figure 91). You can also use the *Tools* pull-down menu, and choose *Show Status* in the *Shutdown Facility* selection.

SF has a test mechanism built into it. SF periodically has each shutdown agent verify that it can shut down cluster nodes. The shutdown agent does this by going through all the steps to shut down a node, except the very last one which would actually cause the node to go down. It then reports if the test was successful. This test is run for each node that a particular agent is configured to potentially shut down.

The table in Figure 91 shows, among other things, the results of these tests. The columns *Cluster Host*, *Agent*, *SA State*, *Shut State*, *Test State*, and *Init State* when taken together in a single row, represent a test result.

If the word `InitFailed` appears in the `InitState` column, then the agent found a problem when initializing that particular shutdown agent.

If the words `TestFailed` appear in red in the *Test State* column, then it means that the agent found a problem when testing to see if it could shut down the node listed in the *Cluster Host* column. This indicates some sort of problem with the software, hardware, or networking resources used by that agent.

If the word `Unknown` appears in the *Shut State*, *Test State*, or the *Init State* columns, it means that SF has not attempted to shut down, test, or initialize those SAs. For the *Test State* and the *Init State* columns, the `Unknown` state is usually a temporary state that disappears when the actual state is known.

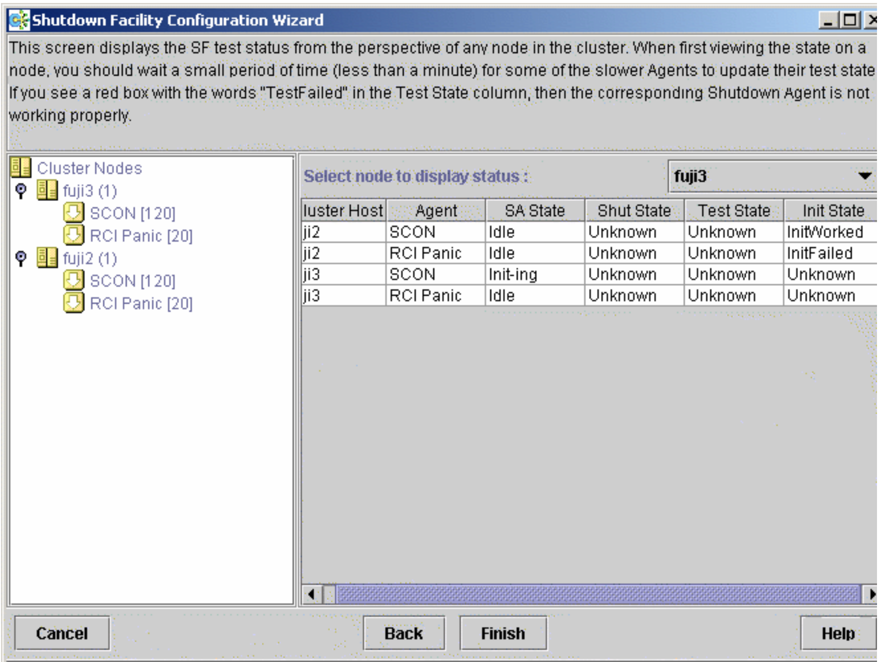


Figure 91: Status of Shutdown Agents

If you see `TestFailed` or `InitFailed`, look at the SA log file or in `/var/adm/messages`. The log files show debugging information on why the SA's test or initialization failed. Once the problem is corrected, and SF is restarted, the status should change to `InitWorked` or `TestWorked`.

Click on the *Finish* button to exit the SF Wizard. A confirmation popup appears and asks if you really want to exit the Wizard (see Figure 92). If you click on *Yes*, then the SF Wizard disappears, and you see the base Cluster Admin window.

If you click on the *Back* button in the SF Wizard instead of the *Finish* button, then you can go back and re-edit the SF configuration.

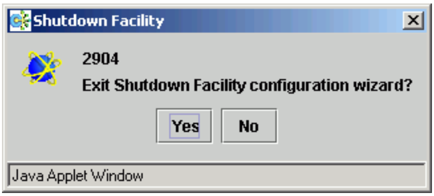


Figure 92: Exiting SF configuration wizard

8.4.2 Configuration via CLI

This section describes the setup and configuration via Command Line Interface (CLI).

> **i** Note that the format of the configuration file is presented for information purposes only. The preferred method of configuring the shutdown facility and all SAs is to use the Cluster Admin GUI (refer to the Section "Configuring the Shutdown Facility").

8.4.2.1 Shutdown daemon

To configure the Shutdown Daemon (SD), you will need to modify the file `/etc/opt/SMAW/SMAWsf/rcsd.cfg` on every node in the cluster.

A file, `rcsd.cfg.template`, is provided under the `/etc/opt/SMAW/SMAWsf` directory, which is a sample configuration file for the Shutdown Daemon using fictitious nodes and agents.

> **i** It is important that the `rcsd.cfg` file is identical on all cluster nodes; care should be taken in administration to ensure that this is true.

An example configuration for SD (which is created by editing the sample `rcsd.cfg.template`) follows:

```
#This file is generated by Shutdown Facility Configuration Wizard
#Generation Time : Sat Feb 22 10:32:06 PST 2003
fuji3,weight=1,admIP=fuji3ADM:agent=SA_scon,timeout=120:agent=SA_pprcip,timeout=
20:agent=SA_pprcir,timeout=20
fuji2,weight=1,admIP=fuji2ADM:agent=SA_scon,timeout=120:agent=SA_pprcip,timeout=
20:agent=SA_pprcir,timeout=20
```

The configuration file must be created in the `/etc/opt/SMAW/SMAWsf` directory and must use `rcsd.cfg` as the file name.

The format of the configuration file is as follows:

cluster-node1 [`,weight=`*w1*][`,admIP=`*admIP1*]`:agent=`*SA1*, `timeout=`*t1*[`:agent=`*SA2*`, timeout=`*T2*]...
cluster-node2 [`,weight=`*w2*][`,admIP=`*admIP2*]`:agent=`*SA1*, `timeout=`*t1*[`:agent=`*SA2*`, timeout=`*T2*]...
...

- *cluster-nodeN* is the *cfname* of a node within the cluster.
- *agent* and *timeout* are reserved words.
- `SA`*N* is the command name of a SA.
- `t`*N* is the maximum time in seconds that are allowed for the associated SA to run before assuming failure.
- w*N* is the node weight.
- admIP*N* is the admin interface on the Administrative LAN on this cluster node.

The order of the SAs in the configuration file should be such that the first SA in the list is the preferred SA. If this preferred SA is issued a shutdown request and if its response indicates a failure to shut down, the secondary SA is issued the shutdown request. This request/response is repeated until either an SA responds with a successful shutdown, or all SAs have been tried. If no SA is able to successfully shut down a cluster node, then operator intervention is required and the node is left in the `LEFTCLUSTER` state.

The location of the log file will be `/var/opt/SMAWsf/log/rcsd.log`.

8.4.2.2 Shutdown Agents

This section contains information on how to configure the SAs with CLI.

SCON

The configuration of the `SA_scon` SA involves creating a configuration file (`SA_scon.cfg`) in the correct format. The file is located as follows:

`/etc/opt/SMAW/SMAWsf/SA_scon.cfg`

There exists a template file for use as an example (`SA_scon.cfg.template`) which resides in the `/etc/opt/SMAW/SMAWsf` directory.

The format of the `SA_scon.cfg` file is as follows:

`single-console-names` *Scon1* [*Scon2*] […]

[`reply-ports-base` *number*]

`cluster-host` *cfname* *node-type*

- `single-console-names`, `reply-ports-base` and `cluster-host` are reserved words and must be in lower-case letters.
- *Scon1* is the IP name of the cluster console, *Scon2*, and … are the names of additional cluster consoles for use in a distributed or Hot Spare (standby) cluster console configuration.
- *number* is a port number used by `SMAWRscon` to reply to shutdown requests. The default value for this is `2137` and is used such that if you have four cluster nodes then the ports used on the all cluster nodes are `2137`, `2138`, `2139` and `2140`. Note that setting `reply-ports-base` is optional.
- *cfname* is the CF name of a cluster node and *node-type* is the output of `uname -m` for that named cluster node. There must be one cluster-node line for each node in the cluster.
- *node type* for the named cluster node is the output from the following command:

  ```
  # uname -m
  ```

For node elimination with PRIMEPOWER entry and midrange machines, a line must be inserted into `/etc/syslog.conf`. Refer to the Section “Entry and midrange machines” for more details.

The `SA_scon.cfg` file is as follows:

```
single-console-names fujiSCON1 fujiSCON2
cluster-host fuji1 sun4us
cluster-host fuji2 sun4us
cluster-host fuji3 sun4us
cluster-host fuji4 sun4us
```

SCON log file

`/var/opt/SMAWsf/log/SA_scon.log`

RCCU and XSCF

i Always configure the console MA after configuring CF and CIP, and before configuring the Shutdown Facility.

Configure the console MA according to the following steps if you are not using the default values:

1. Register console information by executing the `clrccusetup -a` command on each node. For information how to use this command, refer to the `clrccusetup`(1M) manual page.

   – When RCCU is used, enter the following command:

     # **/etc/opt/FJSVcluster/bin/clrccusetup -a rccu** *IP-address user-name*

     IP-address is the RCCU's IP address or the RCCU host name that is defined in `/etc/inet/hosts`. *user-name* is a user name to log on to the RCCU control port.

     1. Enter user's password
     2. Re-enter user's password to confirm
     3. Enter super user's password
     4. Re-enter super user's password to confirm

     For user's password, enter a password to log on to the RCCU control port. For super user's password, enter a password to log on to the RCCU control port using super-user access privileges.

   – When XSCF is used, enter the following command:

     # **/etc/opt/FJSVcluster/bin/clrccusetup -a xscf** *IP-address user-name*

IP-address is the XSCF's IP address or the XSCF host name that is defined in `/etc/inet/hosts`. *user-name* is a user name to log on to the XSCF control port.

1. Enter Password
2. Re-enter Password to confirm

For Password, enter a password to log on to the XSCF control port.

2. Check if the console information is correctly registered by executing the `clrccusetup -l` command on each node. If there are any incorrect settings, return to Step 1 and start over.

   For example, enter the following command:

   ```
   # /etc/opt/FJSVcluster/bin/clrccusetup -l
   ```

   Output similar to the following appears:

   ```
   device-name cluster-host-name  IP-address      host-name      user-name
   -------------------------------------------------------------------------
   xscf        fuji2              xscf2           -              scf
   xscf        fuji3              xscf3           -              scf
   ```

RCCU and XSCF log files

`/var/opt/SMAWsf/log/SA_rccu.log`

`/var/opt/SMAWsf/log/SA_xscfp.log`

`/var/opt/SMAWsf/log/SA_xscfr.log`

NPS

To configure NPS, you will need to create the following file:
`/etc/opt/SMAW/SMAWsf/SA_wtinps.cfg`

A sample configuration file can be found in the following directory:
`/etc/opt/SMAW/SMAWsf/SA_wtinps.cfg.template`

The configuration file `SA_wtinps.cfg` contains lines that are in one of two formats. A line defining an attribute and value pair or a line defining a plug set up:

- Lines defining attribute value pairs

  Attributes are similar to global variables, as they are values that are not modifiable for each NPS unit, or each cluster node. Each line contains two fields:

Attribute-name Attribute-value

The currently supported attribute/value pairs are as follows:

`Initial-connect-attempts` *positive integer*

This sets the number of connect retries until the first connection to an NPS unit is made. The default value for the numbers of connect retries is 12.

- Lines defining a plug set up

  Each line contains four fields:

  Plug-ID IP-name Password Action

  The four fields are:

  – *Plug-ID*: The `Plug-ID` of the `WTI NPS` unit, which should correspond to a cluster node. The *CF_name* of the cluster node must be used here.

  – *IP-name*: The IP name of the WTI NPS unit.

  – *Password*: The password to access the WTI NPS unit.

  – *Action*: The action may either be `cycle` or `leave-off`.

i The *Plug-ID* defined in the `SA_wtinps.cfg` file must be defined on the WTI NPS unit.

i The permissions of the `SA_wtinps.cfg` file are read/write by `root` only. This is to protect the password to the WTI NPS unit.

NPS log file

`/var/opt/SMAWsf/log/SA_wtinps.log`

i NPS is not supported in all regions. Please check with your sales representative to see if the NPS is supported in your area.

An example of configuring the NPS SA is as follows:

```
# Configuration for Shutdown Agent for the WTI NPS
# Each line of the file has the format:
#
#Attribute-name Attribute-value
# - or -
#Plug-ID IP-name-of-WTI-box password {cycle|leave-off}
#
# Sample:
# initial-connect-attempts 12
# fuji2wtinps1.mycompany.comwtipwdcycle
```

```
# fuji3wtinps1.mycompany.comwtipwdleave-off
# fuji4wtinps2.mycompany.comnewpwdcycle
# fuji5wtinps2.mycompany.comnewpwdleave-off
#
# Note:
#The Plug-ID's that are specified here must be
#configured on the named WTI NPS unit.
#
# Note:
#The permissions on the file should be read/write
#only for root.  This is to protect the password
#of the WTI NPS unit.
#
fuji2 nps6 mypassword cycle
fuji3 nps6 mypassword cycle
```

RPS

To configure RPS, you will need to create the following file:

`/etc/opt/SMAW/SMAWsf/SA_rps.cfg`

A sample configuration file can be found at the following location:

`/etc/opt/SMAW/SMAWsf/SA_rps.cfg.template`

The configuration file `SA_rps.cfg` contains lines with four fields (and some subfields) on each line. Each line defines a node in the cluster than can be powered-off (leaving it off) or powered-off and then on again. The fields are:

- *cfname*—The name of the node in the CF cluster. With redundant power supply, there may be more than one RPS necessary to power off one node. In this case, more than one entry with the same name will be needed.
- *Access-Information*—The access information is of the following format:

  ip-address-of-unit`[:`*port*`:`*user*`:`*password*`]`

  The fields for *port*, *user*, and *password* can be missing, but not the corresponding colon. If a field (other than *port*) is missing, it must have a default value configured in the rps software. The software SMAWrps must be of version 1.2A0000 or later. The correct value for *port* is auto detected. It should always be omitted.
- *Index*—The index must be the index of the plug, which corresponds to the given Cluster-Node (the name of the node in the CF cluster).

- *Action*—The action may either be `cycle` or `leave-off`. If it is `cycle`, it will be powered on again after power off. If it is `leave-off`, a manual action is required to turn the system back on.

i The permissions of the `SA_rps.cfg` file are `read/write` by `root` only.

RPS log file

`/var/opt/SMAWsf/log/SA_rps.log`

An example of configuring the RPS SA is as follows:

```
fuji2 172.25.222.221::root:rpspwd 1 cycle
fuji3 172.25.222.222::root:rpspwd 2 cycle
fuji4 172.25.222.223::root:rpspwd 3 leave-off
fuji5 172.25.222.224::root:rpspwd 4 leave-off
```

Delaying the Monitoring Agent recovery from LEFTCLUSTER

This section discusses how to set and cancel the function of delaying the Monitoring Agent recovery from `LEFTCLUSTER` until sync of a panicked node is done.

You need to delay the Monitoring Agent recovery in the following cases:

- If you use SCON and use the RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) SA.
- If you want to enable sync after a system panic and use the RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) SA.

The Monitoring Agent recovery from LEFTCLUSTER is delayed until panicked node sync is terminated. This function is disabled by default. Enable the function if you use both the RCI Monitoring Agent and SCON, or if you want to initiate sync after a system panic.

Be aware that CF is configured before initiating the setting.

Set the Monitoring Agent recovery delay using the following steps:

1. Execute the `cldevparam -p` command on any one of cluster nodes. For this command, see cldevparam(1M).

   `#` **`/etc/opt/FJSVcluster/bin/cldevparam -p WaitForPROM 1`**

2. Check if the function is enabled on all the nodes by executing the `cldev-param` command.

```
# /etc/opt/FJSVcluster/bin/cldevparam
```

You should see the following output; if not, go to Step 1 and start over:

```
Parameter        Value
WaitForPROM      1
```

3. Execute the `clsetsync` command on all the nodes as follows:

```
# /etc/opt/FJSVcluster/FJSVcldev/system/clsetsync
```

4. Reboot all nodes.

> **i** Timeout values of RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) might need to be changed according to your system configuration. If the following time exceeds 20 seconds, the Shutdown Agent timeout must be longer than it.
>
> – For RCI (Panic, Reset), the time required for OBP (Open Boot PROMPT) initiation from a node panic.
>
> – For XSCF (Panic, Reset, Console Break), the time required for sync completion from a node panic.

Cancel the Monitoring Agent recovery delay using the following steps:

1. Execute the `clunsetsync` command on all the nodes as follows:

```
# /etc/opt/FJSVcluster/FJSVcldev/system/clunsetsync
```

2. Execute the `cldevparam -p` command on any node. For this command, see cldevparam(1M).

```
# /etc/opt/FJSVcluster/bin/cldevparam -p WaitForPROM 0
```

3. Check if the function is disabled on all the nodes by executing the `cldev-param` command.

```
# /etc/opt/FJSVcluster/bin/cldevparam
```

You should see the following output; if not, go to Step 2 and start over:

```
Parameter        Value
WaitForPROM      0
```

4. Reboot all nodes.

> **i** If you change the timeout values of RCI (Panic, Reset) or XSCF (Panic, Reset, Console Break) at the time of recovery delay setting, you need to change the value back to `20` seconds or set the proper value according to the number of nodes.

Delaying the Monitoring Agent recovery from LEFTCLUSTER

This section discusses how to set and cancel the function of delaying the Monitoring Agent recovery from `LEFTCLUSTER` until sync of a panicked node is done.

You need to delay the Monitoring Agent recovery in the following cases:

- If you use SCON and use the RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) SA.
- If you want to enable sync after a system panic and use the RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) SA.

The Monitoring Agent recovery from LEFTCLUSTER is delayed until panicked node sync is terminated. This function is disabled by default. Enable the function if you use both the RCI Monitoring Agent and SCON, or if you want to initiate sync after a system panic.

Be aware that CF is configured before initiating the setting.

Set the Monitoring Agent recovery delay using the following steps:

1. Execute the `cldevparam -p` command on any one of cluster nodes. For this command, see cldevparam(1M).

   ```
   # /etc/opt/FJSVcluster/bin/cldevparam -p WaitForPROM 1
   ```

2. Check if the function is enabled on all the nodes by executing the `cldevparam` command.

   ```
   # /etc/opt/FJSVcluster/bin/cldevparam
   ```

   You should see the following output; if not, go to Step 1 and start over:

   ```
   Parameter       Value
   WaitForPROM     1
   ```

3. Execute the `clsetsync` command on all the nodes as follows:

   ```
   # /etc/opt/FJSVcluster/FJSVcldev/system/clsetsync
   ```

4. Reboot all nodes.

> **i** Timeout values of RCI (Panic, Reset) and XSCF (Panic, Reset, Console Break) might need to be changed according to your system configuration. If the following time exceeds 20 seconds, the Shutdown Agent timeout must be longer than it.
>
> – For RCI (Panic, Reset), the time required for OBP (Open Boot PROMPT) initiation from a node panic.

– For XSCF (Panic, Reset, Console Break), the time required for sync completion from a node panic.

Cancel the Monitoring Agent recovery delay using the following steps:

1. Execute the `clunsetsync` command on all the nodes as follows:

   ```
   # /etc/opt/FJSVcluster/FJSVcldev/system/clunsetsync
   ```

2. Execute the `cldevparam -p` command on any node. For this command, see cldevparam(1M).

   ```
   # /etc/opt/FJSVcluster/bin/cldevparam -p WaitForPROM 0
   ```

3. Check if the function is disabled on all the nodes by executing the `cldevparam` command.

   ```
   # /etc/opt/FJSVcluster/bin/cldevparam
   ```

   You should see the following output; if not, go to Step 2 and start over:

   ```
   Parameter       Value
   WaitForPROM     0
   ```

4. Reboot all nodes.

i If you change the timeout values of RCI (Panic, Reset) or XSCF (Panic, Reset, Console Break) at the time of recovery delay setting, you need to change the value back to 20 seconds or set the proper value according to the number of nodes.

8.5 SF administration

This section provides information on administering SF. SF can be administered with the CLI or Cluster Admin. It is recommended to use Cluster Admin.

8.5.1 Starting and stopping SF

This section describes the following administrative procedures for starting and stopping SF:

- Manually via the CLI
- Automatically via the `rc` script interface

8.5.1.1 Starting and stopping SF manually

SF may be manually started or stopped by using the `sdtoo`(1M) command. The `sdtool`(1M) command. Refer to the Chapter “Manual pages” for more information on CLI commands.

8.5.1.2 Starting and stopping SF automatically

SF can be started automatically using the `S64rcfs` RC-script available under the `/etc/rc2.d` directory. The `rc` start/stop script for SF is installed as `/etc/init.d/RC_sf`.

8.6 Logging

Whenever there is a recurring problem where the cause cannot be easily detected, turn on the debugger with the following command:

```
# sdtool -d on
```

This will dump the debugging information into the `/var/opt/SMAWsf/log/rscd.log`, which will provide additional information to find the cause of the problem. You can also use the `sdtool -d off` command to turn off debugging.

Note that the `rcsd` log file does not contain logging information from any SA. Refer to the SA specific log files for logging information from a specific SA.

9 System console

This chapter discusses the SCON product functionality and configuration. The SCON product is installed on the cluster console.

This chapter discusses the following:

- The Section “Overview” discusses the role of the cluster console and the hardware platforms.
- The Section “Topologies” discusses the two distinct topologies imparting different configuration activities for the SCON product.
- The Section “Network considerations” notes the network configuration of both a single cluster console and distributed cluster console configuration.
- The Section “Configuring the cluster console” discusses the steps necessary for the configuration on the cluster console.
- The Section “Updating a configuration on the cluster console” discusses updating the cluster console configuration after the addition or the removal of the cluster nodes.
- The Section “Configuring the cluster nodes” discusses the recommended method of configuring the SA_scon, the Shutdown Agent, and the Shutdown Facility.
- The Section “Collecting debugging information” explains how to collect debugging information about SCON on the cluster console.
- The Section “Using the cluster console” explains how to access the consoles of individual cluster nodes.

9.1 Overview

This section discusses the SCON product functionality and configuration. The SCON product is installed on the cluster console.

9.1.1 Role of the cluster console

In PRIMECLUSTER, a cluster console is used to replace the consoles for standalone systems. This cluster console is used to provide a single point of control for all cluster nodes. In addition to providing administrative access, a cluster console runs the `SMAWRscon` software which performs needed node elimination tasks when required.

In most installations of PRIMECLUSTER a single cluster console can be used, but in some instances multiple cluster consoles must be configured in order to provide adequate administrative access to cluster nodes. The instances where multiple cluster consoles are needed are:

- When the cluster uses two or more PRIMEPOWER enterprise model's cabinets which do not share a common system management console.
- When cluster nodes are separated by a large distance (more than what the cluster administrator deems to be reasonable) such that it would be unreasonable for them to share a common cluster console. This may be the case when the cluster nodes are placed far apart in order to provide a disaster recovery capability.
- When the Hot Spare system management console is used (the system management console functionality is to be switched from one system management console to another one).

When two or more cluster consoles are used in a cluster it is called a distributed cluster console configuration. The pre-installation and installation steps for both the single cluster console and distributed cluster console are identical while the configuration step differs between the two.

9.1.2 Platforms

The cluster console is a generic term describing one of several hardware platforms on which the SCON product can run. The selection of a cluster console platform is in turn dependant on the platform of the cluster nodes:

- PRIMEPOWER entry and midrange models:

  A cluster console is optional. If a cluster console is desired, use one of the following:

  – RCA unit and a PRIMESTATION

  – RCCU unit and a PRIMESTATION

  i Certain product options are region specific. For information on the availability of RCA or RCCU, contact your local customer-support representative.

- PRIMEPOWER enterprise models:

  A cluster console is optional. If a cluster console is desired, it must be the System Management Console already present for the node.

9.2 Topologies

The cluster console can be configured in two distinct topologies imparting different configuration activities for the SCON product. This section discusses the two topologies.

In both topologies, the console lines of the cluster nodes are accessible from the cluster console(s) via a serial-line-to-network converter unit. This unit may be one of several types supported in PRIMEPOWER clusters such as the RCA (Remote Console Access) or RCCU (Remote Console Control Unit). The SCON product does not differentiate between the units and as such their setup is not addressed in this manual. For information regarding specifics of these units, refer to your customer support center.

9.2.1 Single cluster console

A single cluster console configuration is one in which the console lines for all cluster nodes are accessible from one central cluster console as depicted in Figure 93.

The conversion unit (CU) in Figure 93 represents a generic conversion unit, which is responsible for converting serial-line to network access and represents either the RCA or RCCU units.

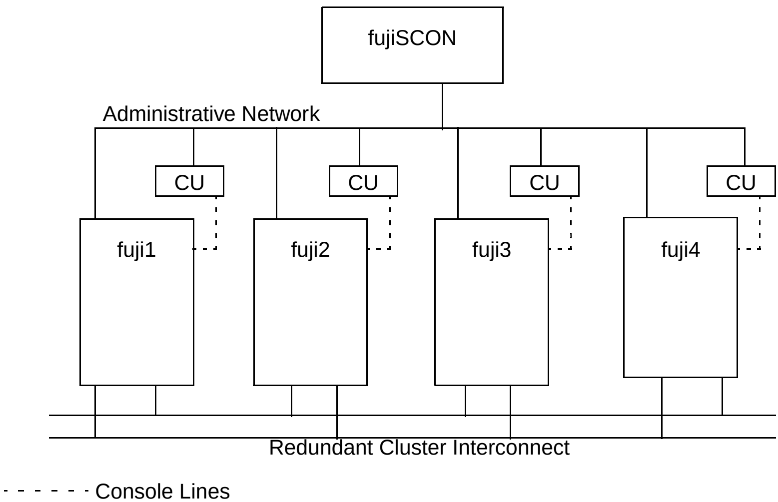


Figure 93: Single cluster console

This single cluster console runs the `SMAWRscon` software which is responsible for performing the node elimination tasks for all nodes in the cluster. When configuring the single cluster console, all cluster nodes will be known to it and at runtime all cluster nodes will forward shutdown requests to it. SCON is responsible for node elimination tasks when the `SA_scon` Shutdown Agent is used.

9.2.2 Distributed cluster console

i In the current release, distributed console support is limited to four cluster consoles (2 distributed with one standby each).

A distributed cluster console configuration is one in which there is more than one cluster console and each cluster console has access to a selected subset of the console lines for the cluster nodes. Note that the console line for each cluster node may only be accessed by one cluster console. A distributed cluster console configuration is depicted in Figure 94.

i The conversion unit (CU) in Figure 94 represents a generic conversion unit, which is responsible for converting serial-line to network access and represents either the RCA or RCCU units.

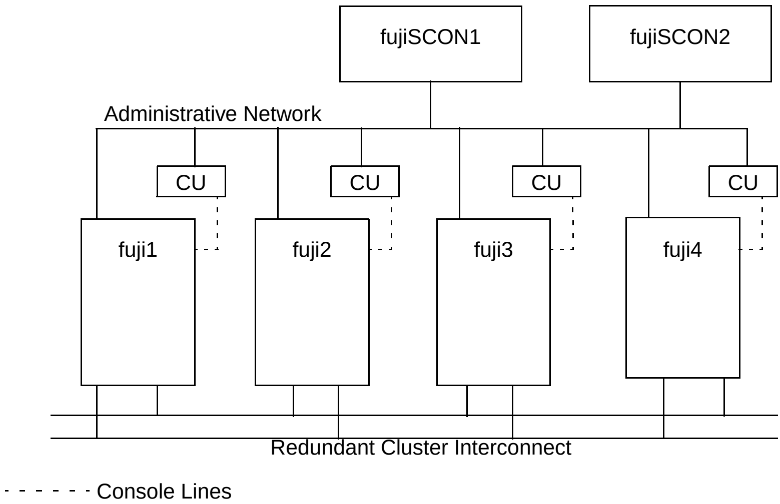


Figure 94: Distributed cluster console

In our example, `fujiSCON1` controls access to `fuji1` and `fuji2` and `fujiSCON2` controls access to `fuji3` and `fuji4`. When configuring the SCON product on `fujiSCON1` only `fuji1` and `fuji2` will be known by it, similarly on `fujiSCON2` the SCON product will only know of `fuji3` and `fuji4`.

At runtime, all shutdown requests are sent to all cluster consoles and the cluster console responsible for the node being shut down performs the work and responds to the request.

9.2.3 Hot Spare console

The SCON product supports Hot Spare technology. Install and configure the `SMAWRscon` package on both cluster consoles in the same manner as a single cluster console and setup the `SA_scon` on the cluster nodes in the same manner as distributed SCON.

For example, `fujiSCON1` controls access to `fuji1`, `fuji2`, `fuji3`, and `fuji4`. `fujiSCON2` functions as a spare and is in standby mode. At runtime, all shutdown requests are sent to `fujiSCON1` and `fujiSCON2`. Because `fujiSCON2` is in standby mode, it will drop the request without any action.

9.3 Network considerations

There are several things to note in regards to the network configuration of both a single cluster console and distributed cluster console configuration:

- The cluster console(s) are not on the cluster interconnect.
- All CUs, cluster consoles, and cluster nodes are on an administrative network.
- The administrative network should be physically separate from the public network(s).

9.4 Configuring the cluster console

The configuration on the cluster console consists of several steps:

- Updating the `/etc/hosts` file
- Running the `Configure` script
- Optionally editing the `rmshosts` and `rmshosts.method` file

  After editing, or overwriting, the `rmshosts` file all processes associated with the SCON product must be restarted. This can be done by either rebooting the cluster console or by using the `ps` command to find all related processes and issuing them a `SIGKILL` as follows:

```
# kill -KILL `ps -elf | grep scon| grep -v grep | awk -e
'{print $4}'`
```

9.4.1 Updating the /etc/hosts file

The cluster console must know the IP address associated with the CF name of each cluster node. In most cases the CF name of the cluster node is the same as the `uname -n` of the cluster node, but in other cases the cluster administrator has chosen a separate CF name for each cluster node that does not match the `uname -n`.

For each cluster node, using the editor of your choice, add an entry to the `/etc/hosts` file for each CF name so that the cluster console can communicate with the cluster node. The CF name must be used because the Shutdown Facility on each cluster node and the cluster console communicate using only CF names.

> **i** Note that when working with a distributed cluster console configuration, all cluster consoles must have an entry for each cluster node, regardless of which cluster console administers which sub-set of cluster nodes.

As an example, referring to our sample `FUJI` cluster (refer to the PRIME-CLUSTER *Installation Guide (Solaris)*, “Cluster site planning worksheet”), the CF name of the cluster nodes are `fuji2` and `fuji3` which happen to match the public IP names of their nodes. Since the cluster console (`fujiSCON`) is on the administration network and on the public network then `fujiSCON` can directly contact the cluster nodes by using the CF names because they happen to match the public IP names of the nodes. So in our sample cluster, no extra `/etc/hosts` work will need to be done.

This setup may not always be the case because the administrator may have chosen that the cluster console will not be accessible on the public network, or the CF names do not match the public IP names. In either of these cases, then aliases would have to be set up in the `/etc/hosts` file so that the cluster console can contact the cluster nodes using the CF name of the cluster node. Assume that the sample `FUJI` cluster chose CF names of `fuji2cf` and `fuji3cf` (instead of `fuji2` and `fuji3`), then entries in the `/etc/hosts` file would have to be made that look like:

```
172.25.200.4 fuji2ADM fuji2cf
172.25.200.5 fuji3ADM fuji3cf
```

9.4.2 Configure script

The configuration of the SCON product is slightly different depending on the platform of the cluster nodes.

If the cluster consists PRIMEPOWER enterprise models, the script will derive the partition information from the partition tables on the management console. It will place the correct entries into the `/etc/uucp/Systems` and `/etc/uucp/Devices` files and install symbolic link under `/dev`.

If the cluster consists of PRIMEPOWER entry or midrange models, then the entries in the `/etc/uucp/Systems` and `/etc/uucp/Devices` files are already present. They were created when performing the setup of the cluster console.

9.4.2.1 Status check

PRIMEPOWER enterprise models have a status check utility. This software can detect a state change from `Panic` to `Initialize`. This change occurs when the panic dump has been written. Writing a dump can take a long time under certain conditions. The earliest point to start failover is when the syncing of the file systems has been finished or been given up. This event occurs between the `Panic` and the `Initialize phase`. The `Configure -f` option optimizes this behavior as described in the following examples.

Example 1

A kill request comes in after a failure caused by a system panic. The query of the system state returns `Panic`. No second panic is produced, to prevent the destruction of the dump.

If `-f` is not set, `SUCCESS` is reported after the delay (in seconds) of the `-T` option, which is `1` by default. Together with the time elapsed until system failure is detected, this should be sufficient to reach the end of syncing activities with normal discs. With shared file systems, which take a long time for syncing, the possibilities are as follows:

– Increase the value of `-T` <*sec*>

– Set the `-f` option to search the console output for file syncing activity

If the `-f` option is set, the end of syncing actions is searched in the latest console output that has gone out and in the console output that arrives. If found, `SUCCESS` is reported immediately. After 9 attempts, SCON performs a status check to detect a status change to `Initialize phase`, which would cause SCON to report `SUCCESS`.

In rare situations, the default value of 9 attempts for the status check must be increased. This is done using the `-i` option for the `scon` entry in the `/etc/inittab` file. The value to which the `-i` option must be increased must be tested and verified for each configuration. After each change in the `/etc/inittab` file, the appropriate process must be terminated to be automatically restarted with the new settings.

Example 2

A kill request comes in when the system state is `System running`. SCON will panic the partition and, if the `-f` option is set, search only in the incoming console output. In addition, all activities are the same as in the previous example. That is, the time for syncing large file systems might not be enough with the default of 1 second for the `-T` option and without setting the `-f` option.

If time for failover is not an issue, but you need the dump urgently for analysis, you should use the `-f` option and a large timeout configured for `SA_scon` in SF on the nodes. The timeout should be long enough to include the time for writing the dump in case the end of syncing cannot be detected. You should also use the `-f` option if time is critical and a secondary kill is available.

If time is not an issue and a secondary kill is not available, you should not use the `-f` option, and you should increase the `-T` option to a value that guarantees the end of syncing action (for example 20 seconds). This avoids the situation where a hardware failure could leave a dead console without syncing messages and without a state change to `Initialize phase`.

9.4.2.2 Running the Configure script

The SCON software is configured through the `/opt/SMAW/SMAWRscon/bin/Configure` script. The `Configure` script contains interactive questions regarding the cluster console configuration, which typically accept the default response of a carriage return.

Enter the following to run the `Configure` script:

`# /opt/SMAW/SMAWRscon/bin/Configure`

> **i** Note that running the `Configure` script with a distributed cluster console will only show the sub-set of cluster nodes that are administered by the local cluster console. The sub-set of cluster nodes administered by other cluster consoles will not appear in the output of the `Configure` script. This is true regardless of the platform type of the cluster nodes.

9.4.3 Syncing the file systems after a panic

After installing the packages contained in the CF product, the sync of the file systems is suppressed if a panic occurs. If SCON is used as the Shutdown Agent, the sync of the file systems must be allowed because the SCON SA is able to detect the end of file system sync and reports only then the successful node elimination.

Turn the sync of the file systems back on as follows:

`/# opt/FJSVcldev/system/clsetsync`

Suppress the sync of the file systems as follows:

`# /opt/FJSVcldev/system/clunsetsync`

9.4.4 Editing the rmshosts file

The `/opt/SMAW/SMAWRscon/etc/rmshosts` file contains the list of cluster nodes that are configured on the local cluster console. The order in which the nodes appear in the file are treated as a priority list in the event of a split-cluster (when SCON is the decision maker and the weight at elimination time is the same for all nodes).

If you want to change the priority of cluster nodes, you can reorder them. When reordering the node names, ensure that all node names are spelled correctly and that all nodes in the cluster are included in the file. The priority is taken from here only when the default weights for the cluster nodes are used.

9.4.5 Additional steps for distributed cluster console

The `SCON` product arbitrates between sub-sets of cluster nodes in a distributed cluster console configuration. In order for this to occur correctly, the list of cluster nodes in the `rmshosts` file on all cluster consoles must be a complete list of all cluster nodes and all cluster nodes must appear in the same order.

Update the `rmshosts` file by adding a line with the CF name of all cluster nodes that are not listed in the following file:

```
/opt/SMAW/SMAWRscon/etc/rmshosts
```

9.4.6 rmshosts.method file

The entries in this file determine whether the SCON does split-cluster processing before eliminating a node. By default a `no` entry of the form `cfname uucp no` causes split-cluster processing before eliminating a node, and a `yes` entry does not allow split-cluster processing to be done.

> **i** This file needs to be edited only if you are using other Shutdown Agents along with SCON or SCON is not the first Shutdown Agent specified in the SF configuration file.

Change the entries of the following form:

```
cfname uucp no
```

to

```
cfname uucp yes
```

> **i** Make sure that the number and names of cluster nodes are consistent across `rmshosts` and the `rmshosts.method` file. In the case of distributed console, they should be consistent across all console nodes.

9.4.7 Entry and midrange machines

For successful node elimination on PRIMEPOWER entry and midrange models, SCON needs to write status messages on the cluster node’s console output. These messages are read back by SCON to verify node elimination.

To enable the writing of status messages on the cluster node's console output, a line must be inserted into `/etc/syslog.conf` file. The line is as follows, with at least one tab separating two entries in the line:

```
user.notice     /dev/console
```

If the above configuration is not done in /`etc/syslog.conf`, the status messages will be suppressed on console output and SCON will not work correctly.

9.5 Updating a configuration on the cluster console

Once a cluster is configured with a cluster console, if cluster nodes are added or removed the cluster console configuration must be updated to reflect the new cluster. Modifying the cluster console configuration will be different, depending on the platform of the cluster nodes:

- Clusters with PRIMEPOWER entry and midrange models:
  - Perform the needed setup of the cluster console hardware as defined. See instructions specific to the cluster console hardware at your site.
  - Re-run the `Configure` script.
- Clusters with PRIMEPOWER enterprise models:
  - Remove all entries for that refer to partitions from the `/etc/uucp/Systems` and `/etc/uucp/Devices` files. For configurations that use CF names different from unames, remove the comments inserted earlier by the `Configure` script.
  - Re-run the `Configure` script.

9.6 Configuring the cluster nodes

The recommended method of configuring the `SA_scon` and the Shutdown Facility is to use the Cluster Admin GUI. Information on manual configuration is presented here for those who choose to do so.

This section contains other information in addition to `SA_scon` Shutdown Agent, and the Shutdown Facility configuration. Please be sure to review all sections and apply those that are relevant to your cluster.

9.6.1 Shutdown Facility

> **i** This section applies only to clusters with PRIMEPOWER entry and midrange models.

For the Shutdown Facility to begin using `SA_scon`, the Shutdown Agent and the Shutdown Facility must be configured properly. Please refer to the Section “Configuring the Shutdown Facility” for more information.

In addition to the configuration of the `SA_scon` Shutdown Agent and Shutdown Facility, there may be additional configuration work needed on the cluster nodes to make them work with the SCON product.

9.6.2 Redirecting console input/output

Most likely the console input and output have already been redirected as part of the hardware setup of the cluster console. This information is provided as a backup.

Use the `eeprom` command to modify the input-device, `output-device`, and `ttya-mode` settings on the nodes boot prom as follows:

```
# eeprom input-device=ttya
# eeprom output-device=ttya
# eeprom ttya-mode=9600,8,n,1,-
```

9.6.3 Booting with kadb

Ensure that the cluster nodes boot using `kadb` by using the `eeprom` command to set the boot file to `kadb`. The command is as follows:

```
# eeprom boot-file=kadb
```

9.6.3.1 Restrictions

PRIMEPOWER nodes only reboot automatically after a panic if the setting of the `eeprom` variable boot-file is not `kadb`. The SCON kill on PRIMEPOWER entry and midrange nodes requires the `kadb` setting. An automatic reboot after panic (for both RCI and XSCF) is not possible on those nodes if the elimination via panic is supposed to be a fall-back elimination method after a failing SCON elimination.

9.6.3.2 Setting the alternate keyboard abort sequence

Edit the `/etc/default/kbd` file and ensure that the line defining the keyboard abort sequence is uncommented and set to the alternate abort sequence. The line should look exactly like the following:

```
KEYBOARD_ABORT=alternate
```

For the `KEYBOARD_ABORT` settings to work, you must reboot the machine where the change was done.

9.6.4 mklancon work around

In a PRIMECLUSTER configuration with SCON that uses console lines which are set up by mklancon, the CF names should conform to the restrictions imposed by the LAN console as in the following:

"*console_name*: *tag_name_of_LAN_console_device*"

As documented in LAN console manual, non-alphanumeric characters like the hyphen (-) are not allowed.

If the CF names do not conform to the mklancon requirements, a work around is possible to circumvent the restriction. Use a similar name to the needed name, but without the offending characters, in the mklancon command. After this step, replace the name in the `/etc/uucp/Systems` file with the desired CF name. The changed name will not be used in the output of commands like `pmadm -l`, but it will be used in the `Configure` script to set up the proper environment for PRIMECLUSTER Scon node elimination.

9.7 Collecting debugging information

The `/opt/SMAW/SMAWRscon/bin/scondump` command is used to collect debugging information about SCON on the cluster console. When this command is invoked, it gathers the following information:

- SCON log files
- SCON configuration files

- LAN console configuration files
- Status of LAN console configuration
- SCON binaries (to debug if there is a core)

The `scondump` utility sends its output to the `/usr/scon/log/scondump.log` file if there are any errors encountered during the information collection process.

The final compressed archive can be found in the `/opt/SMAW/SMAWRscon` directory and is named as follows:

`Scon.` <*timestamp*>`.debug_information.tar.Z`

<*timestamp*> is the time that the scon dump was called.

9.8 Using the cluster console

This section explains how to access the consoles of individual cluster nodes.

> **i** This function is only available on clusters with PRIMEPOWER entry and midrange models. The console access for enterprise models is handled through the system management software.

9.8.1 Without XSCON

The SCON `Configure` script automatically starts the `SMAWRscon` software running on the cluster console. Since this software is already running, all the administrator needs to do in order to get a console window for each cluster node is to use the `xco` utility to start a console window as follows:

/opt/SMAW/SMAWRscon/bin/xco *cfname*

cfname is the CF name of a cluster node.

9.8.2 With XSCON

The console window can be accessed using the `SMAWxscon` software by setting the `XSCON_CU` environment variable in the administrators environment. It must be set to: `/opt/SMAW/SMAWRscon/bin/scon.scr`. As an example in korn shell:

export XSCON_CU=/opt/SMAW/SMAWRscon/bin/scon.scr

The `xsco` utility will use the SCON command to open windows in this environment.

10 CF over IP

This chapter describes CF over IP and how it is configured.

This chapter discusses the following:

- The Section “Overview” introduces CF over IP and describes its use.
- The Section “Configuring CF over IP” details how to configure CF over IP.

10.1 Overview

All IP configuration must be done prior to using CF over IP. The devices must be initialized with a unique IP address and a broadcast mask. IP must be configured to use these devices. If the configuration is not done, `cfconfig`(1M) will fail to load CF, and CF will not start.

The devices used for CF over IP must not be controlled by an RMS `userApplication` that could unconfigure a device due to `Offline` processing.

CF communications are based on the use of interconnects. An interconnect is a communications medium which can carry CF's link-level traffic between the CF nodes. A properly configured interconnect will have connections to all of the nodes in the cluster through some type of device. This is illustrated in Figure 95.

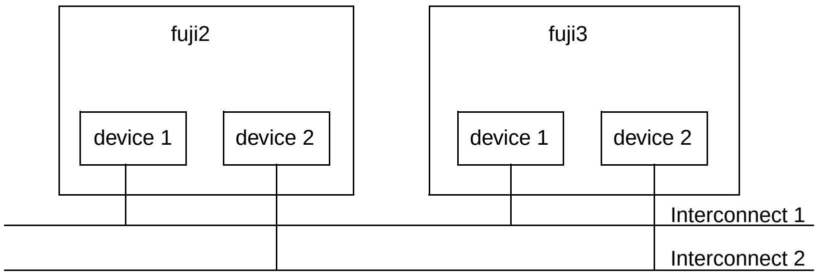


Figure 95: Conceptual view of CF interconnects

When CF is used over Ethernet, Ethernet devices are used as the interfaces to the interconnects. The interconnects themselves are typically Ethernet hubs or switches. An example of this is shown in Figure 96.

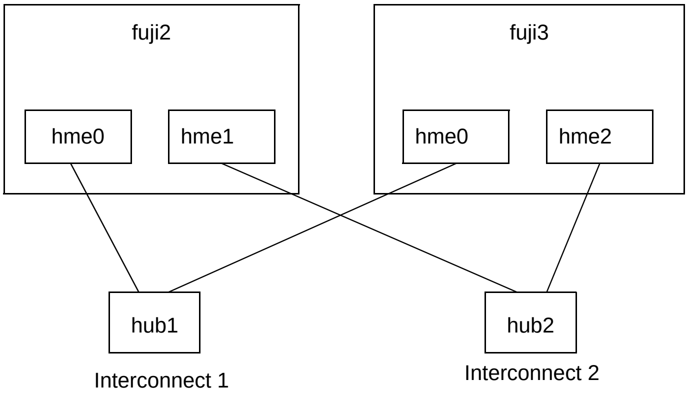


Figure 96: CF with Ethernet interconnects

When CF is run over IP, IP interfaces are the devices used to connect to the interconnect. The interconnect is an IP subnetwork. Multiple IP subnetworks may be used for the sake of redundancy. Figure 97 shows a CF over IP configuration.

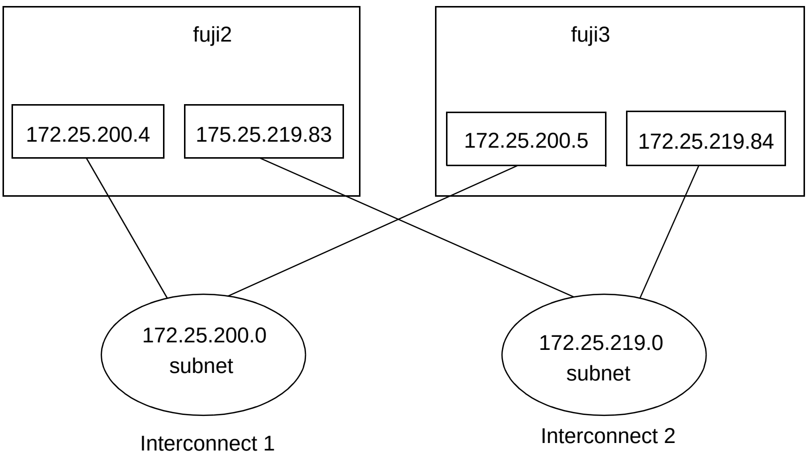


Figure 97: CF with IP interconnects

It is also possible to use mixed configurations in which CF is run over both Ethernet devices and IP subnetworks.

When using CF over IP, you should make sure that each node in the cluster has an IP interface on each subnetwork used as an interconnect. You should also make sure that all the interfaces for a particular subnetwork use the same IP broadcast address and the same netmask on all cluster nodes. This is particularly important since CF depends on an IP broadcast on each subnet to do its initial cluster join processing.

The current version does not allow CF to reach nodes that are on different subnets.

Caution

When selecting a subnetwork to use for CF, you should use a private subnetwork that only cluster nodes can access. CF security is based on access to its interconnects. Any node that can access an interconnect can join the cluster and acquire root privileges on any cluster node. When CF over IP is used, this means that any node on the subnetworks used by CF must be trusted. You should not use the public interface to a cluster node for CF over IP traffic unless you trust every node on your public network.

10.2 Configuring CF over IP

To configure CF over IP, you should do the following:

- Designate which subnetworks you want to use for CF over IP. Up to four subnetworks can be used.
- Make sure that each node that is to be in the cluster has IP interfaces properly configured for each subnetwork. Make sure the IP broadcast and netmasks are correct and consistent on all nodes for the subnetworks.
- Make sure that all of these IP interfaces are up and running.
- Run the CF Wizard in Cluster Admin.

The CF Wizard has a window which allows CF over IP to be configured. The Wizard will probe all the nodes that will be in the cluster, find out what IP interfaces are available on each, and then offer them as choices in the CF over IP window. It will also try to group the choices for each node by subnetworks. See Section “CF, CIP, and CIM configuration” for details.

CF uses special IP devices to keep track of CF over IP configuration. There are four of these devices named as follows:

```
/dev/ip0
/dev/ip1
/dev/ip2
/dev/ip3
```

These devices do not actually correspond to any device files under `/dev` in the Solaris. Instead, they are just place holders for CF over IP configuration information within the CF product. Any of these devices can have an IP address and broadcast address assigned by the `cfconfig`(1M) command (or by Cluster Admin which invokes the `cfconfig`(1M) command in the Wizard).

If you run `cfconfig`(1M) by hand, you may specify any of these devices to indicate you want to run CF over IP. The IP device should be followed by an IP address and broadcast address of an interface on the local node. The addresses must be in internet dotted-decimal notation. For example, to configure CF on `fuji2` in Figure 97, the `cfconfig`(1M) command would be as follows:

fuji2 # **`cfconfig -S A clustername /dev/ip0 \`**172.25.200.4 172.25.200.255 /dev/ip1 172.25.219.83

It really does not matter which IP device you use. The above command could equally have used `/dev/ip2` and `/dev/ip3`.

> **i** The `cfconfig`(1M) command does not do any checks to make sure that the IP addresses are valid.

The IP devices chosen in the configuration will appear in other commands such as `cftool -d` and `cftool -r`.

IP interfaces will not show up in CF pings using `cftool -p` unless they are configured for use with CF and the CF driver is loaded.

> **i** `cftool -d` shows a relative speed number for each device, which is used to establish priority for the message send. If the configured device is IP, the relative speed 100 is used. This is the desired priority for the logical IP device. If a Gigabit Ethernet hardware device is also configured, it will have priority.

11 Diagnostics and troubleshooting

This chapter provides help for troubleshooting and problem resolution for PRIMECLUSTER Cluster Foundation. This chapter will help identify the causes of problems and possible solutions. If a problem is in another component of the PRIMECLUSTER suite, the reader will be referred to the appropriate manual. This chapter assumes that the installation and verification of the cluster have been completed as described in the PRIMECLUSTER *Installation Guide (Solaris)*.

This chapter discusses the following:

- The Section “Beginning the process” discusses collecting information used in the troubleshooting process.
- The Section “Symptoms and solutions” is a list of common symptoms and the solutions to the problems.
- The Section “PCI Hot Plug” describes how you can deconfigure an active network interface card (NIC) so that you can replace it.
- The Section “Collecting troubleshooting information” gives steps and procedures for collecting troubleshooting information.

11.1 Beginning the process

Start the troubleshooting process by gathering information to help identify the causes of problems.You can use the CF log viewer facility from the Cluster Admin GUI, look for messages on the console, or look for messages in the `/var/adm/messages` file. You can use the `cftool`(1M) command for checking states, configuration information. To use the CF log viewer click on the *Tools* pull-down menu and select *View Syslog messages*. The log messages are displayed. You can search the logs using a date/time filter or scan for messages based on severity levels. To search based on date/time, use the date/time filter and press the *Filter* button. To search based on severity levels, click on the *Severity* button and select the desired severity level. You can use keyword also to search the log. To detach the CF log viewer window, click on the *Detach* button; click on the *Attach* button to attach it again.

Collect information as follows:

- Look for messages on the console that contain the identifier CF.

- Look for messages in `/var/adm/messages`. You might have to look in multiple files (`/var/adm/messages.`*N*).
- Use `cftool` as follows:
  - `cftool -l`: Check local node state
  - `cftool -d`: Check device configuration
  - `cftool -n`: Check cluster node states
  - `cftool -r`: Check the route status

Error log messages from CF are always placed in the `/var/adm/messages` file; some messages may be replicated on the console. Other device drivers and system software may only print errors on the console. To have a complete understanding of the errors on a system, both console and error log messages should be examined. The Section “Alphabetical list of messages” contains messages that can be found in the `/var/adm/messages` file. This list of messages gives a description of the cause of the error. This information is a good starting point for further diagnosis.

All of the parts of the system put error messages in this file or on the console and it is important to look at all of the messages, not just those from the PRIME-CLUSTER suite. The following is an example of a CF error message from the `/var/adm/messages` file:

```
Nov  9 08:51:45 fuji2 unix:  LOG3.0973788705 1080024   1008 4
0    1.0         cf:ens CF: Icf Error: (service err_type
route_src route_dst). (0 0 0 0 0 0 0 0 2 0 0 0 5 0 0 0 5)
```

The first 80 bytes are the `log3` prefix as in the following:

```
Nov  9 08:51:45 fuji2 unix:  LOG3.0973788705 1080024   1008 4
0    1.0         cf:ens
```

This part of the message is a standard prefix on each CF message in the log file that gives the date and time, the node name, and `log3` specific information. Only the date, time, and node name are important in this context. The remainder is the error message from CF as in the following:

```
CF: Icf Error: (service err_type route_src route_dst). (0 0 0 0
0 0 0 0 2 0 0 0 5 0 0 0 5)
```

This message is from the `cf:ens` service (that is, the Cluster Foundation, Event Notification Service) and the error is `CF: Icf Error`. This error is described in the Section “Alphabetical list of messages” as signifying a missing heartbeat and/or a route down. This gives us direction to look into the cluster interconnect further. A larger piece of the `/var/adm/messages` file shows as follows:

fuji2# **tail /var/adm/messages**

```
Nov  9 08:51:45 fuji2 unix: SUNW,pci-gem1: Link Down - cable problem?
Nov  9 08:51:45 fuji2 unix: SUNW,pci-gem0: Link Down - cable problem?
Nov  9 08:51:45 fuji2 unix:  LOG3.0973788705 1080024   1008 4    0    1.0
cf:ens          CF: Icf Error: (service err_type route_src route_dst). (0 0 0 0
0 0 0 0 2 0 0 0 5 0 0 0 5)
Nov  9 08:51:46 fuji2 unix: SUNW,pci-gem0: Link Down - cable problem?
Nov  9 08:51:48 fuji2 last message repeated 1 time
Nov  9 08:51:48 fuji2 unix:  LOG3.0973788708 1080024   1008 4    0    1.0
cf:ens          CF: Icf Error: (service err_type route_src route_dst). (0 0 0 0
0 0 0 0 2 0 0 0 4 0 0 0 4)
Nov  9 08:51:50 fuji2 unix: SUNW,pci-gem0: Link Down - cable problem?
Nov  9 08:51:52 fuji2 last message repeated 1 time
Nov  9 08:51:53 fuji2 unix:  LOG3.0973788713 1080024   1008 4    0    1.0
cf:ens          CF: Icf Error: (service err_type route_src route_dst). (0 0 0 0
0 0 0 0 2 0 0 0 4 0 0 0 4)
Nov  9 08:51:53 fuji2 unix:  LOG3.0973788713 1080024   1015 5    0    1.0
cf:ens          CF: Node fuji2 Left Cluster POKE. (0 0 2)
Nov  9 08:51:53 fuji2 unix: Current Nodee Status = 0
```

Here we see that there are error messages from the Ethernet controller indicating that the link is down, possibly because of a cable problem. This is the clue we need to solve this problem; the Ethernet used for the interconnect has failed for some reason. The investigation in this case should shift to the cables and hubs to insure that they are all powered up and securely connected.

Several options for the command `cftool` are listed above as sources for information. Some examples are as follows:

fuji2# **cftool -l**

```
Node     Number State        Os      Cpu
fuji2    2      UP           Solaris Sparc
```

This shows that the local node has joined a cluster as node number `2` and is currently `UP`. This is the normal state when the cluster is operational. Another possible response is as follows:

fuji2# **cftool -l**

```
Node     Number State      Os
fuji2 --     COMINGUP  --
```

This indicates that the CF driver is loaded and that the node is attempting to join a cluster. If the node stays in this state for more than a few minutes, then something is wrong and we need to examine the `/var/adm/messages` file. In this case, we see the following:

fuji2# **tail /var/adm/messages**

```
May 30 17:36:39 fuji2 unix: pseudo-device: fcp0
May 30 17:36:39 fuji2 unix: fcp0 is /pseudo/fcp@0
May 30 17:36:53 fuji2 unix:  LOG3.0991269413 1080024   1007 5
0    1.0        cf:eventlog     CF: (TRACE): JoinServer:
Startup.
May 30 17:36:53 fuji2 unix:  LOG3.0991269413 1080024   1009 5
0    1.0        cf:eventlog     CF: Giving UP Mastering
(Cluster already Running).
May 30 17:36:53 fuji2 unix:  LOG3.0991269413 1080024   1006 4
0    1.0        cf:eventlog     CF: fuji4: busy: local node not
DOWN: retrying.
```

We see that this node is in the `LEFTCLUSTER` state on another node (`fuji4`). To resolve this condition, see Chapter “GUI administration” for a description of the `LEFTCLUSTER` state and the instructions for resolving the state.

The next option to `cftool` shows the device states as follows:

fuji2# **`cftool -d`**

```
Number Device    Type Speed    Mtu      State Configured Address
1      /dev/hme0 4    100      1432     UP    YES        00.80.17.28.21.a6
2      /dev/hme3 4    100      1432     UP    YES        08.00.20.ae.33.ef
3      /dev/hme4 4    100      1432     UP    YES        08.00.20.b7.75.8f
4      /dev/ge0  4    1000     1432     UP    YES        08.00.20.b2.1b.a2
5      /dev/ge1  4    1000     1432     UP    YES        08.00.20.b2.1b.b5
```

Here we can see the interconnects configured for the cluster (the lines with `YES` in the `Configured` column). This information shows the names of the devices and the device numbers for use in further troubleshooting steps.

The `cftool -n` command displays the states of all the nodes in the cluster. The node must be a member of a cluster and `UP` in the `cftool -l` output before this command will succeed as shown in the following:

fuji2# **`cftool -n`**

```
Node     Number State        Os       Cpu
fuji2    1      UP           Solaris  Sparc
fuji3    2      UP           Solaris  Sparc
```

This indicates that the cluster consists of two nodes `fuji2` and `fuji3`, both of which are `UP`. If the node has not joined a cluster, the command will wait until the join succeeds.

`cftool -r` lists the routes and the current status of the routes as shown in the following example:

fuji2# **`cftool -r`**

```
Node     Number Srcdev Dstdev Type State Destaddr
fuji2     1      4      4      4    UP    08.00.20.b2.1b.cc
fuji2     1      5      5      4    UP    08.00.20.b2.1b.94
fuji3     2      4      4      4    UP    08.00.20.b2.1b.a2
fuji3     2      5      5      4    UP    08.00.20.b2.1b.b5
```

This shows that all of the routes are `UP`. If a route shows a `DOWN` state, then the step above where we examined the error log should have found an error message associated with the device. At least the CF error noting the route is down should occur in the error log. If there is not an associated error from the device driver, then the diagnosis steps are covered below.

The last route to a node is never marked `DOWN`, it stays in the `UP` state so that the software can continue to try to access the node. If a node has left the cluster or gone down, there will still be an entry for the node in the route table and one of the routes will still show as `UP`. Only the `cftool -n` output shows the state of the nodes as shown in the following:

fuji2# **`cftool -r`**

```
Node     Number Srcdev Dstdev Type State Destaddr
fuji2    2      3      2      4    UP    08.00.20.bd.5e.a1
fuji3    1      3      3      4    UP    08.00.20.bd.60.e4
```

fuji2# **`cftool -n`**

```
Node     Number State        Os      Cpu
fuji2    2      UP           Solaris Sparc
fuji3    1      LEFTCLUSTER  Solaris Sparc
```

11.2 Symptoms and solutions

The previous section discussed the collection of data. This section discusses symptoms and gives guidance for troubleshooting and resolving the problems. The problems dealt with in this section are divided into two categories: problems with joining a cluster and problems with routes, either partial or complete loss of routes. The solutions given here are either to correct configuration problems or to correct interconnect problems. Problems outside of these categories or solutions to problems outside of this range of solutions are beyond the scope of this manual and are either covered in another product's manual or require technical support from your customer service representative. Samples from the error log (`/var/adm/messages`) have the `log3` header stripped from them in this section.

11.2.1 Join-related problems

Join problems occur when a node is attempting to become a part of a cluster. The problems covered here are for a node that has previously successfully joined a cluster. If this is the first time that a node is joining a cluster, the PRIMECLUSTER *Installation Guide (Solaris)* section on verification covers the issues of initial startup. If this node has previously been a part of the cluster and is now failing to rejoin the cluster, here are some initial steps in identifying the problem.

First, look in the error log and at the console messages for any clue to the problem. Have the Ethernet drivers reported any errors? Any other unusual errors? If there are errors in other parts of the system, the first step is to correct those errors. Once the other errors are corrected, or if there were no errors in other parts of the system, proceed as follows.

Is the CF device driver loaded? The device driver puts a message in the log file when it loads and the `cftool -l` command will indicate the state of the driver. The logfile message looks as follows:

```
CF: (TRACE): JoinServer: Startup.
```

`cftool -l` prints the state of the node as follows:

fuji2# **`cftool -l`**

```
Node    Number State     Os
fuji2 --     COMINGUP  --
```

This indicates the driver is loaded and the node is trying to join a cluster. If the errorlog message above does not appear in the logfile or the `cftool -l` command fails, then the device driver is not loading. If there is no indication in the `/var/adm/messages` file or on the console why the CF device driver is not loading, it could be that the CF kernel binaries or commands are corrupted, and you might need uninstall and reinstall CF. Before any further steps can be taken, the device driver must be loaded.

After the CF device driver is loaded, it attempts to join a cluster as indicated by the message "`CF: (TRACE): JoinServer: Startup.`". The join server will attempt to contact another node on the configured interconnects. If one or more other nodes have already started a cluster, this node will attempt to join that cluster. The following message in the error log indicates that this has occurred:

```
CF: Giving UP Mastering (Cluster already Running).
```

If this message does not appear in the error log, then the node did not see any other node communicating on the configured interconnects and it will start a cluster of its own.   The following two messages will indicate that a node has formed its own cluster:

```
CF: Local Node fuji2 Created Cluster FUJI. (#0000 1)
CF: Node fuji2 Joined Cluster FUJI. (#0000 1)
```

At this point, we have verified that the CF device driver is loading and the node is attempting to join a cluster. In the following list, problems are described with corrective actions. Find the problem description that most closely matches the symptoms of the node being investigated and follow the steps outlined there.

i Note that the `log3` prefix is stripped from all of the error message text displayed below. Messages in the error log will appear as follows:

```
Mar 10 09:47:55 fuji2 unix: LOG3.0952710475 1080024 1014 4
0 1.0 cf:ens
CF: Local node is missing a route from node: fuji3
```

However they are shown here as follows:

```
CF: Local node is missing a route from node: fuji3
```

Join problems

Problem:

The node does not join an existing cluster, it forms a cluster of its own.

Diagnosis:

The error log shows the following messages:

```
CF: (TRACE): JoinServer: Startup.
CF: Local Node fuji4 Created Cluster FUJI. (#0000 1)
CF: Node fuji2 Joined Cluster FUJI. (#0000 1)
```

This indicates that the CF devices are all operating normally and suggests that the problem is occurring some place in the interconnect. The first step is to determine if the node can see the other nodes in the cluster over the interconnect. Use `cftool` to send an echo request to all the nodes of the cluster:

fuji2# **`cftool -e`**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
```

This shows that node `fuji3` sees node `fuji2` using interconnect device 3 (`Localdev`) on `fuji3` and device 2 (`Srcdev`) on `fuji2`. If the `cftool -e` shows only the node itself then look under the Interconnect Problems heading for the problem “The node only sees itself on the configured interconnects.” If some or all of the expected cluster nodes appear in the list, attempt to rejoin the cluster by unloading the CF driver and then reloading the driver as follows:

fuji2# **`cfconfig -u`**

fuji2# **`cfconfig -l`**

> **i** There is no output from either of these commands, only error messages in the error log.

If this attempt to join the cluster succeeds, then look under the Problem: “The node intermittently fails to join the cluster.” If the node did not join the cluster then proceed with the problem below “The node does not join the cluster and some or all nodes respond to `cftool -e`.”

Problem:

The node does not join the cluster and some or all nodes respond to `cftool -e`.

Diagnosis:

At this point, we know that the CF device is loading properly and that this node can communicate to at least one other node in the cluster. We should suspect at this point that the interconnect is missing messages. One way to test this hypothesis is to repeatedly send echo requests and see if the result changes over time as in the following example:

fuji2# **cftool -e**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
```

fuji2# **cftool -e**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
3 3 08.00.20.bd.60.e4 FUJI fuji4 1 6
```

fuji2# **cftool -e**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
```

fuji2# **cftool -e**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
3 3 08.00.20.bd.60.e4 FUJI fuji4 1 6
```

fuji2# **cftool -e**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
3 3 08.00.20.bd.60.e4 FUJI fuji4 1 6
```

fuji2# **`cftool -e`**

```
Localdev Srcdev Address Cluster Node Number Joinstate
3 2 08.00.20.ae.33.ef FUJI fuji1 3 6
3 2 08.00.20.bd.5e.a1 FUJI fuji2 2 6
3 3 08.00.20.bd.60.ff FUJI fuji3 1 6
3 3 08.00.20.bd.60.e4 FUJI fuji4 1 6
```

Notice that the node `fuji4` does not show up in each of the echo requests. This indicates that the connection to the node `fuji4` is having errors. Because only this node is exhibiting the symptoms, we focus on that node. First, we need to examine the node to see if the Ethernet utilities on that node show any errors. If we log on to `fuji4` and look at the network devices, we see the following:

```
Number Device     Type Speed    Mtu      State Configured Address
1      /dev/hme0 4    100      1432     UP    NO         00.80.17.28.2c.fb
2      /dev/hme1 4    100      1432     UP    NO         00.80.17.28.2d.b8
3      /dev/hme2 4    100      1432     UP    YES        08.00.20.bd.60.e4
```

The `netstat`(1M) utility in Solaris reports information about the network interfaces. The first attempt will show the following:

fuji4# **`netstat -i`**

```
Name  Mtu  Net/Dest      Address        Ipkts  Ierrs Opkts  Oerrs Collis Queue
lo0   8232 loopback      localhost      65      0     65      0     0      0
hme0  1500 fuji4         fuji4          764055 8     9175    0     0      0
hme1  1500 fuji4-priva   fuji4-priva   2279991 0     2156309 0    7318   0
```

Notice that the `hme2` interface is not shown in this report. This is because Solaris does not report on interconnects that are not configured for TCP/IP. To temporarily make Solaris report on the `hme2` interface, enter the `ifconfig plumb` command as follows:

fuji4# **`ifconfig hme2 plumb`**

Repeat the command as follows:

fuji4# **`netstat -i`**

```
Name  Mtu  Net/Dest      Address        Ipkts  Ierrs Opkts  Oerrs Collis Queue
lo0   8232 loopback      localhost      65      0     65       0     0      0
hme0  1500 fuji4         fuji4          765105 8     9380      0     0      0
hme1  1500 fuji4-priva   fuji4-priva   2282613 0     2158931   0     7319   0
hme2  1500 default       0.0.0.0        752    100   417       0     0      0
```

Here we can see that the `hme2` interface has 100 input errors (`Ierrs`) from 752 input packet (`Ipkts`). This means that one in seven packets had an error; this rate is too high for PRIMECLUSTER to use successfully. This also explains why `fuji4` sometimes responded to the echo request from `fuji2` and sometimes did not.

> **i** It is always safe to plumb the interconnect. This will not interfere with the operation of PRIMECLUSTER.

To resolve these errors further, we can look at the undocumented `-k` option to the Solaris `netstat` command as follows:

fuji4# **`netstat -k hme2`**

```
hme2:
ipackets 245295 ierrors 2183 opackets 250486 oerrors 0 collisions 0
defer 0 framing 830 crc 1353 sqe 0 code_violations 38 len_errors 0
ifspeed 100 buff 0 oflo 0 uflo 0 missed 0 tx_late_collisions 0
retry_error 0 first_collisions 0 nocarrier 0 inits 15 nocanput 0
allocbfail 0 runt 0 jabber 0 babble 0 tmd_error 0 tx_late_error 0
rx_late_error 0 slv_parity_error 0 tx_parity_error 0 rx_parity_error 0
slv_error_ack 0 tx_error_ack 0 rx_error_ack 0 tx_tag_error 0
rx_tag_error 0 eop_error 0 no_tmds 0 no_tbufs 0 no_rbufs 0
rx_late_collisions 0 rbytes 22563388 obytes 22729418 multircv 0 multixmt 0
brdcstrcv 472 brdcstxmt 36 norcvbuf 0 noxmtbuf 0 phy_failures 0
```

Most of this information is only useful to specialists for problem resolution. The two statistics that are of interest here are the `framing` and `crc` errors. These two error types add up to exactly the number reported in ierrors. Further resolution of this problem consists of trying each of the following steps:

- Ensure the Ethernet cable is securely inserted at each end.
- Try repeated `cftool -e` and look at the `netstat -i`. If the results of the `cftool` are always the same and the input errors are gone or greatly reduced, the problem is solved.
- Replace the Ethernet cable.
- Try a different port in the Ethernet hub or switch or replace the hub or switch, or temporarily use a cross-connect cable.
- Replace the Ethernet adapter in the node.

If none of these steps resolves the problem, then your support personnel will have to further diagnose the problem.

Problem:

The following console message appears on node `fuji2` while node `fuji3` is trying to join the cluster with node `fuji2`:

```
Mar 10 09:47:55 fuji2 unix:  LOG3.0952710475 1080024   1014 4
0    1.0 cf:ens          CF: Local node is missing a route from
node: fuji3
Mar 10 09:47:55 fuji2 unix:  LOG3.0952710475 1080024   1014 4
0    1.0 cf:ens          CF: missing route on local device: /
dev/hme3
Mar 10 09:47:55 fuji2 unix:  LOG3.0952710475 1080024   1014 4
0    1.0 cf:ens          CF: Node fuji3 Joined Cluster FUJI. (0
1 0)
```

Diagnosis:

Look in `/var/adm/messages` on node `fuji2`.
Same message as on console.
No console messages on node `fuji3`.
Look in `/var/adm/messages` on node `fuji3`:

fuji2# **`cftool -d`**

```
Number Device     Type Speed    Mtu      State Configured Address
1      /dev/hme0 4    100      1432     UP    NO         08.00.06.0d.9f.c5
2      /dev/hme1 4    100      1432     UP    YES        00.a0.c9.f0.15.c3
3      /dev/hme2 4    100      1432     UP    YES        00.a0.c9.f0.14.fe
4      /dev/hme3 4    100      1432     UP    NO         00.a0.c9.f0.14.fd
```

fuji3# **`cftool -d`**

```
Number Device     Type Speed    Mtu      State Configured Address
1      /dev/hme0 4    100      1432     UP    NO         08.00.06.0d.9f.c5
2      /dev/hme1 4    100      1432     UP    YES        00.a0.c9.f0.15.c3
3      /dev/hme2 4    100      1432     UP    YES        00.a0.c9.f0.14.fe
4      /dev/hme3  4    100      1432     UP    YES        00.a0.c9.f0.14.fd
```

```
/dev/hme3 is not configured on node fuji2
Mar 10 11:00:28 fuji2 unix:WARNING:hme3:no MII link detected
Mar 10 11:00:31 fuji2 unix:LOG3.0952714831 1080024 1008 4 0
1.0cf:ens
CF:Icf Error:(service err_type route_src route_dst).(0 0 0 0 0 2
0 0 0 3 0 0 0
3 0 0 0)
Mar 10 11:00:53 fuji2 unix:NOTICE:hme3:100 Mbps full-duplex link
up
Mar 10 11:01:11 fuji2 unix:LOG3.0952714871 1080024 1007 5 0
1.0cf:ens
CF (TRACE):Icf:Route UP:node src dest.(0 2 0 0 0 3 0 0 0 3 0 0
0)
```

```
The hme3 device or interconnect temporarily failed.
```

fuji2# **`cftool -n`**

```
Node  Number State       Os      Cpu
fuji2 1      LEFTCLUSTER Solaris Sparc
fuji3 2      UP          Solaris Sparc
```

Problem:

`/dev/hme3` is not configured on node `fuji2`.

```
Mar 10 11:00:28 fuji2 unix: WARNING: hme3: no MII link detected
Mar 10 11:00:53 fuji2 unix: NOTICE: hme3: 100 Mbps full-duplex
link up
```

Diagnosis:

Look in `/var/adm/messages` on node `fuji2`:

```
Mar 10 11:00:28 fuji2 unix: WARNING: hme3: no MII link detected
Mar 10 11:00:31 fuji2 unix:  LOG3.0952714831 1080024   1008 4
0    1.0cf:ens          CF: Icf Error: (service err_type
route_src route_dst). (0 0 0 0 0 2 0 0 0 3 0 0 0 3 0 0 0)
Mar 10 11:00:53 fuji2 unix: NOTICE: hme3: 100 Mbps full-duplex
link up
Mar 10 11:01:11 fuji2 unix:  LOG3.0952714871 1080024   1007 5
0    1.0cf:ens          CF (TRACE): Icf: Route UP: node src
dest. (0 2 0 0 0 3 0 0 0 3 0 0 0)
```

Problem:

The `hme3` device or interconnect temporarily failed. It could be the NIC on either of the cluster nodes or a cable or hub problem.

Node in LEFTCLUSTER state

IF SF is not configured, and node `fuji2` panicked and has rebooted. The following console message appears on node `fuji2`:

```
Mar 10 11:23:41 fuji2 unix:  LOG3.0952716221 1080024   1012 4
0    1.0
cf:ens          CF: fuji2: busy: local node not down: retrying.
```

Diagnosis:

Look in `/var/adm/messages` on node `fuji2`:

```
Mar 10 11:23:41 fuji2 unix:  LOG3.0952716221 1080024   1007 5
0    1.0     cf:ens          CF (TRACE): JoinServer: Startup.
Mar 10 11:23:41 fuji2 unix:  LOG3.0952716221 1080024   1009 5
0    1.0     cf:ens          CF: Giving UP Mastering (Cluster
already Running).
Mar 10 11:23:41 fuji2 unix:  LOG3.0952716221 1080024   1012 4
0    1.0     cf:ens         CF: Join postponed, server fuji3 is
busy.
```

… last message repeats.

No new messages on console or in `/var/adm/messages` on `fuji2`:

fuji2: **`cftool -n`**

```
Node    Number State       Os      Cpu
fuji2   1      LEFTCLUSTER Solaris Sparc
fuji3   2      UP          Solaris Sparc
```

Identified problem:

Node `fuji2` has left the cluster and has not been declared `DOWN`.

Fix:

To fix this problem, enter the following command:

\# **`cftool -k`**

This option will declare a node down. Declaring an operational node down can result in catastrophic consequences, including loss of data in the worst case. If you do not wish to declare a node down, quit this program now.

```
Enter node number: 1
Enter name for node #1: fuji2
cftool(down): declaring node #1 (fuji2) down
cftool(down): node fuji2 is down
```

The following console messages then appear on node `fuji2`:

```
Mar 10 11:34:21 fuji2 unix:  LOG3.0952716861 1080024   1005 5
0    1.0
cf:ens          CF: MYCLUSTER: fuji2 is Down. (0 1 0)
Mar 10 11:34:29 fuji2 unix:  LOG3.0952716869 1080024   1004 5
0    1.0
cf:ens          CF: Node fuji2 Joined Cluster MYCLUSTER. (0 1 0)
```

The following console message appears on node `fuji2`:

```
Mar 10 11:32:37 fuji2 unix:  LOG3.0952716757 1080024   1004 5
0    1.0
cf:ens          CF: Node fuji2 Joined Cluster MYCLUSTER. (0 1 0)
```

11.3 PCI Hot Plug

The `cfrecon` command, with certain restrictions, allows you to deconfigure an active network interface card (NIC) so that you can replace it. This procedure is called PCI Hot Plug (PHP). After the device has been replaced and reconfigured, you can then add the cluster interconnect back into the cluster configuration without ever having to bring the node to the `DOWN` state.

For example, to change the NIC on `fuji2` for `/dev/hme0`, proceed as follows:

1. Identify the PCI slot for `/dev/hme0`. Refer to the PRIMECLUSTER *DR/PCI Hot Plug User's Guide* for details.
2. Unconfigure the CF routes for this NIC as follows:

   fuji2# **`cfrecon -d /dev/hme0`**

3. Run PHP commands. Refer to the PRIMECLUSTER *DR/PCI Hot Plug User's Guide* for details.
4. Remove the defective NIC and replace it with the new one.
5. Continue with additional PHP commands. Refer to the PRIMECLUSTER *DR/PCI Hot Plug User's Guide* for details.
6. Configure CF routes for the replacement NIC as follows:

   # **`cfrecon -a /dev/hme0`**

11.4 Collecting troubleshooting information

If a failure occurs in the PRIMECLUSTER system, collect the following information required for investigations from all cluster nodes. Then, contact your local customer support.

1. Obtain the following PRIMECLUSTER investigation information:
   - Use `fjsnap` to collect information required for error investigations.
   - Retrieve the system dump.
   - Collect the Java Console on the clients.

     Refer to the Java console documentation in the *Web-Based Admin View Operation Guide*.
   - Collect screen shots on the clients.

     Refer to the screen hard copy documentation in the *Web-Based Admin View Operation Guide*.
2. In case of application failures, collect such investigation material.
3. If the problem is reproducible, then include a description on how it can be reproduced.

i It is essential that you collect the debugging information described in this section. Without this information, it may not be possible for customer support to debug and fix your problem.

i Be sure to gather debugging information from all nodes in the cluster. It is very important to get this information (especially the `fjsnap` data) as soon as possible after the problem occurs. If too much time passes, then essential debugging information may be lost.

i If a node is panicked, execute `sync` in OBP mode and take a system dump.

11.4.1 Executing the fjsnap command

The `fjsnap` command is a system information tool provided with the Enhanced Support Facility `FJSVsnap` package. In the event of a failure in the PRIMECLUSTER system, the necessary error information can be collected to pinpoint the cause.

Execute the `fjsnap` command as follows:

1. Log in as root.
2. Execute one of the following `fjsnap` commands:

   # **`/opt/FJSVsnap/bin/fjsnap -h`** *output*

   # **`/opt/FJSVsnap/bin/fjsnap -a`** *output*

   – As `-a` collects all detailed information, the data is very large. When `-h` is specified, only information relative to PRIMECLUSTER is collected.

   – In *output*, specify the special file name or output file name (for example, `/dev/rmt/0`) of the output medium to which the error information collected with the `fjsnap` command is written.

   For details about the `fjsnap` command, see the `README` file included in the `FJSVsnap` package.

When to run `fjsnap`:

- If an error message appears during normal operation, execute `fjsnap` immediately to collect investigation material.
- If the necessary investigation material cannot be collected because of a hang, shut down the system, and start the system in single mode. Execute the `fjsnap` command to collect information.
- If the system has rebooted automatically to multi-user mode, then execute the `fjsnap` command to collect information.

11.4.2 System dump

If the system dump is collected while the node is in panicked, retrieve the system dump as investigation material. The system dump is saved as a file during the node's startup process. The default destination directory is `/var/crash/`*node_name*.

11.4.3 SCF dump

You need to collect the System Control Facility (SCF) dump if one of the following messages is output:

`7003`	`An error was detected in RCI.` `(node:`***nodename*** `address:`***address*** `status:`***status***`)`
`7004`	`The RCI monitoring agent has been stopped due to an RCI address error.` `(node:`***nodename*** `address:`***address***`)`

A message from the SCF driver

The SCF dump is output to the following locations:

- `/var/opt/FJSVhwr/scf.dump`

  The RAS monitoring daemon, which is notified of a failure from SCF, stores SCF dump in the `/var/opt/FJSVhwr/scf.dump` file. You can collect SCF dump messages by executing the following commands:

  \# **`cd /var/opt`**

  \# **`tar cf /tmp/scf.dump.tar ./FJSVhwr`**

- /`var/opt/FJSVcsl/log/` on models with SMC (System Management Console) connected

  You can collect SCF dump using the `getscfdump` command on models with SMC connected. For details about this command, refer to the *System Console Software User's Guide*.

i Refer to the *Enhanced Support Facility User's Guide* for details on SCF driver messages.

12 CF messages and codes

This chapter is a printed version of information that can be found on the PRIME-CLUSTER CD.

This chapter discusses the following:

- The Section “cfconfig messages” discusses the `cfconfig`(1M) command and it’s error messages.
- The Section “cipconfig messages” describes the `cipconfig`(1M) command and it’s messages.
- The Section “cftool messages” details the `cftool`(1M) command and it’s messages.
- The Section “rcqconfig messages” discusses the `rcqconfig`(1M) command and it’s messages.
- The Section “rcqquery messages” describes the `rcqquery`(1M) command and it’s messages.
- The Section “CF runtime messages” discusses CF runtime messages.
- The Section “CF Reason Code table” lists CF reason codes.
- The Section “Error messages for different systems” provides a pointer for accessing error messages for different systems.
- The Section “Solaris ERRNO table” lists error messages for Solaris by number.
- The Section “Resource Database messages” explains the Resource Database messages.
- The Section “Shutdown Facility” lists messages, causes, and actions.
- The Section “Monitoring Agent messages” details the MA messages.
- The Section “CCBR messages” provides information on CCBR messages.

The following lexicographic conventions are used in this chapter:

- Messages that will be generated on `stdout` or `stderr` are shown on the first line(s).
- Explanatory text is given after the message.
- Messages that will be generated in the system-log file and may optionally appear on the console are listed after the explanation.

- Message text tokens shown in a italic font style are placeholders for substituted text.
- Many messages include a token of the form `#0407`, which always denotes a hexadecimal reason code. Section “CF Reason Code table” has a complete list of these codes.

12.1 cfconfig messages

The `cfconfig`(1M) command will generate an error message on `stderr` if an error occurs. Additional messages giving more detailed information about this error may be generated by the support routines in the `libcf` library. However, these additional messages will only be written to the system log file, and will not appear on `stdout` or `stderr`.

Refer to the `cfconfig`(1M) manual page for an explanation of the command options and the associated functionality. The `cfconfig`(1M) manual page also describes the format of all non-error related command output.

12.1.1 Usage message

A usage message will be generated if:

- Multiple `cfconfig`(1M) options are specified (all options are mutually exclusive).
- An invalid `cfconfig`(1M) option is specified.
- No `cfconfig`(1M) option is specified.
- The `-h` option is specified.

`Usage:`

`cfconfig [-d|-G|-g|-h|-L|-l|-S` *nodename clustername device* [*device* [...]] |-s *clustername device* [*device* `[...]]|-u]`

```
    -d delete configuration
    -g get configuration
    -G get configuration including address information
    -h help
    -L fast load (use configured devicelist)
    -l load
    -S set configuration (including nodename)
    -s set configuration
    -u unload
```

A device can ether be a network device or an IP device like `/dev/ip[0-3]` followed by the IP-Address and Broadcast Address number.

12.1.2 Error messages

cfconfig –l

```
cfconfig: cannot load: #0423: generic: permission denied
```

The CF startup routine has failed. This error message usually indicates that an unprivileged user has attempted to start CF. You must have administrative privileges to start, stop, and configure CF. An additional error message, for this case, will also be generated in the system-log file:

```
OSDU_start: failed to open /dev/cf (EACCES)
```

```
cfconfig: cannot load: #041f: generic: no such file or
directory
cfconfig: check that configuration has been specified
```

The CF startup routine has failed. This error message usually indicates that the CF configuration file `/etc/default/cluster` cannot be found. Additional error messages, for this case, may also be generated in the system-log file:

```
OSDU_getconfig: failed to open config file (errno)
OSDU_getconfig: failed to stat config file (errno)
```

```
cfconfig: cannot load: #0405: generic: no such device/resource
cfconfig: check if configuration entries match node's device
list
```

The CF startup routine has failed. This error message usually indicates that the CF configuration file does not match the physical hardware (network interfaces) installed in/on the node.

`cfconfig: cannot load: #04`*xx*`: generic:` *reason_text*

The CF startup routine has failed. One cause of an error message of this pattern is that the CF cluster configuration file has been damaged or is missing. If you think this is the case, delete and then re-specify your cluster configuration information, and try the command again. If the same error persists, see below.

Additional error messages, for this case, will also be generated in the system-log file:

```
OSDU_getconfig: corrupted config file
OSDU_getconfig: failed to open config file (errno)
```

```
OSDU_getconfig: failed to stat config file (errno)
OSDU_getconfig: read failed (errno)
```

Another cause of an error message of this pattern is that the CF driver and/or other kernel components may have somehow been damaged. Remove and then re-install the CF package. If this does not resolve the problem, contact your customer support representative. Additional error messages, for this case, will also be generated in the system-log file:

```
OSDU_getconfig: malloc failed
OSDU_getstatus: mconn status ioctl failed (errno)
OSDU_nodename: malloc failed
OSDU_nodename: uname failed (errno)
OSDU_start: failed to get configuration
OSDU_start: failed to get nodename
OSDU_start: failed to kick off join
OSDU_start: failed to open /dev/cf (errno)
OSDU_start: failed to open /dev/mconn (errno)
OSDU_start: failed to select devices
OSDU_start: failed to set clustername
OSDU_start: failed to set nodename
OSDU_start: icf_devices_init failed
OSDU_start: icf_devices_setup failed
OSDU_start: IOC_SOSD_DEVSELECTED ioctl failed
OSDU_start: netinit failed
```

If the device driver for any of the network interfaces to be used by CF responds in an unexpected way to DLPI messages, additional message output (in the system-log) may occur, with no associated command error message. These messages may be considered as warnings, unless a desired network interface cannot be configured as a cluster interconnect. These messages are:

```
dl_attach: DL_ACCESS error
dl_attach: DL_ATTACH_REQ putmsg failed (errno)
dl_attach: DL_BADPPA error
dl_attach: DL_OUTSTATE error
dl_attach: DL_SYSERR error
dl_attach: getmsg for DL_ATTACH response failed (errno)
dl_attach: unknown error
dl_attach: unknown error hexvalue
dl_bind: DL_ACCESS error
dl_bind: DL_BADADDR error
dl_bind: DL_BIND_REQ putmsg failed (errno)
dl_bind: DL_BOUND error
dl_bind: DL_INITFAILED error
dl_bind: DL_NOADDR error
dl_bind: DL_NOAUTO error
dl_bind: DL_NOTESTAUTO error
```

```
dl_bind: DL_NOTINIT error
dl_bind: DL_NOXIDAUTO error
dl_bind: DL_OUTSTATE error
dl_bind: DL_SYSERR error
dl_bind: DL_UNSUPPORTED error
dl_bind: getmsg for DL_BIND response failed (errno)
dl_bind: unknown error
dl_bind: unknown error hexvalue
dl_info: DL_INFO_REQ putmsg failed (errno)
dl_info: getmsg for DL_INFO_ACK failed (errno)
```

It is also possible that while CF is examining the kernel device tree, looking for eligible network interfaces, that a device or streams responds in an unexpected way. This may trigger additional message output in the system-log, with no associated command error message. These messages may be considered as warnings, unless a desired network interface cannot be configured as a cluster interconnect. These messages are:

```
get_net_dev: cannot determine driver name of nodename device
get_net_dev: cannot determine instance number of nodename device
get_net_dev: device table overflow - ignoring /dev/drivernameN
get_net_dev: dl_attach failed: /dev/drivernameN
get_net_dev: dl_bind failed: /dev/drivernameN
get_net_dev: dl_info failed: /dev/drivername
get_net_dev: failed to open device: /dev/drivername (errno)
get_net_dev: not an ethernet device: /dev/drivername
get_net_dev: not DL_STYLE2 device: /dev/drivername
icf_devices_init: cannot determine instance number of drivername device
icf_devices_init: device table overflow − ignoring /dev/scin
icf_devices_init: di_init failed
icf_devices_init: di_prom_init failed
icf_devices_init: dl_bind failed: /dev/scin
icf_devices_init: failed to open device: /dev/scin (errno)
icf_devices_init: no devices found
icf_devices_select: devname device not found
icf_devices_select: fstat of mc1x device failed: /devices/pseudo/icfn − devname (errno)
icf_devices_select: mc1_select_dev failed: /devices/pseudo/icfn - devname (errno)
icf_devices_select: open of mc1x device failed: /devices/pseudo/icfn - devname (errno)
icf_devices_setup: calloc failed: devname
icf_devices_setup: failed to create mc1x dev: /devices/pseudo/icfn - devname (errno)
icf_devices_setup: failed to open /dev/kstat (errno)
```

```
  icf_devices_setup: failed to open mc1x device: /devices/
pseudo/icfn - devname (errno)
  icf_devices_setup: failed to stat mc1x device: /dev/mc1x
(errno)
  icf_devices_setup: failed to stat mc1x device: /devices/
pseudo/icfn - devname (errno)
  icf_devices_setup: I_LIST failed: devname
(errno)icf_devices_setup: I_LIST 0 failed: devname (errno)
  icf_devices_setup: I_PLINK failed: /devices/pseudo/icfn -
devname (errno)
  icf_devices_setup: I_POP failed: devname (errno)
  icf_devices_setup: I_PUSH failed: devname (errno)
  icf_devices_setup: mc1_set_device_id failed: /devices/pseudo/
icfn - devname (errno)
  icf_devices_setup: mc1x_get_device_info failed: /devices/
pseudo/icfn - devname (errno)
  icf_devices_setup: mc1x device already linked: /devices/
pseudo/icfn - devname (errno)
  icf_devices_setup: mc1x not a device
  mc1_select_device: MC1_IOC_SEL_DEV ioctl failed (errno)
  mc1_set_device_id: MC1_IOC_SET_ID ioctl failed (errno)
  mc1x_get_device_info: MC1X_IOC_GET_INFO ioctl failed (errno)
```

cfconfig –u

```
cfconfig: cannot unload: #0406: generic: resource is busy
cfconfig: check if dependent service—layer module(s) active
```

The CF shutdown routine has failed. This error message is generated if a PRIMECLUSTER Layered Service still has a CF resource active/allocated. RMS, SIS, OPS, CIP, and so forth, need to be stopped before CF can be unloaded. Please refer to the layered-products software `README` file on how to stop these software. An additional error message, for this case, will also be generated in the system-log file:

```
  OSDU_stop: failed to unload cf_drv
```

In the special case where the `cfconfig`(1M) command was called by a shutdown script that is rebooting the system, the following additional error message is generated in the system-log file:

```
OSDU_stop: runlevel now n: sent EVENT_NODE_LEAVING_CLUSTER
(#xxxx)
```

```
cfconfig: cannot unload: #0423: generic: permission denied
```

The CF shutdown routine has failed. This error message usually indicates that an unprivileged user has attempted to stop CF. You must have administrative privileges to start, stop, and configure CF. An additional error message, for this case, will also be generated in the system-log file:

```
OSDU_stop: failed to open /dev/cf (EACCES)
```

`cfconfig: cannot unload: #04`*xx*`: generic:` *reason_text*

The cause of an error message of this pattern is that the CF driver and/or other kernel components may have somehow been damaged. Remove and then re-install the CF package. If this does not resolve the problem, contact your customer support representative. Additional error messages, for this case, will also be generated in the system-log file:

```
  mc1x_get_device_info: MC1X_IOC_GET_INFO ioctl failed (errno)
  OSDU_stop: disable unload failed
  OSDU_stop: enable unload failed
  OSDU_stop: failed to open /dev/cf (errno)
  OSDU_stop: failed to open mc1x device: /devices/pseudo/icfn
(errno)
  OSDU_stop: failed to unlink mc1x device: /devices/pseudo/icfn
(errno)
  OSDU_stop: failed to unload cf_drv
  OSDU_stop: failed to unload mc1 module
  OSDU_stop: failed to unload mc1x driver
  OSDU_stop: mc1x_get_device_info failed: /devices/pseudo/icfn
```

cfconfig –s
cfconfig -S

```
cfconfig: specified nodename: bad length: #407: generic: invalid
parameter
```

This usually indicates that nodename is too long. The maximum length is 31 characters.

```
cfconfig: invalid nodename: #407: generic: invalid parameter
```

This indicates that nodename contains one or more non-printable characters.

```
cfconfig: node already configured: #0406: generic: resource is
busy
```

This error message usually indicates that there is an existing CF configuration. To change the configuration of a node, you must first delete (`cfconfig -d`) any pre-existing configuration. Also, you must have administrative privileges to start, stop, and configure CF. A rare cause of this error would be that the CF driver and/or other kernel components have somehow been damaged. If you believe this is the case, remove and then re-install the CF package. If this does not resolve the problem, contact your customer support representative. Additional error messages may also be generated in the system-log file:

```
  OSDU_getconfig: corrupted config file
  OSDU_getconfig: failed to open config file (errno)
  OSDU_getconfig: failed to stat config file (errno)
  OSDU_getconfig: malloc failed
  OSDU_getconfig: read failed (errno)
```

`cfconfig: too many devices specified: #0407: generic: invalid parameter`

Too many devices have been specified on the command line. The current limit is set to 255.

`cfconfig: clustername cannot be a device: #0407: generic: invalid parameter`

This error message indicates that “clustername,” is a CF-eligible device. This usually means that the clustername has accidentally been omitted.

`cfconfig: invalid clustername: #0407: generic: invalid parameter`

This error message indicates that clustername is a CF-eligible device.

`cfconfig: duplicate device names specified: #0407: generic: invalid parameter`

This error message indicates that duplicate device names have been specified on the command line. This is usually a typographical error, and it is not permitted to submit a device name more than once.

`cfconfig: device [device […]]: #0405: generic: no such device/resource`

This error message indicates that the specified device names are not CF-eligible devices. Only those devices displayed by `cftool -d` are CF-eligible devices.

`cfconfig: cannot open mconn: #04`*`xx`*`: generic: `*`reason_text`*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

`cfconfig: cannot set configuration:`
`#04`*`xx`*`: generic: `*`reason_text`*

This message can occur if concurrent `cfconfig -s` or `cfconfig –S` commands are being run. Otherwise, it should not occur unless the CF driver and/or other kernel components have somehow been damaged. If this is the case, remove and then re-install the CF package. If the problem persists, contact your customer support representative. Additional error messages may also be generated in the system-log file:

```
  OSDU_setconfig: config file exists
  OSDU_setconfig: failed to create config file (errno)
  OSDU_setconfig: write failed (errno)
```

`cfconfig: cannot get new configuration: #04`*`xx`*`: generic:` *`reason_text`*

This message indicates that the saved configuration cannot be read back. This may occur if concurrent `cfconfig -s` or `cfconfig –S` commands are being run, or if disk hardware errors are reported. Otherwise, it should not occur unless the CF driver and/or other kernel components have somehow been damaged. If this is the case, remove and then re-install the CF package. If the problem persists, contact your customer support representative. Additional error messages may also be generated in the system-log file:

```
  OSDU_getconfig: corrupted config file
  OSDU_getconfig: failed to open config file (errno)
  OSDU_getconfig: failed to stat config file (errno)
  OSDU_getconfig: malloc failed
  OSDU_getconfig: read failed (errno)
```

`cfconfig: cannot load: #04`
`xx``: generic:` *`reason_text`*

This error message indicates that the device discovery portion of the CF startup routine has failed. (See error messages associated with `cfconfig –l` above).

cfconfig –g

`cfconfig: cannot get configuration: #04`*xx*`: generic:` *reason_text*

This message indicates that the CF configuration cannot be read. This may occur if concurrent `cfconfig`(1M) commands are being run, or if disk hardware errors are reported. Otherwise, it should not occur unless the CF driver and/or other kernel components have somehow been damaged. If this is the case, remove and then re-install the CF package. If the problem persists, contact your customer support representative. Additional error messages may also be generated in the system-log file:

```
  OSDU_getconfig: corrupted config file
  OSDU_getconfig: failed to open config file (errno)
  OSDU_getconfig: failed to stat config file (errno)
  OSDU_getconfig: malloc failed
```

`OSDU_getconfig: read failed (`*errno*`)`

cfconfig –d

`cfconfig: cannot get joinstate: #0407: generic: invalid parameter`

This error message usually indicates that the CF driver and/or other kernel components have somehow been damaged. remove and then re-install the CF package. If this does not resolve the problem, contact your customer support representative.

`cfconfig: cannot delete configuration: #0406: generic: resource is busy`

This error message is generated if CF is still active (i.e., if CF resource(s) are active/allocated). The configuration node may not be deleted while it is an active cluster member.

`cfconfig: cannot delete configuration: #04`*xx*`: generic:` *reason_text*

You must have administrative privileges to start, stop, and configure CF. A rare cause of this error would be that the CF driver and/or other kernel components have somehow been damaged. If you believe this is the case, remove and then re-install the CF package. If this does not resolve the problem, contact your customer support representative. An additional error message will also be generated in the system-log file:

`OSDU_delconfig: failed to delete config file (`*errno*`)`

12.2 cipconfig messages

The `cipconfig`(1M) command will generate an error message on `stderr` if an error occurs. Additional error messages giving more detailed information about the error may be generated by the support routines of the `libcf` library. However, these additional messages will only be written to the system-log file, and will not appear on `stdout` or `stderr`.

Refer to the `cipconfig`(1M) manual page for an explanation of the command options and associated functionality. The `cipconfig`(1M) manual page also describes the format of all non-error related command output.

12.2.1 Usage message

A usage message will be generated if:

- Multiple `cipconfig`(1M) options are specified (all options are mutually exclusive).
- An invalid `cipconfig`(1M) option is specified.
- No `cipconfig`(1M) option is specified.
- The `-h` option is specified.

```
usage: cipconfig [-l|-u|-h]
      -l start/load
      -u stop/unload
       -h help
```

12.2.2 Error messages

cipconfig –l

`cipconfig: could not start CIP - detected a problem with CF.`
`cipconfig: cannot open mconn: #04`*xx*`: generic:` *reason_text*

These messages should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

`cipconfig: cannot setup cip: #04`*xx*`: generic:` *reason_text*

The cip startup routine(s) have failed. There may be problems with the configuration file. Additional error messages will be generated in the system-log file:

`OSDU_cip_start: cip kickoff failed (`*errno*`)`
`OSDU_cip_start: dl_attach failed:` *devpathn*
`OSDU_cip_start: dl_bind failed:` *devpathn*
`OSDU_cip_start: dl_info failed:` *devpath*
`OSDU_cip_start: failed to open device: /dev/cip (`*errno*`)`
`OSDU_cip_start: failed to open device:` *devpath* (*errno*`)`
`OSDU_cip_start: I_PLINK failed:` *devpath* (*errno*`)`
`OSDU_cip_start: POPing module failed:` *errno*
`OSDU_cip_start: ppa` *n* is not valid: *devpath*
`OSDU_cip_start: setup controller/speed failed:` *devpath* (*errno*`)`

If the device driver for any of the network interfaces used by CIP responds in an unexpected way to DLPI messages, additional message output may occur:

```
dl_info: DL_INFO_REQ putmsg failed (errno)
dl_info: getmsg for DL_INFO_ACK failed (errno)
dl_attach: DL_ACCESS error
dl_attach: DL_ATTACH_REQ putmsg failed (errno)
dl_attach: DL_BADPPA error
dl_attach: DL_OUTSTATE error
dl_attach: DL_SYSERR error
dl_attach: getmsg for DL_ATTACH response failed (errno)
dl_attach: unknown error
dl_attach: unknown error hexvalue
dl_bind: DL_ACCESS error
dl_bind: DL_BADADDR error
dl_bind: DL_BIND_REQ putmsg failed (errno)
dl_bind: DL_BOUND error
dl_bind: DL_INITFAILED error
dl_bind: DL_NOADDR error
dl_bind: DL_NOAUTO error
dl_bind: DL_NOTESTAUTO error
dl_bind: DL_NOTINIT error
dl_bind: DL_NOXIDAUTO error
dl_bind: DL_OUTSTATE error
dl_bind: DL_SYSERR error
dl_bind: DL_UNSUPPORTED error
dl_bind: getmsg for DL_BIND response failed (errno)
dl_bind: unknown error
dl_bind: unknown error hexvalue
```

If these messages appear and they do not seem to be associated with problems in your CIP configuration file, contact your customer support representative.

cipconfig –u

`cipconfig: cannot unload cip: #04`*xx*`: generic: `*reason_text*

The CIP shutdown routine has failed. Usually this mean that another PRIMECLUSTER Layered Service has a CIP interface open (active). It must be stopped first. Additional error messages may be generated in the system-log file:

```
OSDU_cip_stop: failed to unload cip driver
OSDU_cip_stop: failed to open device: /dev/cip (errno)
```

12.3 cftool messages

The `cftool`(1M) command will generate an error message on `stderr` if an error condition is detected. Additional messages, giving more detailed information about this error, may be generated by the support routines of the `libcf` library. Note that these additional error messages will only be written to the system-log file, and will not appear on `stdout` or `stderr`.

Refer to the `cftool`(1M) manual page for an explanation of the command options and the associated functionality. The `cftool`(1M) manual page also describes the format of all non-error related command output.

12.3.1 Usage message

A usage message will be generated if:

- Conflicting `cftool`(1M) options are specified (some options are mutually exclusive).
- An invalid `cftool`(1M) option is specified.
- No `cftool`(1M) option is specified.
- The `-h` option is specified.

```
usage: cftool [-c][-l][-n][-r][-d][-v][-p][-e][-i nodename][-A
cluster][-T timeout][-F][-C count][-I nodename][-E xx.xx.xx.xx.xx.xx][-
P][-m][-u][-k][-q][-h]
```

```
-c                      clustername
-l                      local nodeinfo
-n                      nodeinfo
-r                      routes
-d                      devinfo
-v                      version
-p                      ping
-e                      echo
-i                      icf stats for nodename
-m                      mac stats
-u                      clear all stats
-k                      set node status to down
-q                      quiet mode
-h                      help
-F                      flush ping queue. Be careful, please
```

```
-T timeout              millisecond ping timeout
-I                      raw ping test by node name
-P                      raw ping
-A cluster              ping all interfaces in one cluster
-E xx.xx.xx.xx.xx.xx    raw ping by 48-bit physical address
-C count               stop after sending count raw ping messages
```

A device can either be a network device or an IP device like `/dev/ip[0-3]` followed by IP address and broadcast address.

12.3.2 Error messages

`cftool: CF not yet initialized`

cftool –c

`cftool: failed to get cluster name:` *#xxxx*`: service:` *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –d

`cftool: cannot open mconn: #04`*xx*`: generic:` *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –e

`cftool: cannot open mconn: #04`*xx*`: generic:` *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –i nodename

`cftool:` *nodename*`: No such node`
`cftool: cannot get node details:` *#xxxx*`: service:` *reason_text*

Either of these messages indicates that the specified nodename is not an active cluster node at this time.

`cftool: cannot open mconn: #04`*xx*`: generic:` *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –k

`cftool(down): illegal node number`

This message indicates that the specified node number is non-numeric or is out of allowable range (1–64).

`cftool(down): not executing on active cluster node`

This message is generated if the command is executed either on a node that is not an active cluster node or on the specified `LEFTCLUSTER` node itself.

```
cftool(down): cannot declare node down: #0426: generic:
invalid node name
cftool(down): cannot declare node down: #0427: generic:
invalid node number
cftool(down): cannot declare node down: #0428: generic: node
is not in LEFTCLUSTER state
```

One of these messages will be generated if the supplied information does not match an existing cluster node in `LEFTCLUSTER` state.

`cftool(down): cannot declare node down: #`*xxxx*`: service:`
reason_text

Other variations of this message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –l

`cftool: cannot get nodename: #04`*xx*`: generic:` *reason_text*
`cftool: cannot get the state of the local node: #04`*xx*`: generic:`
reason_text

These messages should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –m

cftool: cannot open mconn: #04*xx*: generic: *reason_text*
cftool: cannot get icf mac statistics: #04*xx*: generic: *reason_text*

These messages should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –n

cftool: cannot get node id: #*xxxx*: service: *reason_text*
cftool: cannot get node details: #*xxxx*: service: *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –p

cftool: cannot open mconn: #04*xx*: generic: *reason_text*

This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –r

cftool: cannot get node details: #*xxxx*: service: *reason_text*

These messages should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –u

cftool: cannot open mconn: #04*xx*: generic: *reason_text*
cftool: clear icf statistics: #04*xx*: generic: *reason_text*

These messages should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

cftool –v

`cftool: cannot open mconn: #04`*xx*`: generic:` *reason_text*
`cftool: unexpected error retrieving version: #04`*xx*`: generic:` *reason_text*

These messages should not occur unless the CF driver and/or other kernel components are damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

12.4 rcqconfig messages

The `rcqconfig`(1M) command will generate an error message on standard error if an error condition is detected. Additional messages, giving more detailed information about this error, may be generated by the support routines of the `libcf` library. Please note that these additional error messages will only be written to the system-log file during `cfconfig -l`, and will not appear on standard out or standard error.

Refer to the `rcqconfig`(1M) manual page for an explanation of the command options and the associated functionality.

12.4.1 Usage message

A usage message will be generated if:

- Conflicting `rcqconfig`(1M) options are specified (some options are mutually exclusive).
- An invalid `rcqconfig`(1M) option is specified.
- The ‘–h’ option is specified.

```
usage: rcqconfig [ -g | -h ] or
          rcqconfig -s or
          rcqconfig [ -v ] [ -c ]
               [ -a Add-node-1 ... Add-node-n ]
               [ -x Ignore-node-1 ... Ignore-node-n ]
               [ -d Delete-node-1 ... Delete-node-n ]
               [ -m quorum-method-1 ... quorum-method-n ]
```

12.4.2 Error messages

`rcqconfig -a node-1 node-2 …. node-n`
`-g and -a cannot exist together.`

This error message usually indicates that get configuration option (`-g`) cannot be specified with this option (`-a`). Refer to the manual pages for the correct syntax definition.

`Nodename is not valid nodename.`

This error message usually indicates that the length of the node is less than 1 or greater than 31 bytes. Refer to the manual pages for the correct syntax definition.

`rcqconfig : failed to start`

The following errors will also be reported in standard error if `rcqconfig`(1M) fails to start.

`rcqconfig failed to configure qsm since quorum node set is empty.`

Quorum state machine (qsm) is the kernel module that collects the states of the cluster nodes specified in the quorum node set. This error message usually indicates that the quorum configuration does not exist. Refer to the manual pages for `rcqconfig`(1M) for the correct syntax to configure the quorum nodes.

``cfreg_start_transaction: `#2813: cfreg daemon not present` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the synchronization daemon is not running on the node. The cause of error messages of this pattern may be that the `cfreg` daemon has died and the previous error messages in the system log or console will indicate why the daemon died. Restart the daemon using `cfregd -r`. If it fails again, the error messages associated with it will indicate the problem. The data in the registry is most likely corrupted. If the problem persists, contact your customer service support representative.

``cfreg_start_transaction: `#2815: registry is busy` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the daemon is not in synchronized state or if the transaction has been started by another application. This messages should not occur. The cause of error messages of this pattern is that the registries are not in consistent state. If the problem persists, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem still persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_start_transaction: `#2810: an active transaction exists``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the application has already started a transaction. If the cluster is stable, the cause of error messages of this pattern is that different changes may be done concurrently from multiple nodes. Therefore, it might take longer time to commit. Retry the command again. If the problem persists, the cluster might not be in a stable state. The error messages in the log will indicate the problem. If this is the case, unload the cluster by using `cfconfig -u` and reload the cluster by using cf`config -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Too many nodename are defined for quorum. Max node = 64`

This error message usually indicates that if the number of node specified are more than 64 for which the quorum is to be configured. The following errors will also be reported in standard error if there are too many nodename defined:

`cfreg_get: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This messages should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2819: data or key buffer too small``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size of the data buffer is too small to hold the entire data for the entry. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Cannot add node node that is not up.`

This error message usually indicates that the user is trying to add a node whose state is not up in the NSM node space. Try to bring up the down node or remove the node from the list which quorum is to be configured.

`Cannot proceed. Quorum node set is empty.`

This error message usually indicates that if no node is specified to this option or there is no configured node prior to this call. The following errors will also be reported in standard error if quorum node set is empty:

The following errors will also be reported in standard error if `rcqconfig`(1M) fails to start:

``cfreg_put: `#2809: specified transaction invalid` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This messages should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

``cfreg_put: `#2820: registry entry data too large` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size data is larger than 28K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

```
rcqconfig -s
stopping quorum space methods `#0408: unsuccessful`
```

The `rcqconfig`(1M) routine has failed. This error message usually indicates that there is no method specified.

`rcqconfig -x ignore_node-1 … ignore_node-n`

`−g` and `−x` cannot exist together.

This error message usually indicates that get configuration option (`−g`) cannot be specified with this option (`−x`). Refer to the manual pages for the correct syntax definition.

`Nodename is not valid nodename.`

This error message usually indicates that the length of the node is less than 1 or greater than 31 bytes.

`rcqconfig : failed to start`

The following errors will also be reported in standard error if `rcqconfig`(1M) fails to start:

`` cfreg_start_transaction: `#2813: cfreg daemon not present` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the synchronization daemon is not running on the node. The cause of error messages of this pattern may be that the `cfreg` daemon has died and the previous error messages in the system log or console will indicate why the daemon died. Restart the daemon using `cfregd -r`. If it fails again, the error messages associated with it will indicate the problem. The data in the registry is most likely corrupted. If the problem persists, contact your customer service support representative.

`` cfreg_start_transaction: `#2815: registry is busy` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the daemon is not in synchronized state or if the transaction has been started by another application. This messages should not occur. If the problem persists, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem still persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`` cfreg_start_transaction: `#2810: an active transaction exists` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the application has already started a transaction. If the cluster is stable, the cause of error messages of this pattern is that different changes may be done concurrently from multiple nodes. Therefore, it might take longer time to commit. Retry the command again. If the problem persists, the cluster might not be in a stable state. The error messages in the log will indicate the problem. If this is the case, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Too many ignore node names are defined for quorum. Max node = 64`

This error message usually indicates that if the number of ignore nodes specified are more than 64. The following errors will also be reported in standard error if the ignore node names exceed 64.

`cfreg_get: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This messages should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2804: entry with specified key does not exist``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified entry does not exist. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2819: data or key buffer too small``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size of the data buffer is too small to hold the entire data for the entry. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Can not add node node that is not up.`

This error message usually indicates that the user is trying to add a node whose state is not up in the NSM node space. Try to bring up the down node or remove the node from the list which quorum is to be configured.

`Can not proceed. Quorum node set is empty.`

This error message usually indicates that if no node is specified to this option or there is no configured node prior to this call. The following errors will also be reported in standard error if Quorum node set is empty:

`cfreg_put: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This messages should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2820: registry entry data too large``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the event information (data being passed to the kernel) to be used for other sub-systems) is larger than 32K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2807: data file format is corrupted``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the registry data file format has been corrupted. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cms_post_event: `#0c01: event information is too large``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the event information (data being passed to the kernel) to be used for other sub-systems) is larger than 32K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`rcqconfig -m method_name−1 … method_name −n`

`−g` and `−m` cannot exist together.

This error message usually indicates that get configuration option (-g) cannot be specified with this option (`−x`). Refer to the manual pages for the correct syntax definition.

`Methodname is not valid method name.`

This error message usually indicates that the length of the node is less than 1 or greater than 31 bytes. Refer to the manual pages for the correct syntax definition.

`rcqconfig : failed to start`

The following errors will also be reported in standard error if `rcqconfig`(1M) fails to start:

`cfreg_start_transaction: `#2813: cfreg daemon not present``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the synchronization daemon is not running on the node. The cause of error messages of this pattern may be that the `cfreg` daemon has died and the previous error messages in the system log or console will indicate why the daemon died. Restart the daemon using `cfregd −r`. If it fails again, the error messages associated with it will indicate the problem. The data in the registry is most likely corrupted. If the problem persists, contact your customer service support representative.

`cfreg_start_transaction: `#2815: registry is busy``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the daemon is not in synchronized state or if the transaction has been started by another application. This message should not occur. The cause of error messages of this pattern is that the registries are not in consistent state. If the problem persists, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem still persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_start_transaction: `#2810: an active transaction exists``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the application has already started a transaction. If the cluster is stable, the cause of error messages of this pattern is that different changes may be done concurrently from multiple nodes. Therefore, it might take longer time to commit. Retry the command again. If the problem persists, the cluster might not be in a stable state. If this is the case, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Too many method names are defined for quorum. Max method = 8`

This error message usually indicates that if the number of methods specified are more than 8. The following errors will also be reported in standard error if Quorum method names exceed the limit:

`cfreg_get: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This message should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2804: entry with specified key does not exist``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified entry does not exist. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2819: data or key buffer too small``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size of the data buffer is too small to hold the entire data for the entry. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This messages should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2820: registry entry data too large``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the event information (data being passed to the kernel) to be used for other sub-systems) is larger than 32K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`` cfreg_put: `#2807: data file format is corrupted` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the registry data file format has been corrupted. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`` cms_post_event: `#0c01: event information is too large` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the event information (data being passed to the kernel) to be used for other sub-systems) is larger than 32K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`rcqconfig −d node−1 node−2 …. node−n`

`−g` and `−d` cannot exist together.

This error message usually indicates that get configuration option (`−g`) cannot be specified with this option (`−d`). Refer to the manual pages for the correct syntax definition.

`Nodename is not valid nodename.`

This error message usually indicates that the length of the node is less than 1 or greater than 31 bytes. Refer to the manual pages for the correct syntax definition.

`rcqconfig : failed to start`

The following errors will also be reported in standard error if `rcqconfig`(1M) fails to start:

`` cfreg_start_transaction: `#2813: cfreg daemon not present` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the synchronization daemon is not running on the node. The cause of error messages of this pattern may be that the `cfreg` daemon has died and the previous error messages in the system log or console will indicate why the daemon died. Restart the daemon using `cfregd −r`. If it fails again, the error messages associated with it will indicate the problem. The data in the registry is most likely corrupted. If the problem persists, contact your customer service support representative.

`` cfreg_start_transaction: `#2815: registry is busy` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the daemon is not in synchronized state or if the transaction has been started by another application. This messages should not occur. The cause of error messages of this pattern is that the registries are not in consistent state. If the problem persists, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem still persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`` cfreg_start_transaction: `#2810: an active transaction exists` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the application has already started a transaction. If the cluster is stable, the cause of error messages of this pattern is that different changes may be done concurrently from multiple nodes. Therefore, it might take longer time to commit. Retry the command again. If the problem persists, the cluster might not be in a stable state. If this is the case, unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`Too many nodename are defined for quorum. Max node = 64`

This error message usually indicates that if the number of node specified are more than 64 for which the quorum is to be configured. The following errors will also be reported in standard error if nodename defined exceed the maximum limit:

`` cfreg_get: `#2809: specified transaction invalid` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This message should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`` cfreg_get: `#2804: entry with specified key does not exist` ``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified entry does not exist. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_get: `#2819: data or key buffer too small``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size of the data buffer is too small to hold the entire data for the entry. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2809: specified transaction invalid``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the information supplied to get the specified data from the registry is not valid (e.g. transaction aborted due to time period expiring or synchronization daemon termination, etc.). This message should not occur. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2820: registry entry data too large``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the specified size data is larger than 28K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

`cfreg_put: `#2807: data file format is corrupted``

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the registry data file format has been corrupted. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

```
cms_post_event: `#0c01: event information is too large`
```

The `rcqconfig`(1M) routine has failed. This error message usually indicates that the event information (data being passed to the kernel) to be used for other sub-systems) is larger than 32K. The cause of error messages of this pattern is that the memory image may have somehow been damaged. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

12.5 rcqquery messages

The `rcqquery`(1M) command will generate an error message on stderr if an error condition is detected. Additional messages, giving more detailed information about this error, may be generated by the support routines of the `libcf` library. Please note that these additional error messages will only be written to the system-log file, and will not appear on `stdout` or `stderr`.

Refer to the `rcqquery`(1M) manual page for an explanation of the command options and the associated functionality.

12.5.1 Usage message

A usage message will be generated if:

- An invalid `rcqquery`(1M) option is specified.
- The `-h` option is specified.

```
Usage:    rcqquery [ -v ] [ -l ] [-h]
          -v verbose
          -l loop
          -h help
```

12.5.2 Error messages

```
rcqquery -v -l
failed to register user event
```

`# 0c0b: user level ENS event memory limit overflow`

The `rcqquery`(1M) routine has failed. It usually indicates that either the total amount of memory allocated or the amount of memory allocated for use on a per-open basis exceed the limit. Try to unload the cluster by using `cfconfig -u` and reload the cluster by using `cfconfig -l`. If the problem persists, remove and then re-install the CF package. If this does not resolve the problem, contact your customer service support representative.

12.6 CF runtime messages

All CF runtime messages include an 80-byte ASCII `log3` prefix, which includes a timestamp, component number, error type, severity, version, product name, and structure id. This header is not included in the message descriptions that follow.

All of the following messages are sent to the system-log file, and ‘node up’ and ‘node down’ messages are also sent to the console.

There are some common tokens (shown in bold italic font) substituted into the error and warning messages that follow. If necessary, any not covered by this global explanation will be explained in the text associated with the specific message text.

- *clustername* — The name of the cluster to which the node belongs (or is joining). It is specified in the cluster configuration (see `cfconfig -s`).
- *err_type* — Identifies the type of ICF error reported. There are three types of errors:
  1. Debug (none in released product)
  2. Heartbeat missing
  3. Service error (usually, “route down”)
- *nodename* — The name by which a node is known within a cluster (usually derived from `uname -n`).
- *nodenum* — A unique number assigned to each and every node within a cluster.
- *route_dst* — The ICF route number (at the remote node) associated with a specific route.

- *route_src* — The ICF route number (on the local node) associated with a route. An ICF route is the logical connection established between two nodes over a cluster interconnect.
- *servername* — The nodename of the node acting as a join server for the local (client) node that is attempting to join the cluster.
- *service* — Denotes the ICF registered service number. There are currently over 30 registered ICF services.

This first set of messages are “special” in that they deal with the CF driver basic initialization and de-initialization:

`CF: cf_attach Error: invalid command. (#0425 bad_cmd)`
`CF: cf_attach Error: invalid instance. (#0425` *cf_instance instance*`)`
`CF: cf_attach Error: phase 1 init failure. (#`*reason_code*`)`
`CF: cf_attach Error: phase 2 init failure. (#`*reason_code*`)`
`CF: cf_attach Error: unable to create cf minor.`
`CF: cf_detach Error: invalid instance. (#0425` *cf_instance instance*`)`

These messages are associated with a CF initialization failure. They should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

12.6.1 Alphabetical list of messages

`CF: carp_broadcast_version: Failed to announce version` *cip_version*

This message will occur if CIP fails to initialize successfully, indicating some sort of mismatch between CIP and CF. This message should not occur unless the CF driver and/or other kernel components have somehow been damaged. Remove and then re-install the CF package. If the problem persists, contact your customer support representative.

`CF: carp_event: bad nodeid (#0000` *nodenum*)

This message is generated by CIP when a bad nodenumber is received.

`CF: cip: Failed to register ens EVENT_CIP`

This message is generated when CIP initialization cannot register for the event `EVENT_CIP`.

`CF: cip: Failed to register ens EVENT_NODE_LEFTCLUSTER`

This message is generated when CIP initialization cannot register for the event `EVENT_NODE_LEFTCLUSTER`.

`CF: cip: Failed to register icf channel ICF_SVC_CIP_CTL`

This message is generated when CIP initialization cannot register with ICF for the service `ICF_SVC_CIP_CTL`.

`CF: cip: message SYNC_CIP_VERSION is too short`

This message is generated when CIP receives a garbled message.

`CF: ens_nicf_input Error: unknown msg type received. (#0000` *msgtype*`)`

This message is generated by ENS when a garbled message is received from ICF. The message is dropped.

`CF: Giving UP Mastering (Cluster already Running).`

This message is generated when a node detects a join server and joins an existing cluster, rather than forming a new one. No action is necessary.

`CF: Giving UP Mastering (some other Node has Higher ID).`

This message is generated when a node volunteers to be a join server, but detects an eligible join server with a higher id. No action is necessary.

`CF: Icf Error: (service err_type route_src route_dst). (#0000` *service err-type route_src route_dst*`)`

This message is generated when ICF detects an error. It is most common to see this message in missing heartbeat and route down situations.

`CF: Join client` *nodename* `timed out. (#0000 nodenum)`

This message is generated on a node acting as a join server, when the client node does not respond in time.

`CF: Join Error: Invalid configuration: multiple devs on same LAN.`

This message is generated when a node is attempting to join or form a cluster. Multiple network interconnects cannot be attached to the same LAN segment.

`CF: Join Error: Invalid configuration: asymmetric cluster.`

This message is generated when a node is joining a cluster that has a active node that does not support asymmetric clustering, and has configured an incompatible (asymmetric) set of cluster interconnects.

`CF: Join postponed: received packets out of sequence from` *servername*`.`

This message is generated when a node is attempting to join a cluster, but is having difficulty communicating with the node acting as the join server. Both nodes will attempt to restart the join process.

`CF: Join postponed, server` *servername* `is busy.`

This message is generated when a node is attempting to join a cluster, but the join server is busy with another client node. (Only one join may be active in/on the cluster at a time.) Another reason for this message to be generated is that the client node is currently in `LEFTCLUSTER` state. A node cannot re-join a cluster, unless its state is `DOWN`. (See the `cftool -k` manual page.)

`CF: Join timed out, server` *servername* `did not send node number: retrying.`
`CF: Join timed out, server` *servername* `did not send nsm map: retrying.`
`CF: Join timed out, server` *servername* `did not send welcome message.`

These messages are generated when a node is attempting to join a cluster, but is having difficulty communicating with the node acting as the join server. The join client node will attempt to continue the join process.

`CF: Local node is missing a route from node:` *nodename*
`CF: missing route on local device:` *devicename*

These messages are generated when an asymmetric join has occurred in a cluster, and the local node is missing a route to the new node. The nodename and devicename of the associated cluster interconnect are displayed, in case this is not the desired result.

`CF: Local Node` *nodename* `Created Cluster` *clustername*`. (#0000` *nodenum*`)`

This message is generated when a node forms a new cluster.

`CF: Local Node` *nodename* `Left Cluster` *clustername*.

This message is generated when a node leaves a cluster.

`CF: No join servers found.`

This message is generated when a node cannot detect any nodes willing to act as join servers.

`CF: Node` *nodename* `Joined Cluster` *clustername*. `(#0000` *nodenum*`)`

This message is generated when a node joins an existing cluster.

`CF: Node` *nodename* `Left Cluster` *clustername*`. (#0000` *nodenum*`)`

This message is generated when a node leaves a cluster.

`CF: Received out of sequence packets from join client:` *nodename*

This message is generated when a node, acting as a join server, is having difficulty communicating with the client node. Both nodes will attempt to restart the join process.

`CF: Starting Services.`

This message is generated by CF as it is starting.

`CF: Stopping Services.`

This message is generated by CF as it is stopping.

`CF: User level event memory overflow: Event dropped (#0000` *eventid*`)`

This message is generated when an ENS user event is received, but there is no memory for the event to be queued.

`CF:` *clustername*: *nodename* `is Down. (#0000` *nodenum*`)`

This message is generated when a node has left the cluster in an orderly manner (i.e., `cfconfig -u`).

`CF:` *nodename* `Error: local node has no route to node: join aborted.`

This message is generated when a node is attempting to join a cluster, but detects that there is no route to one or more nodes that are already members of the cluster.

`CF:` *nodename* `Error: no echo response from node: join aborted.`

This message is generated when a node is attempting to join a cluster, but is having difficulty communicating with all the nodes in the cluster.

`CF:` *servername*`: busy: cluster join in progress: retrying`
`CF:` *servername*`: busy: local node not DOWN: retrying`
`CF:` *servername*`: busy mastering: retrying`
`CF:` *servername*`: busy serving another client: retrying`
`CF:` *servername*`: local node's status is UP: retrying`
`CF:` *servername*`: new node number not available: join aborted`

These messages are generated when a node is attempting to join a cluster, but the join server is busy with another client node. (Only one join may be active in/on the cluster at a time.) Another reason for this message to be generated is that the client node is currently in `LEFTCLUSTER` state. A node cannot re-join a cluster, unless its state is DOWN. (See the `cftool -k` manual page.)

`CF (TRACE): cip: Announcing version` *cip_version*

This message is generated when a CIP initialization is complete.

`CF (TRACE): EnsEV: Shutdown`

This message is generated when the ENS event-daemon shuts down.

`CF (TRACE): EnsND: Shutdown`

This message is generated when the ENS node_down-daemon shuts down.

`CF (TRACE): Icf: Route UP: node src dest (#0000` *nodenum route_src route_dst*`)`

This message is generated when an ICF route is (re-)activated.

`CF (TRACE): JoinServer: Stop`

This message is generated when the join server mechanism is deactivated.

`CF (TRACE): JoinServer: Startup`

This message is generated when the join daemon is started.

`CF (TRACE): JoinServer: ShutDown`

This message is generated when an active join daemon shuts down.

`CF (TRACE): Load: Complete`

This message is generated when CF initialization is complete.

12.7 CF Reason Code table

Code	Reason	Service	Text
0401	REASON_SUCCESS		Operation was successful
	/* generic error codes */		
0401	REASON_NOERR	generic	Request not completed
0402	REASON_ALERTED	generic	Interrupted call
0403	REASON_TIMEOUT	generic	Timedout call
0404	REASON_NO_MEMORY	generic	Out of memory
0405	REASON_NO_SUCH_DEVICE	generic	No such device/ resource

Code	Reason	Service	Text
0406	REASON_DEVICE_BUSY	generic	Resource is busy
0407	REASON_INVALID_PARAMETER	generic	Invalid parameter
0408	REASON_UNSUCCESSFUL	generic	Unsuccessful
0409	REASON_ADDRESS_ALREADY_EXISTS	generic	Address already exists
040a	REASON_BAD_ADDRESS	generic	Bad memory address
040b	REASON_INSUFFICIENT_RESOURCES	generic	Insufficient resources
040c	REASON_BUFFER_OVERFLOW	generic	Buffer overflow
040d	REASON_INVALID_OWNER	generic	Invalid owner
040e	REASON_INVALID_HANDLE	generic	Invalid handle
040f	REASON_DUPNAME	generic	Duplicate name
0410	REASON_USAGE	generic	Usage
0411	REASON_NODATA	generic	No data
0412	REASON_NOT_INITIALIZED	generic	Driver not initialized
0413	REASON_UNLOADING	generic	Driver unloading
0414	REASON_REASSEMBLY_DOWN	generic	Sender died while sending data
0415	REASON_WENT_DOWN	generic	Destination node went down
0416	REASON_TRANSMIT_TIMEOUT	generic	Data transmission timeout
0417	REASON_BAD_PORT	generic	Bad destination port
0418	REASON_BAD_DEST	generic	Bad destination
0419	REASON_YANK	generic	Message transmission flushed
041a	REASON_SVC_BUSY	generic	SVC has pending transmissions
041b	REASON_SVC_UNREGISTER	generic	SVC has been unregistered
041c	REASON_INVALID_VERSION	generic	Invalid version
041d	REASON_NOT_SUPPORTED	generic	Function not supported
041e	REASON_EPERM	generic	Not super-user

Code	Reason	Service	Text
041f	REASON_ENOENT	generic	No such file or directory
0420	REASON_EINTR	generic	Interrupted system call
0421	REASON_EIO	generic	I/O error
0422	REASON_ENXIO	generic	No such device or address (I/O req)
0423	REASON_EACCES	generic	Permission denied
0424	REASON_EEXIST	generic	File exists
0425	REASON_DDI_FAILURE	generic	Error in DDI/DKI routine
0426	REASON_INVALID_NODENAME	generic	Invalid node name
0427	REASON_INVALID_NODENUMBER	generic	Invalid node number
0428	REASON_NODE_NOT_LEFTC	generic	Node is not in LEFTCLUSTER state
0429	REASON_CORRUPT_CONFIG	generic	Corrupt/invalid cluster config
042a	REASON_FLUSH	generic	Messages trans-mission flushed
042b	REASON_MAX_ENTRY	generic	Maximum entries reached
042c	REASON_NO_CONFIGURATION	generic	No configuration exists
	/* mrpc reasons */		
0801	REASON_MRPC_CLT_SVCUNAVAIL	mrpc	Service not registered on Client
0802	REASON_MRPC_SRV_SVCUNAVAIL	mrpc	Service not registered on Server
0803	REASON_MRPC_CLT_PROCUNAVAIL	mrpc	Service Procedure not avail on Clt
0804	REASON_MRPC_SRV_PROCUNAVAIL	mrpc	Service Procedure not avail on Srv
0805	REASON_MRPC_INARGTOOLONG	mrpc	Input argument size too big

Code	Reason	Service	Text
0806	REASON_MRPC_OUTARGTOOLONG	mrpc	Output argument size too big
0807	REASON_MRPC_RETARGOVERFLOW	mrpc	Return argument size overflow
0808	REASON_MRPC_VERSMISMATCH	mrpc	Version mismatch
0809	REASON_MRPC_ICF_FAILURE	mrpc	ICF send failed
080a	REASON_MRPC_INTR	mrpc	Interrupted RPC
080b	REASON_MRPC_RECURSIVE	mrpc	Illegal recursive call
080c	REASON_MRPC_SVC_EXIST	mrpc	Service already registered
	/* ens reasons */		
0c01	REASON_ENS_INFOTOOBIG	ens	Event information is too large
0c02	REASON_ENS_TOOSOON	ens	Attempt to post event before `ens_init`
0c03	REASON_ENS_NODEST	ens	Remote or local not specified in howto
0c04	REASON_ENS_DAEMONNOTIFY	ens	Invalid event posting by event daemon
0c05	REASON_ENS_NOICF	ens	Attempt to post remote before ICF config
0c06	REASON_ENS_OLDACKVERS	ens	Old version kernel has acked event
0c07	REASON_ENS_IMPLICITACK	ens	Event handler did not obtain ack handle
0c08	REASON_ENS_ACKNOTREQ	ens	Event acknowledgment not required
0c09	REASON_ENS_NOTEVHANDLER	ens	Obtainer of ack handle not event handler
0c0a	REASON_ENS_NOACKHANDLE	ens	Cannot locate event ack handle

Code	Reason	Service	Text
0c0b	REASON_ENS_MEMLIMIT	ens	User level ENS event memory limit overflow
0c0c	REASON_ENS_DUPREG	ens	Duplicate event registration
0c0d	REASON_ENS_REGNOTFOUND	ens	Event registration not found
0c0e	REASON_ENS_INFOTOOSMALL	ens	Event information size too small
0c0f	REASON_ENS_BADFAILNODE	ens	Node cannot post LEFTCLUSTER or NODE DOWN for itself
	/* nsm */		
1001	REASON_NSM_BADVERSION	nsm	Data structure version mismatch
1002	REASON_NSM_NONODES	nsm	No nodes have been specified
1003	REASON_NSM_TOOMANYNODES	nsm	Too many nodes have been specified
1004	REASON_NSM_BADNODEID	nsm	Node ID out of node name space range
1005	REASON_NSM_BADNETALEN	nsm	Invalid network address length
1006	REASON_NSM_ICFCREATE	nsm	Failure trying to create ICF node
1007	REASON_NSM_ICFDELETE	nsm	Failure trying to delete ICF node
1008	REASON_NSM_BADSTARTNODE	nsm	Invalid starting node specified
1009	REASON_NSM_BADINFOLEN	nsm	Invalid event information length
100a	REASON_NSM_BADCNODEID	nsm	Control node out of name space range

Code	Reason	Service	Text
100b	REASON_NSM_BADCNSTATUS	nsm	Control node status invalid
100c	REASON_NSM_BADANODEID	nsm	Invalid node ID for node being added
100d	REASON_NSM_ADDNODEUP	nsm	Node being added is already operational
100e	REASON_NSM_NONODE	nsm	Node does not exist in the node name space
100f	REASON_NSM_NODEFAILURE	nsm	A node has been declared dead
1010	REASON_NSM_NODETIMEOUT	nsm	Heartbeat timeout has expired for a node
1011	REASON_NSM_BADOUTSIZE	nsm	Invalid value for MRPC outsize
1012	REASON_NSM_BADINSIZE	nsm	Invalid value for MRPC insize
1013	REASON_NSM_BADNDNOTIFY	nsm	Failure to post NODE DOWN event
1014	REASON_NSM_VERSIONERR	nsm	`nsetinfo` versioning error
	/* mrpc */		
1401	REASON_ICF_MRPC_SZSM	icfmrpc	Output argument size too small
1402	REASON_ICF_MRPC_BADNDNUM	icfmrpc	Node does not exist
1403	REASON_ICF_MRPC_BADADDR	icfmrpc	`mesh` address does not exist
	/* user events */		
1801	REASON_UEV_ALREADYOPEN	uev	Process already has event device open
1802	REASON_UEV_TOOMANYEVENTS	uev	Too many user events initialized

Code	Reason	Service	Text
1803	REASON_UEV_BADHANDLE	uev	Invalid user event handle specified
1804	REASON_UEV_NOTOPEN	uev	Process does not have event device open
1805	REASON_UEV_REGISTERED	uev	Duplicate user event registration
	/* node group */		
1c01	REASON_NG_DEF_SYNTAX	ng	Bad definition syntax
1c02	REASON_NG_DUPNAME	ng	Name exists already
1c03	REASON_NG_EXIST	ng	Group does not exist
1c04	REASON_NG_ND_EXIST	ng	Node does not exist
1c05	REASON_NG_NAMELEN	ng	Too long a node name
1c06	REASON_NG_STATE	ng	Unknown parser state
1c07	REASON_NG_NODEINFO	ng	Failed to get up-node info
1c08	REASON_NG_ITER_STALE	ng	Iterator is stale
1c09	REASON_NG_ITER_NOSPACE	ng	Iterator pool exhausted
1c0a	REASON_NG_ITER_NOENT	ng	The end of iteration
1c0b	REASON_NG_MEMBER	ng	Node is not a group member
1c0c	REASON_NG_NOENT	ng	No node is up
1c0d	REASON_NG_UNPACK	ng	Failed to unpack definition
1c0e	REASON_NG_DUPDEF	ng	Identical group definition
	/* distributed mount services */		
2001	REASON_DMS_INVALIDCNG	dms	Invalid client node group
2002	REASON_DMS_MNTINUSE	dms	Mount in use

Code	Reason	Service	Text
2003	REASON_DMS_DEVINUSE	dms	Device in use
2004	REASON_DMS_FSCKFAILED	dms	Failover `fsck` failed
2005	REASON_DMS_MNTFAILED	dms	Failover mount failed
2006	REASON_DMS_MNTBUSY	dms	Mount is busy
2007	REASON_DMS_NOMNTPT	dms	No mount point specified
2008	REASON_DMS_NODBENT	dms	Specified mount point not found
2009	REASON_DMS_BADSTATE	dms	Server is up or failover in progress
200a	REASON_DMS_SUBMOUNT	dms	Specified mount point is CFS submount
200b	REASON_MAX_REASON_VAL	dms	Last reason
	/* join */		
2401	REASON_JOIN_FAILED	join	Node has failed to join cluster
2402	REASON_JOIN_DISABLED	join	Cluster join not started
2403	REASON_JOIN_SHUTDOWN	join	Join daemon shut down
	/* cfreg */		
2801	REASON_CFREG_STOPREQUESTED	cfreg	`cfreg` daemon stop requested
2802	REASON_CFREG_DUPDAEMON	cfreg	`cfreg` daemon already running
2803	REASON_CFREG_BADCONFIG	cfreg	Internal `cfreg` configuration error
2804	REASON_CFREG_NOENTRY	cfreg	Entry with specified key does not exist
2805	REASON_CFREG_COMMITTED	cfreg	Specified transaction committed
2806	REASON_CFREG_NOTOPEN	cfreg	Data file not open

Code	Reason	Service	Text
2807	REASON_CFREG_CORRUPTFILE	cfreg	Data file format is corrupt
2808	REASON_CFREG_NSIERR	cfreg	Internal packaging error
2809	REASON_CFREG_INVALIDTRANS	cfreg	Specified transaction invalid
280a	REASON_CFREG_ACTIVETRANS	cfreg	An active transaction exists
280b	REASON_CFREG_NOREQUESTS	cfreg	No daemon requests available
280c	REASON_CFREG_REQOVERFLOW	cfreg	Daemon request buffer overflow
280d	REASON_CFREG_NODAEMON	cfreg	cfreg daemon not present
280e	REASON_CFREG_BADREQUEST	cfreg	Unknown daemon request
280f	REASON_CFREG_REGBUSY	cfreg	Register is busy
2810	REASON_CFREG_REGOWNED	cfreg	Registry is owned
2811	REASON_CFREG_INVALIDUPDATE	cfreg	Invalid update
2812	REASON_CFREG_INVALIDKEY	cfreg	Invalid registry key
2813	REASON_CFREG_OVERFLOW	cfreg	Data or key buffer too small
2814	REASON_CFREG_TOOBIG	cfreg	Registry entry data too large
	/* cflog Message Catalogs */		
2c01	REASON_CFLOG_NOCAT	cflog	cflog could not open message catalog
	/* qsm Message Catalogs */		
3001	REASON_QSM_DUPMETHODNAME	qsm	Duplicate quorum method name
3002	REASON_QSM_TRYAGAIN	qsm	Need to try again later

Code	Reason	Service	Text
3003	REASON_QSM_BUSY	qsm	Method has been registered already
3004	REASON_QSM_IDLE	qsm	Method has not been registered
3005	REASON_QSM_STOP	qsm	qsm stop requested
	/* sens */		
3401	REASON_SENS_BADSEQ	sens	Invalid sequence number
3402	REASON_SENS_TOOSOON	sens	SENS not initialized
3403	REASON_SENS_DUPACK	sens	Duplicate registration for completion ack
3404	REASON_SENS_NOREG	sens	Registration does not exist
3405	REASON_SENS_BADMAP	sens	Node missing from node map
3406	REASON_SENS_NOUREG	sens	User event registration does not exist
3407	REASON_SENS_NOUEVENT	sens	Event not received
	/* CFRS */		
3801	REASON_CFRS_BADFCPSRCCONF	cfrs	cfcp not configured on source node
3802	REASON_CFRS_BADFCPDSTCONF	cfrs	cfcp not configured on destination node
3803	REASON_CFRS_BADEXECSRCCONF	cfrs	cfsh not configured on source node
3804	REASON_CFRS_BADEXECDSTCONF	cfrs	cfsh not configured on execution node
3805	REASON_CFRS_BADDSTPATH	cfrs	Invalid destination file path
3806	REASON_CFRS_DSTPATHTOOLONG	cfrs	Destination file path too long

Code	Reason	Service	Text
3807	REASON_CFRS_SRCACCESSERR	cfrs	Cannot access source file
3808	REASON_CFRS_SRCNOTREG	cfrs	Source file is not regular file
3809	REASON_CFRS_SRCREADERR	cfrs	Source file read error
380a	REASON_CFRS_NOCMD	cfrs	No command string specified
380b	REASON_CFRS_CMDTOOLONG	cfrs	Command string too long
380c	REASON_CFRS_OUTPUTWRTERR	cfrs	Command output write error
380d	REASON_CFRS_NSIERROR	cfrs	Internal CFRS NSI error
380e	REASON_CFRS_DSTABORTEXEC	cfrs	Execution aborted on execution node
380f	REASON_CFRS_INVALIDIOCTL	cfrs	Invalid ioctl call
3810	REASON_CFRS_BADDSTNODE	cfrs	Destination node not in cluster
3811	REASON_CFRS_BADROPHANDLE	cfrs	Bad remote operation handle
3812	REASON_CFRS_SRCEXECABORTED	cfrs	Remote exec aborted on source node
3813	REASON_CFRS_RESPOUTTOOSMALL	cfrs	Response output buffer too small
3814	REASON_CFRS_MRPCOUTSIZE	cfrs	Unexpected MRPC outsize error
3815	REASON_CFRS_DSTNODELEFT	cfrs	Destination node has left the cluster
3816	REASON_CFRS_DSTDAEMONDOWN	cfrs	`cfregd` on destination node down
3817	REASON_CFRS_DSTSTATERR	cfrs	Failure to `stat dst` file
3818	REASON_CFRS_DSTNOTREG	cfrs	Existing `dstpath` not regular file

Code	Reason	Service	Text
3819	REASON_CFRS_DSTTMPOPENERR	cfrs	Cannot open tmp file on dst node
381a	REASON_CFRS_DSTTMPCHOWNERR	cfrs	Cannot chown tmp file on dst node
381b	REASON_CFRS_DSTTMPCHMODERR	cfrs	Cannot chmod tmp file on dst node
381c	REASON_CFRS_DSTTMPWRITEERR	cfrs	tmp file write error on dst node
381d	REASON_CFRS_DSTTMPCLOSEERR	cfrs	tmp file close error on dst node
381e	REASON_CFRS_DSTRENAMEERR	cfrs	Failed to rename existing dstpath
381f	REASON_CFRS_TMPRENAMEERR	cfrs	Failed to tmp file to dstpath
3820	REASON_CFRS_DUPIFC	cfrs	Duplicate remote operation handle error
3821	REASON_CFRS_STALESUBFCREQ	cfrs	Stale remote operation handle error
3822	REASON_CFRS_BADSPAWN	cfrs	Failure to spawn exec cmd on dstnode
	/* CFSF */		
4001	REASON_CFSF_PENDING	cfsf	Invalid node down request with pending ICF failure
4002	REASON_MAX_REASON_VAL		Last reason

12.8 Error messages for different systems

Refer to the file `/usr/include/sys/errno.h` for the meaning of an ERRNO for a particular system.

12.9 Solaris ERRNO table

No	Name	Description
1	`EPERM`	**Operation not permitted / not super-user** Typically this error indicates an attempt to modify a file in some way forbidden except to its owner or the super-user. It is also returned for attempts by ordinary users to do things allowed only to the super-user.
2	`ENOENT`	**No such file or directory** A file name is specified and the file should exist but doesn't, or one of the directories in a path name does not exist.
3	`ESRCH`	**No such process, LWP, or thread** No process can be found in the system that corresponds to the specified PID, `LWPID_t`, or `thread_t`.
4	`EINTR`	**Interrupted system call** An asynchronous signal (such as interrupt or quit), which the user has elected to catch, occurred during a system service function. If execution is resumed after processing the signal, it will appear as if the interrupted function call returned this error condition. In a multi-threaded application, `EINTR` may be returned whenever another thread or `LWP` calls `fork`.(2)
5	`EIO`	**I/O error** Some physical I/O error has occurred. This error may in some cases occur on a call following the one to which it actually applies.
6	`ENXIO`	**No such device or address** I/O on a special file refers to a sub-device which does not exist, or exists beyond the limit of the device. It may also occur when, for example, a tape drive is not on-line or no disk pack is loaded on a drive.

No	Name	Description
7	`E2BIG`	**Arg list too long** An argument list longer than `ARG_MAX` bytes is presented to a member of the exec family of functions (see `exec`(2)). The argument list limit is the sum of the size of the argument list plus the size of the environment's exported shell variables.
8	`ENOEXEC`	**Exec format error** A request is made to execute a file which, although it has the appropriate permissions, does not start with a valid format (see `a.out`(4)).
9	`EBADF`	**Bad file number** Either a file descriptor refers to no open file, or a `read`(2) (respectively, `write`(2)) request is made to a file that is open only for writing (respectively, reading).
10	`ECHILD`	**No child processes** A `wait`(2) function was executed by a process that had no existing or unwaited-for child processes.
11	`EAGAIN`	**Try again / no more processes or no more LWPs** For example, the `fork`(2) function failed because the system's process table is full or the user is not allowed to create any more processes, or a call failed because of insufficient memory or swap space.

No	Name	Description
12	`ENOMEM`	**Out of memory / not enough space** During execution of `brk`() or `sbrk`() (see `brk`(2)), or one of the exec family of functions, a program asks for more space than the system is able to supply. This is not a temporary condition; the maximum size is a system parameter. On some architectures, the error may also occur if the arrangement of text, data, and stack segments requires too many segmentation registers, or if there is not enough swap space during the `fork`(2) function. If this error occurs on a resource associated with Remote File Sharing (RFS), it indicates a memory depletion which may be temporary, dependent on system activity at the time the call was invoked.
13	`EACCES`	**Permission denied** An attempt was made to access a file in a way forbidden by the protection system.
14	`EFAULT`	**Bad address** The system encountered a hardware fault in attempting to use an argument of a routine. For example, errno potentially may be set to `EFAULT` any time a routine that takes a pointer argument is passed an invalid address, if the system can detect the condition. Because systems will differ in their ability to reliably detect a bad address, on some implementations passing a bad address to a routine will result in undefined behavior.
15	`ENOTBLK`	**Block device required** A non-block device or file was mentioned where a block device was required (for example, in a call to the `mount`(2) function).

No	Name	Description
16	EBUSY	**Device or resource busy** An attempt was made to mount a device that was already mounted or an attempt was made to unmount a device on which there is an active file (open file, current directory, mounted-on file, active text segment). It will also occur if an attempt is made to enable accounting when it is already enabled. The device or resource is currently unavailable. EBUSY is also used by mutexes, semaphores, condition variables, and read-write locks, to indicate that a lock is held, and by the processor control function P_ONLINE.
17	EEXIST	**File exists** An existing file was mentioned in an inappropriate context (for example, call to the link(2) function).
18	EXDEV	**Cross-device link** A hard link to a file on another device was attempted.
19	ENODEV	**No such device** An attempt was made to apply an inappropriate operation to a device (for example, read a write-only device.
20	ENOTDIR	**Not a directory** A non-directory was specified where a directory is required (for example, in a path prefix or as an argument to the chdir(2) function).
21	EISDIR	**Is a directory** An attempt was made to write on a directory.
22	EINVAL	**Invalid argument** An invalid argument was specified (for example, unmounting a non-mounted device), mentioning an undefined signal in a call to the signal(3C) or kill(2) function.
23	ENFILE	**File table overflow** The system file table is full (that is, SYS_OPEN files are open, and temporarily no more files can be opened).

No	Name	Description
24	EMFILE	**Too many open files** No process may have more than OPEN_MAX file descriptors open at a time.
25	ENOTTY	**Not a TTY - inappropriate ioctl for device** A call was made to the ioctl(2) function specifying a file that is not a special character device.
26	ETXTBSY	**Text file busy (obsolete)** An attempt was made to execute a pure-procedure program that is currently open for writing. Also an attempt to open for writing or to remove a pure-procedure program that is being executed.
27	EFBIG	**File too large** The size of the file exceeded the limit specified by resource RLIMIT_FSIZE; the file size exceeds the maximum supported by the file system; or the file size exceeds the offset maximum of the file descriptor.
28	ENOSPC	**No space left on device** While writing an ordinary file or creating a directory entry, there is no free space left on the device. In the fcntl(2) function, the setting or removing of record locks on a file cannot be accomplished because there are no more record entries left on the system.
29	ESPIPE	**Illegal seek** A call to the lseek(2) function was issued to a pipe.
30	EROFS	**Read-only file system** An attempt to modify a file or directory was made on a device mounted read-only.
31	EMLINK	**Too many links** An attempt to make more than the maximum number of links, LINK_MAX, to a file.

No	Name	Description
32	EPIPE	**Broken pipe** A write on a pipe for which there is no process to read the data. This condition normally generates a signal; the error is returned if the signal is ignored.
33	EDOM	**Math argument out of domain of function** The argument of a function in the math package (3M) is out of the domain of the function.
34	ERANGE	**Math result not representable** The value of a function in the math package (3M) is not representable within node precision.
35	ENOMSG	**No message of desired type** An attempt was made to receive a message of a type that does not exist on the specified message queue (see `msgrcv`(2)).
36	EIDRM	**Identifier removed** This error is returned to processes that resume execution due to the removal of an identifier from the file system's name space (see `msgctl`(2), `semctl`(2), and `shmctl`(2)).
37	ECHRNG	**Channel number out of range**
38	EL2NSYNC	**Level 2 not synchronized**
39	EL3HLT	**Level 3 halted**
40	EL3RST	**Level 3 reset**
41	ELNRNG	**Link number out of range**
42	EUNATCH	**Protocol driver not attached**
43	ENOCSI	**No CSI structure available**
44	EL2HLT	**Level 2 halted**
45	EDEADLK	**Resource deadlock condition** A deadlock situation was detected and avoided. This error pertains to file and record locking, and also applies to mutexes, semaphores, condition variables, and read-write locks.

No	Name	Description
46	ENOLCK	**No record locks available** There are no more locks available. The system lock table is full (see `fcntl`(2)).
47	ECANCELED	**Operation canceled** The associated asynchronous operation was canceled before completion.
48	ENOTSUP	**Not supported** This version of the system does not support this feature. Future versions of the system may provide support.
49	EDQUOT	**Disc quota exceeded** A `write`(2) to an ordinary file, the creation of a directory or symbolic link, or the creation of a directory entry failed because the user's quota of disk blocks was exhausted, or the allocation of an inode for a newly created file failed because the user's quota of inodes was exhausted.
50	EBADE	**Invalid exchange**
51	EBADR	**Invalid request descriptor**
52	EXFULL	**Exchange full**
53	ENOANO	**No anode**
54	EBADRQC	**Invalid request code**
55	EBADSLT	**Invalid slot**
56	EDEADLOCK	**File locking deadlock error**
57	EBFONT	**Bad font file format**
58	EOWNERDEAD	**Process died with the lock**
59	ENOTRECOVERABLE	**Lock is not recoverable**
60	ENOSTR	**Device not a stream** A `putmsg`(2) or `getmsg`(2) call was attempted on a file descriptor that is not a STREAMS device.
61	ENODATA	**No data available** No data (for no-delay I/O).

No	Name	Description
62	`ETIME`	**Timer expired** The timer set for a STREAMS `ioctl(2)` call has expired. The cause of this error is device-specific and could indicate either a hardware or software failure, or perhaps a timeout value that is too short for the specific operation. The status of the `ioctl()` operation is indeterminate. This is also returned in the case of `_lwp_cond_timedwait`(2) or `cond_timedwait`(2).
63	`ENOSR`	**Out of stream resources** During a STREAMS `open`(2) call, either no STREAMS queues or no STREAMS head data structures were available. This is a temporary condition; one may recover from it if other processes release resources.
64	`ENONET`	**Node is not on the network** This error is Remote File Sharing (RFS) specific. It occurs when users try to advertise, unadvertise, mount, or unmount remote resources while the node has not done the proper startup to connect to the network.
65	`ENOPKG`	**Package not installed** This error occurs when users attempt to use a call from a package which has not been installed.
66	`EREMOTE`	**Object is remote** This error is RFS-specific. It occurs when users try to advertise a resource which is not on the local node, or try to mount/unmount a device (or pathname) that is on a remote node.
67	`ENOLINK`	**Link has been severed** This error is RFS-specific. It occurs when the link (virtual circuit) connecting to a remote node is gone.

No	Name	Description
68	EADV	**Advertise error** This error is RFS-specific. It occurs when users try to advertise a resource which has been advertised already, or try to stop RFS while there are resources still advertised, or try to force unmount a resource when it is still advertised.
69	ESRMNT	**Srmount error** This error is RFS-specific. It occurs when an attempt is made to stop RFS while resources are still mounted by remote nodes, or when a resource is readvertised with a client list that does not include a remote node that currently has the resource mounted.
70	ECOMM	**Communication error on send** This error is RFS-specific. It occurs when the current process is waiting for a message from a remote node, and the virtual circuit fails.
71	EPROTO	**Protocol error** Some protocol error occurred. This error is device-specific, but is generally not related to a hardware failure
72	ELOCKUNMAPPED	**Locked lock was unmapped**
74	EMULTIHOP	**Multihop attempted** This error is RFS-specific. It occurs when users try to access remote resources which are not directly accessible.
76	EDOTDOT	**RFS specific error** This error is RFS-specific. A way for the server to tell the client that a process has transferred back from mount point.

No	Name	Description
77	EBADMSG	**Not a data message** /* trying to read unreadable message */ During a read(2), getmsg(2), or ioctl(2) I_RECVFD call to a STREAMS device, something has come to the head of the queue that can not be processed. That something depends on the call: read(): control information or passed file descriptor. getmsg():passed file descriptor. ioctl():control or data information.
78	ENAMETOOLONG	**File name too long** The length of the path argument exceeds PATH_MAX, or the length of a path component exceeds NAME_MAX while _POSIX_NO_TRUNC is in effect; see limits(4).
79	EOVERFLOW	**Value too large for defined data type**
80	ENOTUNIQ	**Name not unique on network** Given log name not unique.
81	EBADFD	**File descriptor in bad state** Either a file descriptor refers to no open file or a read request was made to a file that is open only for writing.
83	ELIBACC	**Cannot access a needed shared library** Trying to exec an a.out that requires a static shared library and the static shared library does not exist or the user does not have permission to use it.
84	ELIBBAD	**Accessing a corrupted shared library** Trying to exec an a.out that requires a static shared library (to be linked in) and exec could not load the static shared library. The static shared library is probably corrupted.
85	ELIBSCN	**.lib section in a.out corrupted** Trying to exec an a.out that requires a static shared library (to be linked in) and there was erroneous data in the .lib section of the a.out. The .lib section tells exec what static shared libraries are needed. The a.out is probably corrupted.

No	Name	Description
86	ELIBMAX	**Attempting to link in too many shared libraries** Trying to exec an a.out that requires more static shared libraries than is allowed on the current configuration of the system. See NFS Administration Guide.
87	ELIBEXEC	**Cannot exec a shared library directly** Attempting to exec a shared library directly.
88	EILSEQ	**Illegal byte sequence** Illegal byte sequence when trying to handle multiple characters as a single character.
89	ENOSYS	**Function not implemented / operation not applicable** Unsupported file system operation.
90	ELOOP	**Symbolic link loop** Number of symbolic links encountered during path name traversal exceeds MAXSYMLINKS.
91	ERESTART	**Restartable system call** Interrupted system call should be restarted.
92	ESTRPIPE	**Streams pipe error (not externally visible)** If pipe/FIFO, don't sleep in stream head.
93	ENOTEMPTY	**Directory not empty**
94	EUSERS	**Too many users** Too many users (for UFS).
95	ENOTSOCK	**Socket operation on non-socket**
96	EDESTADDRREQ	**Destination address required** A required address was omitted from an operation on a transport endpoint. Destination address required.
97	EMSGSIZE	**Message too long** A message sent on a transport provider was larger than the internal message buffer or some other network limit.
98	EPROTOTYPE	**Protocol wrong type for socket** A protocol was specified that does not support the semantics of the socket type requested.

No	Name	Description
99	`ENOPROTOOPT`	**Protocol not available** A bad option or level was specified when getting or setting options for a protocol.
120	`EPROTONOSUPPORT`	**Protocol not supported** The protocol has not been configured into the system or no implementation for it exists.
121	`ESOCKTNOSUPPORT`	**Socket type not supported** The support for the socket type has not been configured into the system or no implementation for it exists.
122	`EOPNOTSUPP`	**Operation not supported on transport end-point** For example, trying to accept a connection on a datagram transport endpoint.
123	`EPFNOSUPPORT`	**Protocol family not supported** The protocol family has not been configured into the system or no implementation for it exists. Used for the Internet protocols.
124	`EAFNOSUPPORT`	**Address family not supported by protocol** An address incompatible with the requested protocol was used.
125	`EADDRINUSE`	**Address already in use** User attempted to use an address already in use, and the protocol does not allow this.
126	`EADDRNOTAVAIL`	**Cannot assign requested address** Results from an attempt to create a transport end-point with an address not on the current node.
127	`ENETDOWN`	**Network is down** Operation encountered a dead network.
128	`ENETUNREACH`	**Network is unreachable** Operation was attempted to an unreachable network.

No	Name	Description
129	ENETRESET	**Network dropped connection because of reset** The node you were connected to crashed and rebooted.
130	ECONNABORTED	**Software caused connection abort** A connection abort was caused internal to your node.
131	ECONNRESET	**Connection reset by peer** A connection was forcibly closed by a peer. This normally results from a loss of the connection on the remote node due to a timeout or a reboot
132	ENOBUFS	**No buffer space available** An operation on a transport endpoint or pipe was not performed because the system lacked sufficient buffer space or because a queue was full.
133	EISCONN	**Transport endpoint is already connected** A connect request was made on an already connected transport endpoint; or, a `sendto`(3N) or `sendmsg`(3N) request on a connected transport endpoint specified a destination when already connected.
134	ENOTCONN	**Transport endpoint is not connected** A request to send or receive data was disallowed because the transport endpoint is not connected and (when sending a datagram) no address was supplied.
135	EUCLEAN	**Structure needs cleaning**
137	ENOTNAM	**Not a XENIX named type file**
138	ENAVAIL	**No XENIX semaphores available**
139	EISNAM	**Is a named type file**
140	EREMOTEIO	**Remote I/O error**
141	EINIT	**Define EINIT 141** /* Reserved for future use* /
142	EREMDEV	**Define EREMDEV 142** /* Error 142 */

No	Name	Description
143	`ESHUTDOWN`	**Cannot send after transport endpoint shutdown** A request to send data was disallowed because the transport endpoint has already been shut down.
144	`ETOOMANYREFS`	**Too many references: cannot splice**
145	`ETIMEDOUT`	**Connection timed out** A `connect`(3N) or `send`(3N) request failed because the connected party did not properly respond after a period of time; or a `write`(2) or `fsync`(3C) request failed because a file is on an NFS file system mounted with the soft option.
146	`ECONNREFUSED`	**Connection refused** No connection could be made because the target node actively refused it. This usually results from trying to connect to a service that is inactive on the remote node.
147	`EHOSTDOWN`	**Node is down** A transport provider operation failed because the destination node was down.
148	`EHOSTUNREACH`	**No route to node** A transport provider operation was attempted to an unreachable node.
149	`EALREADY`	**Operation already in progress** An operation was attempted on a non-blocking object that already had an operation in progress.
150	`EINPROGRESS`	**Operation now in progress** An operation that takes a long time to complete (such as a `connect`()) was attempted on a non-blocking object).
151	`ESTALE`	**Stale NFS file handle**
-	`EWOULDBLOCK`	**Operation would block**
-	`ENOMEDIUM`	**No medium found**
-	`EMEDIUMTYPE`	**Wrong medium type**

12.10 Resource Database messages

This section explains the Resource Database message. The message format is described below.

Italic indicates that the output content varies depending on the message.

`FJSVcluster`:*severity*:*program*:*message-number*:*message*

severity	Indicates the message severity level. On the message severity level, there are four types: Stop (`HALT`), Information (`INFORMATION`), Warning (`WARNING`), Error (`ERROR`). For details, refer to the table below.
program	Indicates the name of the Resource Database program that output this message.
message-number	Indicates the message number.
message	Indicates the message text.

Number	Message severity level	Meaning
0000−0999	Stop (`HALT`)	Message indicating an abnormal termination of the function in the Resource Database is output.
2000−3999	Information (`INFORMATION`)	Message providing notification of information on the Resource Database operation status is output.
4000−5999	Warning (`WARNING`)	Message providing notification of a minor error not leading to abnormal termination of the function in the Resource Database is output.
6000−7999	Error (`ERROR`)	Message providing notification of a major error leading to abnormal termination of the function in the Resource Database is output.

Table 11: Resource Database severity levels

12.10.1 HALT messages

0100 `Cluster configuration management facility terminated abnormally.`

Corrective action

Correct the cause of abnormal termination, then restart the error-detected node.

Supplement

The cause of abnormal termination is indicated in the previous error message.

0101 `Initialization of cluster configuration management facility terminated abnormally.`

Corrective action

Correct the cause of abnormal termination, then restart the error-detected node.

Supplement

The cause of abnormal termination is indicated in the previous error message.

0102 `A failure occurred in the server. It will be terminated.`

Corrective action

Follow the corrective action of the error message that was displayed right before this 0102 message

12.10.2 Information messages

2100 `The resource data base has already been set. (detail:`*code1-code2*`)`

2200 `Cluster configuration management facility initialization started.`

2201 `Cluster configuration management facility initialization completed.`

2202 `Cluster configuration management facility exit processing started.`

2203 `Cluster configuration management facility exit processing completed.`

2204 `Cluster event control facility started.`

2205 `Cluster event control facility stopped.`

3200 `Cluster resource management facility initialization started.`

3201 `Cluster resource management facility initialization completed.`

3202 `Cluster resource management facility exit processing completed.`

3203 `Resource activation processing started.`

3204 `Resource activation processing completed.`

3205 `Resource deactivation processing started.`

3206 `Resource deactivation processing completed.`

12.10.3 Warning messages

4250 `The line switching unit cannot be found because FJSVclswu is not installed.`

Supplement

Devices other than the line switching unit register an automatic resource.

5200 `There is a possibility that the resource controller does not start. (ident:`*ident* `command:`*command, ...*`)`

Supplement

Notification of the completion of startup has not yet been posted from the resource controller.*indent* indicates a resource controller identifier while command indicates the startup script of the resource controller.

12.10.4 Error messages

???? `Message not found!!`

Corrective action

The text of the message corresponding to the message number is not available. Copy this message and contact your local customer support.

6000 `An internal error occurred.(function:`*function* `detail:`*code1-code2-code3-code4*)

Corrective action

An internal error occurred in the program.
Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
function, code1, code2, code3, code4 indicates information required for error investigation.

6001 `Insufficient memory. (detail:`*code1-code2*)

Corrective action

Memory resources are insufficient to operate the Resource Database.
code1, *code2* indicates information required for error investigation.
Record this message. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”). Review the estimating of memory resources.
If this error cannot be corrected by this operator response, contact your local customer support.

6002 `Insufficient disk or system resources. (detail:code1-code2)`

Corrective action

This failure might be attributed to the followings:

- The disk space is insufficient
- There are incorrect settings in the kernel parameter

Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
Check that there is enough free disk space required for PRIMECLUSTER operation. If the disk space is insufficient, you need to reserve some free area and reboot the node. For the required disk space, refer to the PRIMECLUSTER *Installation Guide*.
If you still have this problem after going through the above instruction, confirm that the kernel parameter is correctly set. Modify the settings if necessary and reboot the node. Nevertheless, the above instructions are not helpful, contact your customer service representative.**code1** and **code2** indicate information required for troubleshooting.

6003 `Error in option specification. (option:`*option*)

Corrective action

Specify a correct option, and execute the command again.
option indicates an option.

6004 `No system administrator authority.`

Corrective action

Re-execute the processing with the system administrator authority.

6005 `Insufficient shared memory. (detail:`*code1*-code2)

Corrective action

Shared memory resources are insufficient for the Resource Database to operate.
Record this message. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
Refer to the Section “Kernel parameters for Resource Database” to review the estimate of shared memory resources (kernel parameters), Reboot the nodes that have any kernel parameters that have been changed.
If this error cannot be corrected by this operator response, contact your local customer support.
code1, *code2* indicates information required for error investigation.

6006 `The required option` ***option*** `must be specified.`

Corrective action

Specify the correct option, then re-execute the processing.
option indicates an option.

6007 `One of the required options` ***option*** `must be specified.`

Corrective action

Specify a correct option, and execute the command again.
option indicates an option.

6008 `If option` ***option1*** `is specified, option` ***option2*** `is required.`

Corrective action

If the option indicated by *option1* is specified, the option indicated by *option2* is required. Specify the correct option, then re-execute the processing.

6009 `If option` ***option1*** `is specified, option` ***option2*** `cannot be specified.`

Corrective action

If the option indicated by *option1* is specified, the option indicated by *option2* cannot be specified. Specify the correct option, then re-execute the processing.

6010 `If any one of the options` ***option1*** `is specified, option` ***option2*** `cannot be specified.`

Corrective action

If either option indicated by *option1* is specified, the option indicated by *option2* cannot be specified. Specify the correct option, then re-execute the processing.

6021 `The` ***option*** `option(s) must be specified in the following order:` ***order***

Corrective action

Specify option *options* sequentially in the order of *order*. Then, retry execution.
option indicates those options that are specified in the wrong order, while *order* indicates the correct order of specification.

6025 `The value of option` *option* `must be specified from` *value1* `to` *value2*

Corrective action

Specify the value of the *option* in option within the range between *value1* and *value2*, and then re-execute.
option indicates the specified option while *value1*,*value2* indicate values.

6200 `Cluster configuration management facility: configuration database mismatch. (name:`*name* `node:`*node*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).
Collect the investigation information in all nodes, then reactivate the faulty node.
name indicates a database name in which a mismatch occurred, while *node* indicates a node in which an error occurred.

6201 `Cluster configuration management facility: internal error. (node:`*node* `code:`*code*`)`

Corrective action

There might be an error in the system if the kernel parameter `/etc/system` (4) is not properly set up when the cluster was installed. Check if the setup is correct (refer to Section “Kernel parameters for Resource Database”). If incorrect, reset the value of `/etc/system`(4), and then restart the system.
If there's still any problem regardless of the fact that the value of `/etc/system` (4) is larger than the required by Resource Database, and the same value is shown when checked by a `sysdef`(1M) command, take down the message, collect information for investigation, and then contact your local customer support (refer to the Section “Collecting troubleshooting information”).
Collect the investigation information in all nodes, then reactivate the faulty node.
node indicates a node in which an error occurred while *code* indicates the code for the detailed processing performed for the error.

6202 `Cluster event control facility: internal error. (detail:`*code1-code2*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

code1, *code2* indicates information required for error investigation.

6203 `Cluster configuration management facility: communication path disconnected.`

Corrective action

Check the state of other nodes and path of a private LAN.

6204 `Cluster configuration management facility has not been started.`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

6206 `Cluster configuration management facility: error in definitions used by` *target* `command.`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

target indicates a command name.

6207 `Cluster domain contains one or more inactive nodes.`

Corrective action

Activate the node in the stopped state.

6208 `Access denied (`*target*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

target indicates a command name.

6209 `The specified file or cluster configuration database does not exist (`*target*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

target indicates a file name or a cluster configuration database name.

6210 `The specified cluster configuration database is being used (`*table*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

table indicates a cluster configuration database name.

6211 `A table with the same name exists (`*table*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

table indicates a cluster configuration database name.

6212 `The specified configuration change procedure is already registered (`*proc*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

proc indicates a configuration change procedure name.

6213 `The cluster configuration database contains duplicate information.`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

6214 `Cluster configuration management facility: configuration database update terminated abnormally (`*target*`).`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

Collect the investigation information in all nodes, then reactivate all nodes.

target indicates a cluster configuration database name.

6215 `Cannot exceed the maximum number of nodes.`

Corrective action

Since a hot extension is required for an additional node that exceeds the maximum number of configuration nodes that is allowed with Resource Database, review the cluster system configuration so that the number of nodes becomes equal to or less than the maximum number of composing nodes.

6216 `Cluster configuration management facility: configuration database mismatch occurred because another node ran out of memory. (name:`*name*` node:`*node*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

After collecting data for all nodes, stop the node and start it again.

name indicates a database in which a mismatch occurred and *node* indicates a node for which a memory shortfall occurred.

6217 `Cluster configuration management facility: configuration database mismatch occurred because another node ran out of disk or system resources. (name:`*name* `node:`*node*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

Reexamine the estimate for the disk resources and system resources (kernel parameter) (refer to the Section “Kernel parameters for Resource Database”). When the kernel parameter is changed for a given node, restart that node. If this error cannot be corrected by this operator response, contact your local customer support. After collecting data for all nodes, stop and then restart the nodes.

name indicates a database in which a mismatch occurred and *node* indicates the node in which insufficient disk resources or system resources occurred.

6218 `An error occurred during distribution of file to the stopped node. (name:`*name* `node:`*node* `errno:`*errno*`)`

Corrective action

File cannot be distributed to the stopped node from the erroneous node. Be sure to start the stopped node before the active node stops. It is not necessary to re-execute the command.

name indicates the file name that was distributed when an failure occurred, *node* indicates the node in which a failure occurred, and *errno* indicates the error number when a failure occurred.

6219 `The cluster configuration management facility cannot recognize the activating node. (detail:`*code1-code2*`)`

Corrective action

Confirm that there is no failures in Cluster Foundation (CF) or cluster interconnect. If a failure occurs in CF, take the corrective action of the CF message. If a failure occurs in cluster interconnect, check that NIC is connected to the network.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

code1 and *code2* indicate information required for troubleshooting.

6220 `The communication failed between nodes or processes in the cluster configuration management facility. (detail:`*code1-code2*`)`

Corrective action

Confirm that there is no failures in cluster interconnect. If a failure occurs in cluster interconnect, check that NIC is connected to the network.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

code1 and *code2* Indicate information required for troubleshooting.

6221 `Invalid kernel parameter used by cluster configuration database. (detail:`*code1-code2*`)`

Corrective action

The kernel parameter used for the Resource Database is not correctly set up. Modify the settings, referring to Section “Kernel parameters for Resource Database”, and reboot the node.

If you still have this problem after going through the above instruction, contact your local customer support.

code1 and *code2* indicate information required for troubleshooting.

6222 `network service used by the cluster configuration management facility is not available.(detail:`*code1-code2*`)`

Corrective action

Confirm the `/etc/inet/services` file is linked to the `/etc/services` file. If not, you need to create a symbolic link to the `/etc/services` file. When setup process is done, confirm the following network services are set up in the `/etc/inet/services` file. If any of the followings should fail to be set up, you need to add the missing.

```
dcmcom 9331/tcp# FJSVcldbm package
dcmsync 9379/tcp# FJSVcldbm package
dcmlck 9378/tcp# FJSVcldbm package
dcmfcp 9377/tcp# FJSVcldbm package
dcmmst 9375/tcp# FJSVcldbm package
dcmevm 9376/tcp# FJSVcldbm package
```

If this process is successfully done, confirm that the services of the `/etc/nsswitch.conf` file are defined as `services: files nisplus`. If not, you need to define them and reboot the node.

```
services: files nisplus
```

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
code1 and *code2* indicate information required for troubleshooting.

6223 `A failure occurred in the specified command. (command:` *command*`, detail:`*code1-code2*`)`

Corrective action

Confirm that you can run the program specified as an option of the `clexec`(1M) command.If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
code1 and *code2* indicate information required for troubleshooting.

6226 `The kernel parameter setup is not sufficient to operate the cluster control facility. (detail:`*code*`)`

Corrective action

The kernel parameter used for the Resource Database is not correctly setup. Modify the settings, referring to the Section “Kernel parameters for Resource Database”, and reboot the node.

Then, execute the `clinitreset`(1M) command, reboot the node, and initialize the Resource Database again. Confirm that you can run the program specified as an option of the `clexec`(1M) command.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

code indicates the kernel parameter which value is insufficient and the minimum value required to operate the cluster control.

6250 `Cannot run this command because FJSVclswu is not installed.`

Corrective action

Install the `FJSVclswu` package before executing the command. Refer to the PRIMECLUSTER *Installation Guide* for further details.

6300 `Failed in setting the resource data base (insufficient user authority).`

Corrective action

No CIP is set up in the Cluster Foundation. Reset CIP, and execute again after rebooting all nodes. Refer to the Section “CF, CIP, and CIM configuration” for the setup method.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

code1 and *code2* represents information for investigation.

6301 `The resource data base has already been set (insufficient user authority).`

Corrective action

The setup for Resource Database is not necessary. If you need to reset the setup, execute the `clinitreset`(1M) command on all nodes, initialize the Resource Database, and then reboot all nodes. For details, refer to the manual of the `clinitreset`(1M) command.

code1 and *code2* represents information for investigation.

6302 `Failed to create a backup of the resource database information. (detail:`*code1-code2*`)`

Corrective action

The disk space might be insufficient. You need to reserve 1 MB or more of free disk space, and back up the Resource Database information again.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section "Collecting troubleshooting information").

`code1` and `code2` indicate information required for troubleshooting.

6303 `Failed restoration of the resource database information.(detail:`*code1-code2*`)`

Corrective action

The disk space might be insufficient. You need to reserve 1 MB or more of free disk space, and restore the Resource Database information again.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section "Collecting troubleshooting information").

`code1` and `code2` indicate information required for troubleshooting.

6600 `Cannot manipulate the specified resource. (insufficient user authority)`

Corrective action

Re-execute the specified resource with registered user authority.

6601 `Cannot delete the specified resource. (resource:` *resource* `rid:`*rid*`)`

Corrective action

Specify the resource correctly, and then re-execute it.

resource indicates the resource name of the specified resource. *rid* indicates the resource ID of the specified resource.

6602 `The specified resource does not exist. (detail:`*code1-code2*`)`

Corrective action

Specify the correct resource, then re-execute the processing.

code1, *code2* indicates information required for error investigation.

6603 `The specified file does not exist.`

Corrective action

Specify the correct file, then re-execute the processing.

6604 `The specified resource class does not exist.`

Corrective action

Specify the correct resource class, and then re-execute the processing.

A specifiable resource class is a file name itself that is under `/etc/opt/FJSVcluster/classes`. Confirm that there is no error in the character strings that have been specified as the resource class.

6606 `Operation cannot be performed on the specified resource because the corresponding cluster service is not in the stopped state. (detail:`*code1-code2*`)`

Corrective action

Stop the cluster service, then re-execute the processing.

code1, *code2* indicates information required for error investigation.

6607 `The specified node cannot be found.`

Corrective action

Specify the node correctly. Then, execute again.

6608 `Operation disabled because the resource information of the specified resource is being updated. (detail:`*code1-code2*`)`

Corrective action

Re-execute the processing.

code1, *code2* indicates information required for error investigation.

6611 `The specified resource has already been registered. (detail:`*code1-code2*`)`

Corrective action

If this message appears when the resource is registered, it indicates that the specified resource has been already registered. There is no need to register it again.

If this message appears when changing a display name, specify a display name that is not available because the specified display name has already been registered.

code1, *code2* indicates information required for error investigation.

6614 `Cluster configuration management facility: internal error.(detail:`*code1-code2*`)`

Corrective action

Record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
code1, *code2* indicates information required for error investigation.

6615 `The cluster configuration management facility is not running. (detail:`*code1-code2*`)`

Corrective action

Reactivate the Resource Database by restarting the node. If the message is redisplayed, record this message and collect related information for investigation. Then, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
code1, *code2* indicates information required for error investigation.

6616 `Cluster configuration management facility: error in the communication routine. (detail:`*code1-code2*`)`

Corrective action

Record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
code1, *code2* indicates information required for error investigation.

6653 `Operation cannot be performed on the specified resource.`

Corrective action

`userApplication` in which the specified resource is registered is not in the `Deact` state. You need to bring this `UserApplication Deact`.

6661 `Cluster control is not running. (detail:`*code*`)`

Corrective action

Confirm that the Resource Database is running by executing the `clgettree`(1) command. If not, reboot the node.
If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).
`code` indicates information required for troubleshooting.

6665 `The directory was specified incorrectly.`
Corrective action
Specify the correct directory.

6668 `Cannot run this command in single-user mode.`
Corrective action
Boot the node in multi-user mode.

6675 `Cannot run this command because` ***product_name*** `has already been set up.`
Corrective action
Cancel the setting of the Resource Database *product_name*. Refer to appropriate manual for *product_name*.

6680 `The specified directory does not exist.`
Corrective action
Specify the existent directory.

6900 `Automatic resource registration processing terminated abnormally. (detail:` ***reason***`)`
Corrective action
There might be incorrect settings in the shared disk definition file that was specified by the `-f` option of the `clautoconfig`(1M) command. Check the following. For details about the shared disk definition file, refer to the "Register shared disk units" of "PRIMECLUSTER *Global Disk Services Configuration and Administration Guide.*"

- The resource key name, the device name, and the node identifier name are specified in each line.
- The resource key name begins with `shd`.
- The device name begins with `/dev/`.
- The node that has the specified node identifier name exists. You can check by executing the `clgettree`(1) command.

Modify the shared disk definition file if necessary, and then execute the `clautoconfig`(1M) command.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section "Collecting troubleshooting information").
reason indicates the command that was abnormally terminated or the returned value.

6901 `Automatic resource registration processing is aborted due to one or more of the stopping nodes in the cluster domain.`

Corrective action

Start all nodes and perform automatic resource registration.

6902 `Automatic resource registration processing is aborted due to cluster domain configuration manager not running.`

Corrective action

Cancel the automatic resource registration processing since the configuration of Resource Database is not working. Take down this message and collect the information needed for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

Failures may be recovered by restarting all nodes after collecting investigation information.

6903 `Failed to create logical path. (`*node dev1 dev2*`)`

Corrective action

Contact your local customer support to confirm that a logical path can be created in the share disk unit.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

node indicates an identification name of the node where the logical path failed to be created. *dev1* indicates the logical path (`mplb2048`), and *dev2* indicates a tangible path (`c1t0d0` and `c2t0d0`) corresponding to the logical path.

6904 `Fail to register resource. (detail: `*reason*`)`

Corrective action

Failed to register resource during the automatic registration processing. This might happen when the disk resource and system resource are not properly set up. Check the system setting of kernel parameter, disk size, etc.

If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

reason indicates the reason why a direction was invalidated.

6905 `Automatic resource registration processing is aborted due to mismatch instance number of logical device between nodes.`

Corrective action

This message appears when the logical path of the multi-path disk is created before registering the automatic resource.
If this message appears during registering the automatic resource after adding on disks and nodes, the registration command might fail to access the logical path of the multi-path disk and check the instance number. This happens in the following conditions:

- The same logical path name is created on multiple nodes
- This path cannot be accessed from all nodes

The PRIMECLUSTER automatic resource registration has a feature to provide a same environment to all applications. If the instance number (indicates `2048` of `mplb2048`) of the logical path in the same disk is different between nodes, this message appears, and the automatic resource registration process is aborted. You need to check the logical path of all nodes. Recreate the logical path if necessary. The instance number should be the same. Then, register the automatic resource again.
If the cause is the failure of accessing the logical path of the multi-path disk, there might be a failure in the disk, or the disk is disconnected to the node.
Take the corrective action and register the automatic resource again.
If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

6906 `Automatic resource registration processing is aborted due to mismatch setting of disk device path between nodes.`

Corrective action

This failure might be due to one of the following incorrect settings:

- Among the nodes connected to the same shared disk, the package of the multi-path disk control is not installed on all nodes.
- The detection mode of the shared disk is different between nodes.
- The number of paths to the shared disk is different between nodes.

Take the corrective action and register the automatic resource again. If you still have this problem after going through the above instruction, contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

6907 `Automatic resource registration processing is aborted due to mismatch construction of disk device between nodes.`

Corrective action

When the same shared disk was mistakenly connected to other cluster system, the volume label might have been overridden. Check the disk configuration. If there's no problem with the configuration, collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

6910 `It must be restart the specified node to execute automatic resource registration. (node:` *node_name...*`)`

Corrective action

The nodes constituting the cluster system must be restarted. Restart the nodes constituting the cluster system. After that, perform the necessary resource registration again.

node_name indicates a node identifier for which a restart is necessary. If multiple nodes are displayed with *node_name*, these node identifiers are delimited with commas. If *node_name* is `All`, restart all the nodes constituting the cluster system.

6911 `It must be matched device number information in all nodes of the cluster system executing automatic resource registration. (dev:` *dev_name...*`)`

Corrective action

Take down this message, and contact your local customer support. The support engineer will take care of matching transaction for the information on the disk device.

dev_name represents information for investigation.

7500 `Cluster resource management facility: internal error. (function:`*function* `detail:`*code1-code2*`)`

Corrective action

Record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

function, *code1*, *code2* indicates information required for error investigation.

7501 `Cluster resource management facility: insufficient memory. (function:`*function* `detail:`*code1*`)`

Corrective action

Check the memory resource allocation estimate. For the memory required by Resource Database, refer to the PRIMECLUSTER *Installation Guide*. If this error cannot be corrected by this operator response, record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

function, *code1* indicates information required for error investigation.

7502 `Cluster resource management facility: insufficient disk or system resources. (function:`*function* `detail:`*code1*`)`

Corrective action

Referring to Section “Kernel parameters for Resource Database”, review the estimate of the disk resource and system resource (kernel parameter). If the kernel parameters have been changed, reboot the node for which the kernel parameters have been changed. If this error cannot be corrected by this operator response, record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

function, *code1* indicates information required for error investigation.

7503 `The event cannot be notified because of an abnormal communication. (type:`*type* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

After this event is generated, restart all the nodes within a cluster domain.

type,*rid* indicates event information and *code1* indicates information for investigation.

7504 `The event notification is stopped because of an abnormal communication. (type:`*type* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message, and contact your local customer support. Collect information required for troubleshooting (refer to the Section “Collecting troubleshooting information”).

After this event is generated, restart all the nodes within a cluster domain.

type, *rid* indicates event information and *code1* indicates information for investigation.

7505 `The node (node) is stopped because event cannot be notified by abnormal communication. (type:`*type* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Start the stopped node in a single user mode to collect investigation information (refer to the Section “Collecting troubleshooting information”).

node indicates the node identifier of the node to be stopped, type, *rid* the event information, and *code1* the information for investigation.

7506 `The node (`*node*`) is forcibly stopped because event cannot be notified by abnormal communication. (type:`*type* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. Start the forcibly stopped node in a single user mode to collect the investigation information (refer to the Section “Collecting troubleshooting information”).

node indicates the node identifier of the node to be stopped, *type*, *rid* the event information, and *code1* the information for investigation.

7507 `Resource activation processing cannot be executed because of an abnormal communication. (resource:`*resource* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. For details about collecting investigation information (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node to which the resource (*resource*) belongs. *resource* indicates the resource name for which activation processing was disabled, *rid* the resource ID, and *code1* the information for investigation.

7508 `Resource (`*resource1* `resource ID:`*rid1*`, ...) activation processing is stopped because of an abnormal communication.`
`( resource:`*resource2* `rid:`*rid2* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support. For details about collecting investigation information (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node to which the resource (*resource2*) belongs.

resource2 indicates the resource name for which activation processing was not performed, *rid2* the resource ID, resource1 the resource name for which activation processing is not performed, *rid1* the resource ID, and *code1* the information for investigation.

7509 `Resource deactivation processing cannot be executed because of an abnormal communication. (resource:`*resource* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node to which the resource (*resource*) belongs.

resource indicates the resource name for which deactivation processing was not performed, *rid* the resource ID, and *code1* the information for investigation.

7510 `Resource (`*resource1* `resource ID:`*rid1*`, ...) deactivation processing is aborted because of an abnormal communication. (resource:`*resource2* `rid:`*rid2* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node to which the resource (*resource2*) belongs.

resource2 indicates the resource name for which deactivation processing was not performed, *rid2* the resource ID, *resource1* the resource name for which deactivation processing is not performed, *rid1* the resource ID, and *code1* the information for investigation.

7511 `An error occurred by the event processing of the resource controller. (type:`*type* `rid:`*rid* `pclass:`*pclass* `prid:`*prid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node in which the message was displayed.

type,*rid* indicates the event information, *pclass*, *prid* indicates resource controller information, and *code1* the information for investigation.

7512 `The event notification is stopped because an error occurred in the resource controller. (type:`*type* `rid:`*rid* `pclass:`*pclass* `prid:`*prid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node in which the message was displayed.

type, *rid* indicates the event information, *pclass*, *prid* indicates resource controller information, and *code1* the information for investigation.

7513 `The node(`***node***`) is stopped because an error occurred in the resource controller. (type:`***type*** `rid:`***rid*** `pclass:`***pclass*** `prid:`***prid*** `detail:`***code1***`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section "Collecting troubleshooting information").

Start up the stopped node in a single user mode to collect investigation information.

node indicates the node identifier of the node to be stopped, *type*,*rid* the event information, *pclass*, *prid* the resource controller information, and *code1* the information for investigation.

7514 `The node (`***node***`) is forcibly stopped because an error occurred in the resource controller. (type:`***type*** `rid:`***rid*** `pclass:`***pclass*** `prid:`***prid*** `detail:`***code1***`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section "Collecting troubleshooting information").

Start up the forcibly stopped node in a single user mode to collect investigation information.

node indicates the node identifier of the node to be forcibly stopped, *type*, *rid* the event information, *pclass*, *prid* the resource controller information, and *code1* the information for investigation.

7515 `An error occurred by the resource activation processing (resource:`*resource* `rid:`*rid* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section "Collecting troubleshooting information").

After this phenomena occurs, restart the node to which the resource (*resource*) belongs. An error occurs in the resource activation processing and activation of the resource (*resource*) cannot be performed.

resource indicates the resource name in which an error occurred in the activation processing, *rid* the resource ID, and *code1* the information for investigation.

7516 `An error occurred by the resource deactivation processing. (resource:`***resource*** `rid:`***rid*** `detail:`***code1***`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section "Collecting troubleshooting information").

After this phenomena occurs, restart the node to which the resource (*resource*) belongs. An error occurs in the resource deactivation processing and deactivation of the resource (*resource*) cannot be performed.

resource indicates the resource name in which an error occurred in the activation processing, *rid* the resource ID, and *code1* the information for investigation.

7517 `Resource (`***resource1*** `resource ID:`***rid1***`, ...) activation processing is stopped because an error occurred by the resource activation processing. (resource:`***resource2*** `rid:`***rid2*** `detail:`***code1***`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section "Collecting troubleshooting information").

After this phenomena occurs, restart the node to which the resource (*resource2*) belongs.

Resource2 indicates the resource name in which an error occurred in the activation processing, *rid2* the resource ID, *resource1* the resource name in which activation processing is not performed, *rid1* the resource ID, and *code1* the information for investigation.

7518 `Resource (`*resource1* `resource ID:`*rid1*`, ...) deactivation processing is aborted because an error occurred by the resource deactivation processing. (resource:`*resource2* `rid:`*rid2* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

After this phenomena occurs, restart the node to which the resource (*resource2*) belongs.

resource2 indicates the resource name in which deactivation processing was disabled, rid2 the resource ID, *resource1* the resource name in which deactivation processing is not performed, *rid1* the resource ID, and *code1* the information for investigation.

7519 `Cluster resource management facility: error in exit processing. (node:`*node* `function:`*function* `detail:`*code1*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

node indicates the node in which an error occurred and *function*, *code1* the information for investigation.

7520 `The specified resource (resource ID:`*rid*`) does not exist or be not able to set the dependence relation.`

Corrective action

Specify the correct resource, then re-execute the processing.

rid indicates a resource ID of the specified resource.

7521 `The specified resource (class:`*rclass* `resource:`*rname*`) does not exist or be not able to set the dependence relation.`

Corrective action

Specify the correct resource, then re-execute the processing.

rname indicates the specified resource name and *rclass* the class name.

7522 `It is necessary to specify the resource which belongs to the same node.`

Corrective action

The resource belonging to other node is specified. Specify a resource that belongs to the same node and re-execute it.

7535 `An error occurred by the resource activation processing. The resource controller does not exist. (`***resource***` resource ID:`***rid***`)`

Corrective action

As the resource controller is not available in the resource processing, resource (*resource*) activation was not performed.
Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).
resource indicates the resource name for which activation processing was disabled, and *rid* a resource ID.

7536 `An error occurred by the resource deactivation processing. The resource controller does not exist. (`***resource***` resource ID:`***rid***`)`

Corrective action

As the resource controller is not available in the resource deactivation processing, resource (*resource*) deactivation was not performed.
Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).
resource indicates the resource name for which deactivation processing could not be performed, and *rid* the resource ID.

7537 `Command cannot be executed during resource activation processing.`

Corrective action

After activation processing of the resource completes, re-execute it. Resource activation processing completion can be confirmed with `3204` message that is displayed on the console of the node to which the resource belongs.

7538 `Command cannot be executed during resource deactivation processing.`

Corrective action

After deactivation processing of the resource completes, re-execute it. Resource deactivation processing completion can be confirmed with `3206` message that is displayed on the console of the node to which the resource belongs.

7539 `Resource activation processing timed out. (code:`*code* `detail:`*detail*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

7540 `Resource deactivation processing timed out. (code:`*code* `detail:`*detail*`)`

Corrective action

Record this message and collect information for an investigation. Then, contact your local customer support (refer to the Section “Collecting troubleshooting information”).

7541 `Setting related to dependence failed.`

Corrective action

After confirming the specified resource, re-execute it.

7542 `Resource activation processing cannot be executed because node (`*node*`) is stopping.`

Corrective action

As the node *node* to which the resource to be activated belongs is stopped, the resource activation processing cannot be performed. After starting up the node to which resource to be activated belongs, re-execute it again.

node indicates the node identifier of the node where the connection is broken.

7543 `Resource deactivation processing cannot be executed because node (`*node*`) is stopping.`

Corrective action

As the node *node* to which the resource to be deactivated belongs is stopped, the resource deactivation processing cannot be performed. After starting up the node to which resource to be deactivated belongs, re-execute it again.

node indicates the node identifier of the node where the connection is broken.

7545 `Resource activation processing failed.`

Corrective action

Refer to the measures in the error message displayed between activation processing start message (`3203`) and completion message (`3204`), which are displayed when this command is executed.

7546 `Resource deactivation processing failed.`

Corrective action

Refer to the measures in the error message displayed between deactivation processing start message (`3205`) and completion message (`3206`), which are displayed when this command is executed.

12.11 Shutdown Facility

(SMAWsf, 10, 2) : %s of %s failed, errno %d

Cause: Internal problem.

Action: Check if there are related error messages following.
If yes, take action from there.
Otherwise, call support.

(SMAWsf, 10, 3) : Unknown command from `sd_tool`, command %d

Cause: Using illegal `sdtool` command line.

Action: Choose the correct argument when `sdtool` is invoked.

(SMAWsf, 10, 4) : Failed to open CLI response pipe for PID %d, errno %d

Cause: `rcsd` daemon could not open the pipe to response to `sdtool`.

Action: Call support.

(SMAWsf, 10, 6) : Failed to create a signal handler for SIGCHLD

Cause: Internal problem.

Action: Call support.

(SMAWsf, 10, 7) : The shutdown agent %s has exceeded its configured timeout, pid %d terminated

Cause: The shutdown agent does not return in 'timeout' seconds, which is configured in `rcsd.cfg`.

Action: If increasing timeout does not help, most likely shutdown agent does not work. check the shutdown agent log and call support.

(SMAWsf, 10, 8) : A shutdown request has come in during a test cycle, test of %s pid %d terminated

Cause: `sdtool -k` was invoked while rcsd was running a shutdown agent testing.

Action: No harm. Just ignore it.

(SMAWsf, 10, 9) : A request to reconfigure came in during a shutdown cycle, this request was ignored

Cause: When `rcsd` is eliminating a node, reconfiguration (`sdtool -r`) is not allowed.

Action: Try again after the node elimination is done.

(SMAWsf, 10, 10) : Could not correctly read the `rcsd.cfg` file.

Cause: either `rcsd.cfg` file does not exist or the syntax in `rcsd.log` is not correct.

Action: Create rcsd.cfg file or fix the syntax.

(SMAWsf, 10, 11) : %s in file %s around line %d

Cause: The syntax is not correct in `rcsd.log`
Action: fix the syntax.

(SMAWsf, 10, 12) : A request to exit `rcsd` came in during a shutdown cycle, this request was ignored

Cause: When `rcsd` is eliminating a node, bringing the `rcsd` daemon (`sdtool -e`) is not allowed.

Action: Try again after the killing node elimination is done.

(SMAWsf, 10, 15) : SA %s to %s host %s failed

Cause: The shutdown agent failed to do `initialization | testing | shutdown | un-initialization` the node

Action: Check the shutdown agent log and call support.

(SMAWsf, 10, 17) : Failed to open lock file

Cause: internal problem

Action: Call support.

(SMAWsf, 10, 19) : Failed to `unlink/create/open` CLI Pipe

Cause: internal problem

Action: Call support.

(SMAWsf, 10, 20) : Illegal catalog open parameter

Cause: internal problem.

Action: Call support.

(SMAWsf 10, 30) : Pthread failed: %s : errcode %d %s

Cause: Internal problem. POSIX thread failed.

Action: Call support.

(SMAWsf, 10, 31) : Pthread failed: %s : errcode %d %s

Cause: Internal problem. `rcsd` was restarted.

Action: Call support.

(SMAWsf, 10, 34) : Host %S MA exec: %s failed, errno %d

Cause: Failed to execute monitor agent’s API.

Action: Call support.

(SMAWsf, 10, 36) : Failed to cancel %s, thread f %s %s of host %s

Cause: POSIX thread was not cancellable.

Action: Call support.

(SMAWsf, 10, 38) : Host %s, MA %s, MAH//get/state() failed

Cause: failed to call monitor agent's API `MAHostGetState ()`.

Action: Call support.

(SMAWsf, 10, 101) : Malloc failed during %s

Cause: Not enough memory.

Action: Increase virtual memory size (`ulimit -v`) or increase system memory. Call support if the problem still exists.

(SMAWsf, 30, 2) : Usage: `sdtool {-d[on | off] | -s | -S | -r | -b | -c | -e | -k node-name | -w weight-factor | -n node-factor }`

Cause: Illegal argument/command line usage.

Action: Use the correct argument

(SMAWsf, 30, 3) : `unlink` failed on RCSD response pipe %s, errno %d

Cause: Can not remove the old pipe file.

Action: Call support.

(SMAWsf, 30, 4) : `mkfifo` failed on RCSD response pipe %s, errno %d

Cause: Could not create the pipe for `rcsd`.

Action: Call support.

(SMAWsf, 30, 5) : `open` failed on RCSD response pipe %s, errno %d

Cause: Could not open the pipe for `rcsd`.

Action: Call support.

(SMAWsf, 30, 6) : `open` failed on `rcsdin` pipe %s, errno %d

Cause: Could not open communication pipe from sdtool to `rcsd`.

Action: Call support.

(SMAWsf, 30, 7) : `write` failed on rcsdin pipe %s, errno %d

Cause: Could not pass command from sdtool to rcsd.
Action: Call support.

(SMAWsf, 30, 8) : `select` failed, errno %d

Cause: `sdtool` could not get information from rcsd.

Action: Call support.

(SMAWsf, 30, 9) : `read` failed, errno %d

Cause: sdtool failed to read data from rcsd daemon.

Action: Call support.

(SMAWsf, 30, 10) : RCSD returned an error for this command, error is %d

Cause: `rcsd` failed to execute the command from `sdtool`.

Action: Check if there are related error messages following.
If yes, take action from there.
Otherwise, call support.

(SMAWsf, 30, 12) : A shutdown is in progress for the machine %s, try again later

Cause: `rcsd` daemon is currently eliminating the machine. The current request is not ignored.

Action: Try again later.

(SMAWsf, 30, 13) : The RCSD is not running

Cause: The command failed because rcsd daemon is not running.

Action: Start up rcsd daemon (`sdtool -b`) then try the command again.

(SMAWsf, 30, 14) : RCSD is exiting. Command is not allowed

Cause: `rcsd` daemon is in the stage of shutting down. The command is not allowed.
Action: Try the command after rcsd daemon is started up.

(SMAWsf, 30, 15) : Failed to get %s product information

Cause: Most likely the product is not installed properly.

Action: Reinstall the product.

(SMAWsf, 30, 16) : Illegal catlog open parameter

Cause: Failed to open log file.

Action: Call support.

(SMAWsf, 30, 17) : Could not execlp (RCSD). Errno = %d

Cause: Most likely the rcsd binary does not exist.

Action: Reinstall the package.

(SMAWsf, 50, 3) : The SF-CF initialization failed, status %d

Cause: Most likely, CF is not configured and/or is not loaded.

Action: Configure and load CF.

(SMAWsf, 50, 4) : The SF-CF event processing failed, status %d

Cause: Internal problem.

Action: Call support.

(SMAWsf, 50, 6) : The SF-CF has failed to locate host %s

Cause: The nodename in the `rcsd.cfg` is not a known CF name.

Action: Use the CF name (`cftool -n`) in `rcsd.cfg`.

(SMAWsf, 50, 9) : The SF-CF failed to declare %s down, status %d

Cause: Internal problem.

Action: Call support.

(SMAWsf, 50, 11) : Failed to open CFSF device, reason (%d%s

Cause: Could not open CFSF device

Action: Call support.

(SMAWsf, 50, 12) : h_cfsf_get_leftcluster() failed. reason (%d) %s

Cause: Failed to call `cfsf_get_leftcluster`.
Action: Call support.

(SMAWsf, 50, 13) : Node id %d ICF communication failure detected

Cause: CF layer has detected lost heartbeat

Action: `rcsd` will take action.

(SMAWsf, 50, 14) : Host %s ICF communications failure detected

Cause: `rcsd` was notified the node has lost heartbeat

Action: `rcsd` take action to eliminate the node.

(SMAWsf, 50, 20) : Failed to cancel thread of the %s-monitor

Cause: Failed to cancel thread

Action: Call support.

(SMAWsf, 50, 21) : Failed to do %s, reason (%d)%s

Cause: Failed to call some internal functions.

Action: Call support.

(SMAWsf, 50, 22) : Failed to get nodeid for host %s. reason (%d)%s

Cause: Not able to get the cluster node id for the node.

Action: Call support.

12.12 Monitoring Agent messages

This section lists the messages output from the Monitoring Agents. The message format is as follows.

Italics indicate that the output varies, depending on the message.

`FJSVcluster`:*severity*:*program*:*message-number*:*message* *severity* Message severity level.

The levels of severity are as follows:
Information (`INFORMATION`), Warning (`WARNING`), Error (`ERROR`). For details, refer to the table below.

program Name of the program that output this message. The monitoring agent is output as DEV.

message-number Message number.

details Detailed classification code.

Number	Severity	Meaning
2000-3999	Information	Message providing information about the monitoring agent state.
4000-5999	Warning	Message warning about an insignificant error that does not cause the abnormal termination of the monitoring agent.
????, 6000-7999	Error	Message indicating that a significant error has occurred that caused the abnormal termination of the monitoring agent.

12.12.1 Information message

3040 `The console monitoring agent has been started. (node:`*nodename*`)`

3041 `The console monitoring agent has been stopped. (node:`*nodename*`)`

3042 `The RCI monitoring agent has been started.`

3043 `The RCI monitoring agent has been stopped.`

3044 `The console monitoring agent took over monitoring Node` *targetnode*.

3045 `The console monitoring agent cancelled to monitor Node` *targetnode*

`3046` `The specified option is not registered because it is not required for` ***device***`. (option:`***option***`)`

`3070` `"Wait-For-PROM" is enable in this node. (node:`***nodename***`)`

`3071` `"Wait-For-PROM" of the console monitoring agent is enable on the node. (node:`***nodename***`)`

12.12.2 Warning message

`5001` `The RCI address has been changed. (node:`***nodename*** `address:`***address)***`)`

Corrective action:
The RCI address is changed while the RCI monitoring agent is running. *nodename* indicates a name of the node where the RCI address is changed. *address* indicates the changed RCI address. Check if the RCI address is correctly set up on the node.

12.12.3 Error message

i When the error messages described in this section are output, investigate the `/var/adm/messages` file and check if another error message is output before this message. If this occurs, follow the corrective action of the other error message.

`????` `Message not found!!`

Corrective action:
The text of the message corresponding to the message number is not available. Copy this message and contact field support.

`6000` `An internal error occurred. (function:`***function*** `detail:`***code1-code2-code3-code4***`)`

Corrective action:
Collect required information to contact field support. Refer to the Chapter “Diagnostics and troubleshooting” for collecting information.

`6003` `Error in option specification. (option:`***option***`)`

Corrective action:
Specify the correct option and execute the command again.
option indicates an option.

`6004        No system administrator authority.`

Corrective action:
Execute using system administrator access privileges.

6007   `One of the required options (`*option*`) must be specified.`

Corrective action:
Specify the correct option and execute the command again.
option indicates an option.

7003   `An error was detected in RCI.`
`(node:`*nodename* `address:`*address* `status:`*status*`)`

Corrective action:
An RCI transmission failure occurs between the node where the error message is output and *nodename* in the error message. Check the following:

- RCI connection is correct

- The node is ON

If either fails, take corrective action. Then, reboot the Shutdown Facility executing the following command on the node where the error message appears.

/opt/SMAW/bin/sdtool -r

If both are not the cause of the RCI error, check the following:

- The RCI cable is broken

- The System Control Facility (hereafter, SCF) is broken

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”. The node *nodename* in the error message is excluded from monitoring and elimination. Field support engineers restart the Shutdown Facility after recovering hardware.

7004   `The RCI monitoring agent has been stopped due to an RCI address error.`
`(node:`*nodename* `address:`*address*`)`

Corrective action:
The RCI address of other node is changed while the RCI monitoring agent is running. Collect required information and SCF dump to contact field support.

Refer to the Section “Collecting troubleshooting information” for collecting information and on SCF dump.

The field support engineer confirms if the RCI address of *nodename* indicated in the message is correctly set up. To check the previous RCI address, execute the following command on an arbitrary node:

```
# /opt/FJSVmadm/sbin/setrci stat
```

If the RCI address is incorrect, set up the address again referring to the instruction for field support engineers.

Execute the following command to restart the RCI monitoring agent:

```
# /etc/opt/FJSVcluster/bin/clrcimonctl restart
```

Execute the following command to restart the Shutdown Facility (SF) where the error message was output:

```
# /opt/SMAW/bin/sdtool -r
```

`7018        The console monitoring agent has been started.`

Corrective action:
The console monitoring agent has been started. If you do not need to restart the console monitoring agent, you do not have to take any action. If you need to restart the console monitoring agent, execute the following command on the node where this error message appeared:

```
# /etc/opt/FJSVcluster/bin/clrccumonctl restart
```

Then, restart the Shutdown Facility on that node as follows:

```
# /opt/SMAW/bin/sdtool -r
```

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7019        The RCI monitoring agent has already been started.`

Corrective action:
The RCI monitoring agent has been started. If you do not need to restart the RCI monitoring agent, you do not have to take any action. If you need to restart the RCI monitoring agent, execute the following command on the node where this error message appeared:

```
# /etc/opt/FJSVcluster/bin/clrcimonctl restart
```

Then, restart the Shutdown Facility on that node as follows:

```
# /opt/SMAW/bin/sdtool -r
```

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7026 HCP is not supported. (version:`*version*`)`

Corrective action
The HCP version is not supported. To use XSCF, you need to update HCP to the appropriate version. For information on how to update HCP, refer to the *XSCF (eXtended System Control Facility) User's Guide*.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7027 The XSCF is not supported.`

Corrective action
XSCF is not supported. XSCF might not be built in a main unit or ESF (Enhanced Support Facility) might not be installed. Referring to the instruction manual of a main unit, check if XSCF is built in. Or referring to the *ESF Installation Guide*, check if ESF is installed. Install ESF if necessary.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7030 CF is not running.`

Corrective action
CF is not running. If CF has not been configured, you need to configure it (refer to Section “CF, CIP, and CIM configuration”). If CF has been configured, reboot the node and start CF.

`7031        Cannot find the HCP version.`

Corrective action
The HCP version is not known. ESF (Enhanced Support Facility) might have been incorrectly installed. Or referring to the *ESF Installation Guide*, check if ESF is installed.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7033        Cannot find the specified CF node name.`
`            (nodename:`*nodename*`)`

Corrective action
The specified CF node name is not found. You need to check the following and execute the command again:

1. The specified CF node name is correct. Check if the specified CF node name is correct using the `cftool`(1M) command.
2. The CF of the specified node is running. Check if CF is running using the `cftool`(1M) command. If not, reboot the node, and start CF.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”)

`7034        The console information is not set.`
`            (nodename:`*nodename*`)`

Corrective action
The specified CF node name is not registered. Check the console information using the `clrccusetup` -l command. Register the console information, if necessary, using the Shutdown Agent Wizard or `clrccusetup`. For the Shutdown Agent Wizard, refer to the PRIMECLUSTER *Installation and Administration Guide*. For the `clrccusetup` command, refer to the `clrccusetup`(1M) manual page.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”)

`7035` `An address error is detected in RCI.`
`(nodename:`***nodename***`address:`***address***`)`

Corrective action
Check if the RCI address is correct. If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

Field support engineers should check if the RCI address of the *nodename* in the error message is correct by executing the following command on any one of cluster nodes:

```
# /opt/FJSVmadm/sbin/setrci stat
```

If the RCI address is incorrect, correct it. For details, refer to the maintenance manual for field support engineers. The node *nodename* in the error message is excluded from monitoring and elimination until the Shutdown Facility is restarted. Field support engineers restart the Shutdown Facility executing the following command:

```
# /opt/SMAW/bin/sdtool -r
```

```
7040      The console was disconnected.
          (node:nodename portno:portnumber detail:code)
```

Corrective action:
When the message is output to the other nodes during one of the following operations:

- Changing the XSCF network settings
- Doing maintenance after turning off AC power supply
- Updating the XSCF firmware

After completing the operation, recover the console monitoring agent daemon by executing the following commands on the node where the error message is output.

```
# /opt/SMAW/bin/sdtool -e
# /opt/SMAW/bin/sdtool -b
```

Once the XSCF IP address or host name is changed, cluster settings will need to be changed. Configure the Shutdown Facility again according to the XSCF settings.

If this error message appears regardless of the above operations, it is necessary to check if XSCF is connected to the console.

- The RCCU is powered on.
- The normal lamp of the port that is connected to HUB and LAN cable.
- The LAN cable is connected to the RCCU and HUB connectors.
- The LAN cable is connected to the XSCF SCF-LAN port and HUB connectors.
- The shell port of the XSCF telnet ports is not connected from other software products outside the cluster system.

You can check by connecting to the XSCF shell via serial port (tty-a). For information on how to connect and check the connection, see the "XSCF (eXtended SystemControl Facility) User's Guide".

If any one of the above turns out to be the cause of the problem, take corrective action then restart the Shutdown Facility (SF), executing the following commands on the node where the error message was output.

```
# /opt/SMAW/bin/sdtool -e
# /opt/SMAW/bin/sdtool -b
```

If the problem still occurs, it is attributed to the fact that the load of the administrative LAN is heavy. Users should not access a public LAN while operating the administrative LAN. If the pubic LAN needs to be used through unavoidable circumstances, you can prevent low performance of the console monitoring agent daemon due to heavy traffic load by specifying the larger value than the default timeout for the following Shutdown Agent.
For information on how to set the timeout, see “5.1.2.3 specifying the Timeout Value” of the PRIMECLUSTER *Installation and Administration Guide (Solaris)*.

- XSCF Panic
- Console Break
- XSCF Reset

If the problem has not yet been resolved, users should consider failures of network and hardware such as RCCU, XSCF, or HUB. Contact your local customer support engineer. Also, collect and submit troubleshooting information and the message to your Fujitsu system engineers. For information on how to collect the information, see Section “Collecting troubleshooting information”.

`7042` `Connection to the console is refused.`
`(node:`***nodename*** `portno:`***portnumber*** `detail:`***code***`)`

Corrective action:
Connection to the console cannot be established during the console monitoring agent startup. Check the following:

- The IP address or host name of RCCU or XSCF is correct. Use the `clrccusetup`(1M) command to check. If the IP address or host name is incorrect, configure the console monitoring agent again.
- The RCCU is powered.
- The normal lamp of the HUB connected to the RCCU is on.
- The LAN cable connectors are connected to the RCCU and HUB.
- The LAN cable connectors are connected to the XSCF's SCF-LAN port and HUB.
- The XSCF shell port for XSCF telnet is not connected from servers outside the cluster.
- The XSCF shell port is not connected from other software products but PRIMECLUSTER. Check this by connecting to the XSCF shell via serial port (`tty-a`). Refer to the *XSCF (eXtended System Control Facility) User's Guide* for information on how to connect and confirm.
- The IP address of RCCU belongs to the same segment as the Administrative LAN.
- The IP address of XSCF belongs to the same segment as the Administrative LAN.
- The console information of RCCU and XSCF is correct. Use the `clrccusetup`(1M) command to check. If it is incorrect, register console information again using the `clrccusetup`(1M) command.

If any of above fails, execute the following command on the node where the error message was output, and restart the Shutdown Facility:

```
#/opt/SMAW/bin/sdtool -r
```

If you still have a problem with connection, there might be a network failure or a failure of hardware such as RCCU, HUB and related cables. Contact field support.

If the above corrective action does not work, collect required information to contact field support. Refer to the Section “Collecting troubleshooting information” for collecting information.

7200 `The configuration file of the console monitoring agent does not exist. (file:`*filename*`)`

Corrective action:

1. Download the configuration file displayed in miscellaneous information using ftp from other nodes.
2. Store this file in the original directory.
3. Set up the same access permission mode of this file as other nodes.
4. Restart the system.

If all the nodes do not have this configuration file, collect required information to contact field support. Refer to the Section “Collecting troubleshooting information” for collecting information.

7201 `The configuration file of the RCI monitoring agent does not exist. (file:`*filename*`)`

Corrective action:

1. Download the configuration file displayed in miscellaneous information using ftp from other nodes.
2. Store this file in the original directory.
3. Set up the same access permission mode of this file as other nodes.
4. Restart the system.

If all the nodes do not have this configuration file, collect required information to contact field support. Refer to the Section “Collecting troubleshooting information” for collecting information.

`7202` `The configuration file of the console monitoring agent has an incorrect format. (file:`*filename*`)`

Corrective action:
There's an incorrect format of the configuration file in the console monitoring agent.

If the configuration file name displayed in miscellaneous information is `SA_rccu.cfg`, reconfigure the Shutdown Facility by invoking the configuration wizard. Then, confirm if the RCCU name is correct.

If the above corrective action does not work, or the configuration file name is other than `SA_rccu.cfg`, collect required information to contact field support. Refer to the Section “Collecting troubleshooting information” for collecting information.

`7203` `The username or password to login to the control port of the console is incorrect.`

Corrective action
You are not allowed to log on to the control port of the console (RCCU or XSCF). The username or password that is registered in a cluster system is different than the one that is configured for the console. Configure the console monitoring agent and Shutdown Facility again.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

`7204` `Cannot find the console's IP address. (nodename:`*nodename*` detail:`*code*`)`

Corrective action
The console's IP address is unknown. You need to check if a host name of RCCU or XSCF is correct using the `clrccusetup`(1M) command. If it is correct, reconfigure the console monitoring agent.

If this corrective action does not work, write down the error message, collect required information for troubleshooting and contact field support (refer to the Section “Collecting troubleshooting information”).

12.13 CCBR messages

The CCBR Framework commands, `cfbackup`(1M) and `cfrestore`(1M), will generate error messages on stderr and warning messages in an error log file if one or more error conditions are detected. All Framework messages have a date and time prefix, optionally followed by the text `WARNING:` and the command name, and then followed by the error text. Layered-product plugin modules can also generate warning messages, error messages, or both.

12.13.1 cfbackup warning/error messages

12.13.1.1 To stderr

- *date time* `cfbackup: invalid option specified`

  One or more invalid arguments were used with the `cfbackup` command. The command syntax is as follows:

  `cfbackup [-test] [-f] [`*n*`]`

where	`-test`	can be used by plug-in developers. It will cause the $CCBROOT tree to remain after a successful run (it is usually deleted). Also, the backup/restore generation number will not be incremented.
	`-f`	specifies FORCE, which will always cause a compressed archive file to be created, even when 'fatal' errors have been detected.
	n	specifies the backup/restore generation to use.

- *date time* `cfbackup: cmd must be run as root`

  The `cfbackup` command must be executed by root (`uid=0`).

- *date time* `cfbackup: ccbr files & directories must be accessible`

  The `cfbackup` command must be able to access `/opt/SMAW/ccbr`, `/opt/SMAW/ccbr/plugins`, and `/opt/SMAW/ccbr/ccbr.conf`.

12.13.1.2 To log file

- *date time* `WARNING: cfbackup: specified generation` ***n*** `too small - using` ***p***

  The generation number specified on the `cfbackup` command is less than the value in /`opt/SMAW/ccbr/ccbr.gen`. The larger value will be used.

- *date time* `cfbackup [FORCE]` ***n*** `[(TEST)] log started`

  This message indicates that `cfbackup` is beginning processing.

- *date time nodename* `not an active cluster node`

  This informational message indicates that the node is not an active PRIME-CLUSTER node.

- *date time* `no runnable plug-ins! cmd aborted.`

  The `cfbackup` command cannot find executable scripts in the `/opt/SMAW/ccbr/plugins` directory.

- *date time* `cfbackup n ended unsuccessfully`

  This message indicates that the `cfbackup` command is ending with an error code of `2` or `3`.

- *date time* `validation failed in pluginname`

  This error message indicates that the validation routine in one or more plugin modules has returned an error code of `2` or `3` to the `cfbackup` command.

- *date time* `backup failed in pluginname`

  This error message indicates that the backup routine in one or more plugin modules has returned an error code of `2` or `3` to the `cfbackup` command.

- *date time* `archive file creation failed`

  This error message indicates the `cfbackup` command cannot successfully create a tar archive file from the backup tree.

- *date time* `archive file compression failed`

  This error message indicates that the `cfbackup` command cannot create a compressed archive file (with compress).

- *date time* `cfbackup n ended`

  This message indicates that the `cfbackup` command has completed all processing. The highest return code value detected while processing will be used as the return/error code value.

12.13.2 cfrestore warning/error messages

12.13.2.1 To stderr

- *date time* `cfrestore: invalid option specified`

  One or more invalid arguments were used with the `cfrestore` command. The command syntax is as follows:

  `cfrestore [-test] [-f] [p] [-y] [`*n*`]`

where	`-test`	can be used by plug-in developers. It will cause the $CCBROOT tree to remain after a successful run (it is usually deleted). Also, the cpio step will restore all saved files to /tmp/ccbr instead of / --- this will give plug-in developers a chance to check results, before “doing it” for real...
	`-f`	specifies FORCE, which will always cause a archive file to be restored, even when 'fatal' errors have been detected.
	`-p`	specifies PASS, which allows cfrestore to use a cfrestore file-tree that has already been 'extracted' from a compressed archive.
	`-y`	specifies an automatic YES answer, whenever the cfrestore command requests a confirmation response.
	`-M`	force restore even if we are in multi-user mode
	n	specifies the backup/restore generation to use.

- *date time* `cfrestore: cmd must be run as root`

  The `cfrestore` command must be executed by root (`uid=0`).

- *date time* `cfrestore: cmd must be run in single-user mode`

  The `cfrestore` command must be executed while at runlevel 1 or S (single-user mode).

- *date time* `cfrestore: ccbr files & directories must be accessible`

  The `cfrestore` command must be able to access `/opt/SMAW/ccbr`, `/opt/SMAW/ccbr/plugins`, and `/opt/SMAW/ccbr/ccbr.conf`.

12.13.2.2 To log file

- *date time* `cfrestore [FORCE] [TREE] [YES] n [(TEST)] log started`

  This message indicates that `cfrestore` is beginning processing.

- *date time* `ERROR: nodename IS an active cluster node`

  This `cfrestore` error message indicates that the node is an active PRIME-CLUSTER node, and that restoring cluster configuration information at this time may lead to severe errors, and is not recommended.

- *date time* `cfrestore` ***n*** `ended unsuccessfully`

  This message indicates that the `cfrestore` command is ending with an error code of `2` or `3`.

- *date time* `no runnable plug-ins! cmd aborted.`

  The `cfrestore` command cannot find executable scripts in the `/opt/SMAW/ccbr/plugins` directory.

- *date time* `unable to find selected archive file:` *archivefile*

  This message indicates that the `cfrestore` command cannot locate the archive file at `$CCBROOT.tar.Z` (Solaris). The `CCBROOT` value is set using *nodename* and *generation number*.

- *date time* `archive file uncompression failed`

  This error message indicates that the `cfrestore` command cannot expand the compressed archive file (with uncompress).

- *date time* `archive file extraction failed`

  This error message indicates the `cfrestore` command cannot successfully recreate a backup tree from the tar archive file.

- *date time* `archive file recompression failed`

  This error message indicates that the `cfrestore` command cannot recreate the compressed archive file (with compress).

- *date time* `warning: backup created with FORCE option`

  This warning message indicates that `cfbackup` created this archive file with the FORCE option specified (usually used to force past an error condition). It is highly recommended that the error logfile in the backup archive be examined to make sure a restore of this data will be valid.

- *date time* `plugin present at backup is missing for restore:` *pluginname*

  This error message indicates that the named plugin module is missing from the `/opt/SMAW/ccbr/plugins` directory. This usually indicates that a PRIMECLUSTER package has been uninstalled and not reinstalled, or that a newer or older package does not have the same named plugin(s).

- *date time* `negative reply terminates processing`

  This error message indicates that the reply to the question (asked by `cfrestore`), `"Are you sure you want to continue (y/n) ?"`, was not answered with YES. Processing terminates unless the FORCE option has been specified.

- *date time* `plugin validation failed`

  This error message indicates that the validation routine of the identified plugin module has returned an error code of `2` or `3` to the `cfrestore` command. Validation will continue so that all plugin modules have a chance to identify problems.

- *date time* `cpio copy for cfrestore failed`

  This error message indicates that the automatic cpio restore of all file trees rooted in the “root” subdirectory of the backup tree failed in execution. The `cpio` command is executed in verbose mode, so that there will be some history of which files were restored. This error usually indicates a partial restore has occurred. This can be a significant problem, and may require manual intervention to repair/restore the modified files.

- *date time* `NOTE: no root subdirectory for cpio copy step`

  This warning message indicates that `cfrestore` did not find any files to automatically restore from the backup tree. This is usually an error, probably indicating a damaged backup archive.

- *date time* `plugin restore failed`

  This error message indicates that the restore routine of the identified plugin module has returned an error code of `2` or `3` to the `cfrestore` command. Only a small number of plugins will need to provide an active restore routine. Restore will continue so that all plugins have a chance to identify problems. Any problems at this time, after the automatic cpio restore, will need to be examined individually and fixed manually.

- *date time* `cfrestore n ended`

  This message indicates that the `cfrestore` command has completed all processing. The highest return code value detected while processing will be used as the return/error code value.

13 Manual pages

This chapter lists the online manual pages for CCBR, CF, CFS, CIP, CPAT, Monitoring Agent, PAS, RCVM, PCS, Resource Database, RMS, RMS Wizards, SCON, SF, SIS, and Web-Based Admin View.

To display a manual page, type the following command:

`$` **`man`** *man_page_name*

13.1 CCBR

System administration

`cfbackup`
: save the cluster configuration information for a PRIMECLUSTER node

`cfrestore`
: restore saved cluster configuration formation on a PRIMECLUSTER node

13.2 CF

System administration

`cfconfig`
: configure or unconfigure a node for a PRIMECLUSTER cluster

`cfregd`
: CF registry synchronization daemon

`cfset`
: apply or modify `/etc/default/cluster.config` entries into the CF module

`cftool`
: print node communications status for a node or the cluster

`rcqconfig`
: configure or start quorum

`rcqquery`
: get quorum state of the cluster

13.3 CFS

`fsck_rcfs`
file system consistency check and interactive repair

`mount_rcfs`
mount RCFS file systems

`rcfs_fumount`
force unmount RCFS mounted file system

`rcfs_list`
list status of RCFS mounted file systems

`rcfs_switch`
manual switchover or failover of a RCFS file system

`ngadmin`
node group administration utility

`cfsmntd`
cfs mount daemon for RCFS

13.4 CIP

System administration

`cipconfig`
start or stop CIP 2.0

`ciptool`
retrieve CIP information about local and remote nodes in the cluster

File format

`cip.cf`
CIP configuration file format

13.5 CPAT

System administration

`cluster_uninstall`
  remove PRIMECLUSTER software from a system

13.6 Monitoring Agent

System administration

`clrcimonctl`
  Start, stop or restart of the RCI monitoring agent daemon, and display of daemon presence

`cldevparam`
  changes or displays the tunable parameter of the RCI/RCCU Monitoring Agent

`clrccumonctl`
  Start, stop or restart of the console monitoring agent daemon, and display of daemon presence

`clrccusetup`
  registers, changes, deletes, or displays console information

13.7 PAS

System administration

`mipcstat`
  MIPC statistics

`clmstat`
  CLM statistics

13.8 RCVM

i Not available in all markets.

System administration

`dkconfig`
: virtual disk configuration utility

`dkmigrate`
: virtual disk migration utility

`vdisk`
: virtual disk driver

`dkmirror`
: mirror disk administrative utility

File format

`dktab`

13.9 virtual disk configuration file

13.10 PCS

System administration

pcstool
: Modifies PCS configurations from the command line

`pcscui`
: Character-based interface for PCS

pcs_reinstall
: Utility for re-integrating PCS with dependent products

13.11 Resource Database

i To display a Resource Database manual page, add `/etc/opt/FJSVcluster/man` to the environment variable `MANPATH`.

System administration

clautoconfig
: execute of the automatic resource registration

`clbackuprdb`
: save the resource database

`clexec`
: execute the remote command

`cldeldevice`
: delete resource registered by automatic resource registration

`clinitreset`
: reset the resource database

`clrestorerdb`
: restore the resource database

`clsetparam`
: display and change the resource database operational environment

`clsetup`
: set up the resource database

`clstartrsc`
: resource activation

`clstoprsc`
: resource deactivation

`clsyncfile`
: distribute a file between cluster nodes

User command

`clgettree`
: display the tree information of the resource database

13.12 RMS

System administration

`hvassert`
: assert (test for) an RMS resource state

`hvcm`
: start the RMS configuration monitor

`hvconfig`
: display or save the RMS configuration file

`hvdisp`
: display RMS resource information

`hvdist`
: distribute RMS configuration files

`hvdump`
: collect debugging information about RMS

`hvgdmake`
: compile an RMS custom detector

`hvlogclean`
: clean RMS log files

`hvrclev`
: change default RMS start run level

`hvreset`
: interrupt ongoing activities and re-initialize the `userApplication` graph

`hvsetenv`
: manipulate RMS rc start or `AutoStartUp`

`hvshut`
: shut down RMS

`hvswitch`
: switch control of an RMS user application resource to another node

`hvthrottle`
: prevent multiple RMS scripts from running simultaneously

`hvutil`
: manipulate availability of an RMS resource

File formats

`hvenv.local`
: RMS local environment configuration file

13.13 RMS Wizards

RMS Wizards and RMS Application Wizards

RMS Wizards are documented as html pages in the `SMAWRhvdo` package on the CD-ROM. After installing this package, the documentation is available in the following directory:
`/usr/opt/reliant/htdocs.solaris/wizards.en`

13.14 SCON

`scon`
: start the cluster console software

13.15 SF

System administration

`rcsd`
: Shutdown Daemon of the Shutdown Facility

`sdtool`
: interface tool for the Shutdown Daemon

File formats

`rcsd.cfg`
: configuration file for the Shutdown Daemon

`SA_rccu.cfg`
: configuration file for RCCU Shutdown Agent

`SA_rps.cfg`
: configuration file for a Remote Power Switch Shutdown Agent

`SA_scon.cfg`
: configuration file for SCON Shutdown Agent

`SA_sspint.cfg`
: configuration file for Sun E10000 Shutdown Agent

`SA_sunF.cfg`
configuration file for sunF system controller Shutdown Agent

`SA_wtinps.cfg`
configuration file for WTI NPS Shutdown Agent

13.16 SIS

System administration

`dtcpadmin`
start the SIS administration utility

`dtcpd`
start the SIS daemon for configuring VIPs

`dtcpstat`
status information about SIS

13.17 Web-Based Admin View

System administration

`fjsvwvbs`
stop Web-Based Admin View

`fjsvwvcnf`
start, stop, or restart the web server for Web-Based Admin View

`wvCntl`
start, stop, or get debugging information for Web-Based Admin View

`wvGetparam`
display Web-Based Admin View's environment variable

`wvSetparam`
set Web-Based Admin View environment variable

`wvstat`
display the operating status of Web-Based Admin View

Glossary

AC

See *Access Client*.

Access Client

GFS kernel module on each node that communicates with the Meta Data Server and provides simultaneous access to a shared file system.

Administrative LAN

In PRIMECLUSTER configurations, an administrative LAN is a private local area network (LAN) on which machines such as the system console and cluster console reside. Because normal users do not have access to the administrative LAN, it provides an extra level of security. The use of an administrative LAN is optional.

See also *public LAN*.

API

See *Application Program Interface*.

application (RMS)

A resource categorized as a `userApplication` used to group resources into a logical collection.

Application Program Interface

A shared boundary between a service provider and the application that uses that service.

application template (RMS)

A predefined group of object definition value choices used by RMS Application Wizards to create object definitions for a specific type of application.

Application Wizards

See *RMS Application Wizards*.

attribute (RMS)

The part of an object definition that specifies how the base monitor acts and reacts for a particular object type during normal operations.

automatic switchover (RMS)
The procedure by which RMS automatically switches control of a `userApplication` over to another node after specified conditions are detected.

See also *directed switchover (RMS)*, *failover (RMS, SIS)*, *switchover (RMS)*, *symmetrical switchover (RMS)*.

availability
Availability describes the need of most enterprises to operate applications via the Internet 24 hours a day, 7 days a week. The relationship of the actual to the planned usage time determines the availability of a system.

base cluster foundation (CF)
This PRIMECLUSTER module resides on top of the basic OS and provides internal interfaces for the CF (Cluster Foundation) functions that the PRIMECLUSTER services use in the layer above.

See also *Cluster Foundation*.

base monitor (RMS)
The RMS module that maintains the availability of resources. The base monitor is supported by daemons and detectors. Each node being monitored has its own copy of the base monitor.

Cache Fusion
The improved interprocess communication interface in Oracle 9i that allows logical disk blocks (buffers) to be cached in the local memory of each node. Thus, instead of having to flush a block to disk when an update is required, the block can be copied to another node by passing a message on the interconnect, thereby removing the physical I/O overhead.

CCBR
See *Cluster Configuration Backup and Restore*.

CF node name
The CF cluster node name, which is configured when a CF cluster is created.

Cluster Configuration Backup and Restore
CCBR provides a simple method to save the current PRIMECLUSTER configuration information of a cluster node. It also provides a method to restore the configuration information.

Cluster Interconnect Protocol
CIP is an interface such as hme0 except the physical layer is built on top of the cluster interconnect.

CF
See *Cluster Foundation*.

child (RMS)
A resource defined in the configuration file that has at least one parent. A child can have multiple parents, and can either have children itself (making it also a parent) or no children (making it a leaf object).

See also *resource (RMS)*, *object (RMS)*, *parent (RMS)*.

cluster
A set of computers that work together as a single computing source. Specifically, a cluster performs a distributed form of parallel computing.

See also *RMS configuration*.

Cluster Foundation
The set of PRIMECLUSTER modules that provides basic clustering communication services.

See also *base cluster foundation (CF)*.

cluster interconnect (CF)
The set of private network connections used exclusively for PRIME-CLUSTER communications.

Cluster Join Services (CF)
This PRIMECLUSTER module handles the forming of a new cluster and the addition of nodes.

concatenated virtual disk

Concatenated virtual disks consist of two or more pieces on one or more disk drives. They correspond to the sum of their parts. Unlike simple virtual disks where the disk is subdivided into small pieces, the individual disks or partitions are combined to form a single large logical disk. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *mirror virtual disk, simple virtual disk, striped virtual disk, virtual disk*.

configuration file (RMS)

The RMS configuration file that defines the monitored resources and establishes the interdependencies between them. The default name of this file is `config.us`.

console

See *single console*.

custom detector (RMS)

See *detector (RMS)*.

custom type (RMS)

See *generic type (RMS)*.

daemon

A continuous process that performs a specific function repeatedly.

database node (SIS)

Nodes that maintain the configuration, dynamic data, and statistics in a SIS configuration.

See also *gateway node (SIS), service node (SIS), Scalable Internet Services (SIS)*.

detector (RMS)

A process that monitors the state of a specific object type and reports a change in the resource state to the base monitor.

directed switchover (RMS)

The RMS procedure by which an administrator switches control of a `userApplication` over to another node.

See also *automatic switchover (RMS)*, *failover (RMS, SIS)*, *switchover (RMS)*, *symmetrical switchover (RMS)*.

DOWN (CF)
A node state that indicates that the node is unavailable (marked as down). A `LEFTCLUSTER` node must be marked as `DOWN` before it can rejoin a cluster.

See also *UP (CF)*, *LEFTCLUSTER (CF)*, *node state (CF)*.

ENS (CF)
See *Event Notification Services (CF)*.

environment variables (RMS)
Variables or parameters that are defined globally.

error detection (RMS)
The process of detecting an error. For RMS, this includes initiating a log entry, sending a message to a log file, or making an appropriate recovery response.

Event Notification Services (CF)
This PRIMECLUSTER module provides an atomic-broadcast facility for events.

failover (RMS, SIS)
With SIS, this process switches a failed node to a backup node. With RMS, this process is known as switchover.

See also *automatic switchover (RMS)*, *directed switchover (RMS)*, *switchover (RMS)*, *symmetrical switchover (RMS)*.

gateway node (SIS)
Gateway nodes have an external network interface. All incoming packets are received by this node and forwarded to the selected service node, depending on the scheduling algorithm for the service.

See also *service node (SIS)*, *database node (SIS), Scalable Internet Services (SIS)*.

GDS
See *Global Disk Services*.

GFS

See *Global File Services*.

GLS

See *Global Link Services*.

Global Disk Services

This optional product provides volume management that improves the availability and manageability of information stored on the disk unit of the Storage Area Network (SAN).

Global File Services

This optional product provides direct, simultaneous accessing of the file system on the shared storage unit from two or more nodes within a cluster.

Global Link Services

This PRIMECLUSTER optional module provides network high availability solutions by multiplying a network route.

generic type (RMS)

An object type which has generic properties. A generic type is used to customize RMS for monitoring resources that cannot be assigned to one of the supplied object types.

See also *object type (RMS)*.

graph (RMS)

See *system graph (RMS)*.

graphical user interface

A computer interface with windows, icons, toolbars, and pull-down menus that is designed to be simpler to use than the command-line interface.

GUI

See *graphical user interface*.

high availability

This concept applies to the use of redundant resources to avoid single points of failure.

interconnect (CF)

See *cluster interconnect (CF)*.

Internet Protocol address

A numeric address that can be assigned to computers or applications.

See also *IP aliasing*.

Internode Communications facility

This module is the network transport layer for all PRIMECLUSTER internode communications. It interfaces by means of OS-dependent code to the network I/O subsystem and guarantees delivery of messages queued for transmission to the destination node in the same sequential order unless the destination node fails.

IP address

See *Internet Protocol address*.

IP aliasing

This enables several IP addresses (aliases) to be allocated to one physical network interface. With IP aliasing, the user can continue communicating with the same IP address, even though the application is now running on another node.

See also *Internet Protocol address*.

JOIN (CF)

See *Cluster Join Services (CF)*.

keyword

A word that has special meaning in a programming language. For example, in the configuration file, the keyword `object` identifies the kind of definition that follows.

leaf object (RMS)

A bottom object in a system graph. In the configuration file, this object definition is at the beginning of the file. A leaf object does not have children.

LEFTCLUSTER (CF)

A node state that indicates that the node cannot communicate with other nodes in the cluster. That is, the node has left the cluster. The reason for the intermediate `LEFTCLUSTER` state is to avoid the network partition problem.

See also *UP (CF)*, *DOWN (CF)*, *network partition (CF)*, *node state (CF)*.

link (RMS)
Designates a child or parent relationship between specific resources.

local area network
See *public LAN*.

local node
The node from which a command or process is initiated.

See also *remote node, node*.

log file
The file that contains a record of significant system events or messages. The base monitor, wizards, and detectors can have their own log files.

MDS
See *Meta Data Server*.

message
A set of data transmitted from one software process to another process, device, or file.

message queue
A designated memory area which acts as a holding place for messages.

Meta Data Server
GFS daemon that centrally manages the control information of a file system (meta-data).

mirrored disks
A set of disks that contain the same data. If one disk fails, the remaining disks of the set are still available, preventing an interruption in data availability. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *mirrored pieces*.

mirrored pieces
Physical pieces that together comprise a mirrored virtual disk. These pieces include mirrored disks and data disks. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *mirrored disks*.

mirror virtual disk

Mirror virtual disks consist of two or more physical devices, and all output operations are performed simultaneously on all of the devices. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *concatenated virtual disk*, *simple virtual disk*, *striped virtual disk*, *virtual disk*.

mount point

The point in the directory tree where a file system is attached.

multihosting

Multiple controllers simultaneously accessing a set of disk drives. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

native operating system

The part of an operating system that is always active and translates system calls into activities.

network partition (CF)

This condition exists when two or more nodes in a cluster cannot communicate over the interconnect; however, with applications still running, the nodes can continue to read and write to a shared device, compromising data integrity.

node

A host which is a member of a cluster. A computer node is the same as a computer.

node state (CF)

Every node in a cluster maintains a local state for every other node in that cluster. The node state of every node in the cluster must be either `UP`, `DOWN`, or `LEFTCLUSTER`.

See also *UP (CF)*, *DOWN (CF)*, *LEFTCLUSTER (CF)*.

object (RMS)

In the configuration file or a system graph, this is a representation of a physical or virtual resource.

See also *leaf object (RMS)*, *object definition (RMS)*, *object type (RMS)*.

object definition (RMS)

An entry in the configuration file that identifies a resource to be monitored by RMS. Attributes included in the definition specify properties of the corresponding resource. The keyword associated with an object definition is `object`.

See also *attribute (RMS)*, *object type (RMS)*.

object type (RMS)

A category of similar resources monitored as a group, such as disk drives. Each object type has specific properties, or attributes, which limit or define what monitoring or action can occur. When a resource is associated with a particular object type, attributes associated with that object type are applied to the resource.

See also *generic type (RMS)*.

online maintenance

The capability of adding, removing, replacing, or recovering devices without shutting or powering off the node.

operating system dependent (CF)

This module provides an interface between the native operating system and the abstract, OS-independent interface that all PRIMECLUSTER modules depend upon.

OPS

See *Oracle Parallel Server*.

Oracle Parallel Server

Oracle Parallel Server allows access to all data in a database to users and applications in a clustered or MPP (massively parallel processing) platform.

OSD (CF)

See *operating system dependent (CF)*.

parent (RMS)

An object in the configuration file or system graph that has at least one child.

See also *child (RMS), configuration file (RMS)*, *system graph (RMS)*.

primary node (RMS)
The default node on which a user application comes online when RMS is started. This is always the nodename of the first child listed in the `userApplication` object definition.

private network addresses
Private network addresses are a reserved range of IP addresses specified by the Internet Assigned Numbers Authority. They may be used internally by any organization but, because different organizations can use the same addresses, they should never be made visible to the public internet.

private resource (RMS)
A resource accessible only by a single node and not accessible to other RMS nodes.

See also *resource (RMS)*, *shared resource*.

queue
See *message queue*.

PRIMECLUSTER services (CF)
Service modules that provide services and internal interfaces for clustered applications.

redundancy
This is the capability of one object to assume the resource load of any other object in a cluster, and the capability of RAID hardware and/or RAID software to replicate data stored on secondary storage devices.

public LAN
The local area network (LAN) by which normal users access a machine.

See also *Administrative LAN*.

Reliant Monitor Services (RMS)
The package that maintains high availability of user-specified resources by providing monitoring and switchover capabilities.

remote node
A node that is accessed through a telecommunications line or LAN.

See also *local node*.

remote node
See *remote node*.

reporting message (RMS)
A message that a detector uses to report the state of a particular resource to the base monitor.

resource (RMS)
A hardware or software element (private or shared) that provides a function, such as a mirrored disk, mirrored disk pieces, or a database server. A local resource is monitored only by the local node.

See also *private resource (RMS)*, *shared resource*.

resource definition (RMS)
See *object definition (RMS)*.

resource label (RMS)
The name of the resource as displayed in a system graph.

resource state (RMS)
Current state of a resource.

RMS
See *Reliant Monitor Services (RMS)*.

RMS Application Wizards
RMS Application Wizards add new menu items to the RMS Wizard Tools for a specific application.

See also *RMS Wizard Tools*, *Reliant Monitor Services (RMS)*.

RMS commands
Commands that enable RMS resources to be administered from the command line.

RMS configuration
A configuration made up of two or more nodes connected to shared resources. Each node has its own copy of operating system and RMS software, as well as its own applications.

RMS Wizard Tools

A software package composed of various configuration and administration tools used to create and manage applications in an RMS configuration.

See also *RMS Application Wizards*, *Reliant Monitor Services (RMS)*.

SAN

See *Storage Area Network*.

Scalable Internet Services (SIS)

Scalable Internet Services is a TCP connection load balancer, and dynamically balances network access loads across cluster nodes while maintaining normal client/server sessions for each connection.

scalability

The ability of a computing system to dynamically handle any increase in work load. Scalability is especially important for Internet-based applications where growth caused by Internet usage presents a scalable challenge.

SCON

See *single console*.

script (RMS)

A shell program executed by the base monitor in response to a state transition in a resource. The script may cause the state of a resource to change.

service node (SIS)

Service nodes provide one or more TCP services (such as FTP, Telnet, and HTTP) and receive client requests forwarded by the gateway nodes.

See also *database node (SIS)*, *gateway node (SIS), Scalable Internet Services (SIS)*.

SF

See *Shutdown Facility*.

shared resource

A resource, such as a disk drive, that is accessible to more than one node.

See also *private resource (RMS)*, *resource (RMS)*.

Shutdown Facility

The Shutdown Facility provides the interface for managing the shutdown of cluster nodes when error conditions occur. The SF also cares for advising other PRIMECLUSTER products of the successful completion of node shutdown so that recovery operations can begin.

simple virtual disk

Simple virtual disks define either an area within a physical disk partition or an entire partition. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *concatenated virtual disk, striped virtual disk, virtual disk*.

single console

The workstation that acts as the single point of administration for nodes being monitored by RMS. The single console software, SCON, is run from the single console.

SIS

See *Scalable Internet Services (SIS)*.

state

See *resource state (RMS)*.

Storage Area Network

The high-speed network that connects multiple, external storage units and storage units with multiple computers. The connections are generally fiber channels.

striped virtual disk

Striped virtual disks consist of two or more pieces. These can be physical partitions or further virtual disks (typically a mirror disk). Sequential I/O operations on the virtual disk can be converted to I/O operations on two or more physical disks. This corresponds to RAID Level 0 (RAID0). (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *concatenated virtual disk*, *mirror virtual disk*, *simple virtual disk*, *virtual disk*.

switchover (RMS)
The process by which RMS switches control of a `userApplication` over from one monitored node to another.

See also *automatic switchover (RMS)*, *directed switchover (RMS)*, *failover (RMS, SIS)*, *symmetrical switchover (RMS)*.

symmetrical switchover (RMS)
This means that every RMS node is able to take on resources from any other RMS node.

See also *automatic switchover (RMS)*, *directed switchover (RMS)*, *failover (RMS, SIS)*, *switchover (RMS)*.

system graph (RMS)
A visual representation (a map) of monitored resources used to develop or interpret the configuration file.

See also *configuration file (RMS)*.

template
See *application template (RMS)*.

type
See *object type (RMS)*.

UP (CF)
A node state that indicates that the node can communicate with other nodes in the cluster.

See also *DOWN (CF)*, *LEFTCLUSTER (CF)*, *node state (CF)*.

virtual disk
With virtual disks, a pseudo device driver is inserted between the highest level of the Solaris logical Input/Output (I/O) system and the physical device driver. This pseudo device driver then maps all logical I/O requests on physical disks. (Applies to transitioning users of existing Fujitsu Technology Solutions products only.)

See also *concatenated virtual disk*, *mirror virtual disk*, *simple virtual disk*, *striped virtual disk*.

Web-Based Admin View
This is a common base to utilize the Graphic User Interface of PRIME-CLUSTER. This interface is in Java.

wizard (RMS)

An interactive software tool that creates a specific type of application using pretested object definitions. An enabler is a type of wizard.

Abbreviations

AC
Access Client

API
application program interface

bm
base monitor

CCBR
Cluster Configuration Backup/Restore

CF
Cluster Foundation or Cluster Framework

CIM
Cluster Integrity Monitor

CIP
Cluster Interconnect Protocol

CLI
command-line interface

CRM
Cluster Resource Management

DLPI
Data Link Provider Interface

ENS
Event Notification Services

GDS
Global Disk Services

GFS
Global File Services

GLS
Global Link Services

GUI
graphical user interface

HA
high availability

ICF
Internode Communication Facility

I/O
input/output

JOIN
cluster join services module

LAN
local area network

MDS
Meta Data Server

MIB
Management Information Base

NIC
network interface card

NSM
Node State Monitor

OE
operating environment

OPS
Oracle Parallel Server

OSD
operating system dependant

PAS
Parallel Application Services

PCS
PRIMECLUSTER Configuration Services

RCCU
Remote Console Control Unit

RCI
Remote Cabinet Interface

RMS
Reliant Monitor Services

RTP
Reliant Telco Product

SA
Shutdown Agent

SAN
Storage Area Network

SCON
single console software

SD
Shutdown Daemon

SF
Shutdown Facility

SIS
Scalable Internet Services

VIP
Virtual Interface Provider

Figures

Tables

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