

PRIMECLUSTER

Cluster Foundation (CF)
Configuration and Administration Guide 4.3
(Oracle Solaris)

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Preface

Cluster Foundation

CF Registry and Integrity Monitor

Cluster resource management

GUI administration

LEFTCLUSTER state

CF topology table

Shutdown Facility

CF over IP

Diagnostics and troubleshooting

CF messages and codes

Manual pages

Glossary

Abbreviations

Figures

Tables

Index

Contents

1	Preface	1
1.1	Contents of this manual	1
1.2	PRIMECLUSTER manuals	2
1.3	Conventions	3
1.3.1	Notation	4
1.3.1.1	Prompts	4
1.3.1.2	The keyboard	4
1.3.1.3	Typefaces	4
1.3.1.4	Example 1	4
1.3.1.5	Example 2	5
1.3.2	Command syntax	5
1.4	Important notes and cautions	5
1.5	Abbreviations	6
1.6	Revision history	6
2	Cluster Foundation	9
2.1	CF, CIP, and CIM configuration	9
2.1.1	Differences between CIP and CF over IP	13
2.1.2	cfset	15
2.1.3	CF security	17
2.1.4	Example of creating a cluster	18
2.1.5	Adding a new node to CF	41
2.2	CIP configuration file	42
2.3	Cluster Configuration Backup and Restore (CCBR)	44
3	CF Registry and Integrity Monitor	51
3.1	CF Registry	51
3.2	Cluster Integrity Monitor	52
3.2.1	Configuring CIM	52
3.2.2	Query of the quorum state	53
3.2.3	Reconfiguring quorum	54
4	Cluster resource management	57
4.1	Overview	57
4.2	Kernel parameters for Resource Database	58
4.3	Resource Database configuration	61
4.4	Registering hardware information	63
4.4.1	Setup exclusive device list	63
4.4.2	Exclusive device list for EMC Symmetrix	64
4.4.2.1	emcpower Devices and native Devices	65
4.4.2.2	BCV, R2, GateKeeper, CKD	65

Contents

4.4.2.3	VCMDB	66
4.4.2.4	Simplified setup for exclusive device list - clmkdiskinfo, clmkdiskinfo 66	
4.4.3	Automatic resource registration	67
4.5	Start up synchronization	69
4.5.1	Start up synchronization and the new node	71
4.6	Adding a new node	71
4.6.1	Backing up the Resource Database	73
4.6.2	Reconfiguring the Resource Database	74
4.6.3	Configuring the Resource Database on the new node	75
4.6.4	Adjusting StartingWaitTime	76
4.6.5	Restoring the Resource Database	76
5	GUI administration	79
5.1	Overview	80
5.2	Starting Cluster Admin GUI and logging in	80
5.3	Main CF table	83
5.4	CF route tracking	85
5.5	Node details	88
5.6	Displaying the topology table	89
5.7	Starting and stopping CF	91
5.7.1	Starting CF	93
5.7.2	Stopping CF	96
5.8	Marking nodes DOWN	97
5.9	Using PRIMECLUSTER log viewer	98
5.9.1	Search based on time filter	101
5.9.2	Search based on keyword	102
5.9.3	Search based on severity levels	103
5.10	Displaying statistics	104
5.11	Heartbeat monitor	109
5.12	Adding and removing a node from CIM	110
5.13	Unconfigure CF	113
5.14	CIM Override	114
6	LEFTCLUSTER state	115
6.1	Description of the LEFTCLUSTER state	116
6.2	Recovering from LEFTCLUSTER	118
6.2.1	Caused by a panic/hung node	118
6.2.2	Caused by staying in the kernel debugger too long	118
6.2.3	Caused by a cluster partition	119
6.2.4	Caused by reboot	121
7	CF topology table	123

7.1	Basic layout	125
7.2	Selecting devices	126
7.3	Examples	127
8	Shutdown Facility	131
8.1	Overview	131
8.2	Available SAs and MAs	133
8.2.1	RCI	133
8.2.2	XSCF	135
8.2.3	XSCF SNMP	137
8.2.4	ALOM	139
8.2.5	ILOM	139
8.2.6	NPS	141
8.3	SF split-brain handling	142
8.3.1	Administrative LAN	142
8.3.2	SF split-brain handling	142
8.3.2.1	RMS ShutdownPriority attribute	143
8.3.2.2	Shutdown Facility weight assignment	143
8.3.2.3	Disabling split-brain handling	143
8.3.3	Runtime processing	144
8.3.4	Configuration notes	145
8.4	Configuring the Shutdown Facility	147
8.5	SF administration	147
8.5.1	Starting and stopping SF	147
8.5.1.1	Starting and stopping SF manually	147
8.5.1.2	Starting and stopping SF automatically	147
8.6	Logging	147
9	CF over IP	149
9.1	Overview	149
9.2	Configuring CF over IP	151
10	Diagnostics and troubleshooting	153
10.1	Beginning the process	153
10.2	Symptoms and solutions	157
10.2.1	Join-related problems	158
10.3	PCI Hot Plug	167
10.4	Collecting troubleshooting information	168
10.4.1	Executing the fjsnap command	168
10.4.2	System dump	169
10.4.3	SCF dump	170
11	CF messages and codes	171
11.1	cfconfig messages	172

Contents

11.1.1	Usage message	172
11.1.2	Error messages	173
11.2	cipconfig messages	180
11.2.1	Usage message	181
11.2.2	Error messages	181
11.3	cftool messages	183
11.3.1	Usage message	183
11.3.2	Error messages	184
11.4	rcqconfig messages	187
11.4.1	Usage message	187
11.4.2	Error messages	188
11.5	rcquery messages	199
11.5.1	Usage message	199
11.5.2	Error messages	199
11.6	CF runtime messages	200
11.6.1	Alphabetical list of messages	201
11.7	CF Reason Code table	205
11.8	Error messages for different systems	216
11.9	Solaris ERRNO table	217
11.10	Resource Database messages	231
11.10.1	HALT messages	232
11.10.2	Information messages	232
11.10.3	Warning messages	233
11.10.4	Error messages	234
11.11	Shutdown Facility	262
11.12	Monitoring Agent messages	268
11.12.1	Information message	269
11.12.2	Warning message	270
11.12.3	Error message	270
11.13	CCBR messages	282
11.13.1	cfbackup warning/error messages	282
11.13.1.1	To stderr	282
11.13.1.2	To log file	283
11.13.2	cfrestore warning/error messages	285
11.13.2.1	To stderr	285
11.13.2.2	To log file	285
12	Manual pages	289
12.1	CCBR	289
12.2	CF	289
12.3	CIP	290
12.4	PAS	290
12.5	Resource Database	290
12.6	RMS	291

12.7	SF	292
12.8	Monitoring Agent	293
12.9	Web-Based Admin View	294
12.10	RMS Wizards	294
13	Release information	295
	Glossary	303
	Abbreviations	319
	Figures	323
	Tables	327
	Index	329

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

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 *Software Release Guide and Installation Guide*.

1.1 Contents of this manual

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

- The Chapter “Cluster Foundation” describes the administration and configuration of the Cluster Foundation (CF).
- 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 Cluster Integrity Monitor (CIM).
- The Chapter “Cluster resource management” discusses the database which is a synchronized clusterwide database holding information to multiple PRIMECLUSTER products.
- The Chapter “GUI administration” describes the administrative 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 administrative information.
- 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 PRIMECLUSTER manuals

The manuals listed in this section contain information relevant to PRIMECLUSTER.

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.
- "PRIMECLUSTER Concepts Guide"-Provides concepts on the PRIMECLUSTER family of products.
- "PRIMECLUSTER Installation and Administration Guide"-Provides the whole process ranging from installing to managing the PRIMECLUSTER system. The manual also provides the instructions for operating PRIMECLUSTER.
- "PRIMECLUSTER Reliant Monitor Services (RMS) with Wizard Tools Configuration and Administration Guide"-Provides instructions for configuring and administering RMS using PRIMECLUSTER Wizard Tools.

- "PRIMECLUSTER Reliant Monitor Services (RMS) Reference 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.
- "PRIMECLUSTER Global Disk Services Configuration and Administration Guide"-Provides information on configuring and administering Global Disk Services (GDS).
- "PRIMECLUSTER Global File Services Configuration and Administration Guide"-Provides information on configuring and administering Global File Services (GFS).
- "PRIMECLUSTER Global Link Services Configuration and Administration Guide (Redundant Line Control Function)"-Provides information on configuring and administering the redundant line control function for Global Link Services (GLS).
- "PRIMECLUSTER Global Link Services Configuration and Administration Guide (Multipath Function)"-Provides information on configuring and administering the multipath function for Global Link Services (GLS).
- "PRIMECLUSTER Web-Based Admin View Operation Guide"-Provides information on using the Web-Based Admin View management GUI.
- "PRIMECLUSTER DR/PCI Hot Plug User's Guide"-Provides the operation of Dynamic Reconfiguration function and PCI Hot Plug function by using PRIMECLUSTER.
- "PRIMECLUSTER Messages"-Provides how to set the environment for PRIMECLUSTER. Messages output during system operation are also provided.
- Release notices for all products -Release notices provide late-breaking information about installation, configuration, and operations for PRIME-CLUSTER.

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, and other literal programming elements in the main body of text.
<i>Italic</i>	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 Important notes and cautions



Important

Indicates important information.



Caution

Indicates a situation that can cause harm to data.

**Note**

Indicates information that needs special attention.

1.5 Abbreviations

Oracle Solaris might be described as Solaris, Solaris Operating System, or Solaris OS.

If "Solaris X" is indicated in the reference manual name of the Oracle Solaris manual, replace "Solaris X" with "Solaris 10 operating system (Solaris 10)" or the "Solaris 11 operating system (Solaris 11)".

1.6 Revision history

Revision	Location	Manual code
Added the description so as to assign the IP address to the same segment as the administrative LAN.	8.2.4 8.2.5	J2S2-1588-03ENZ0(01)
Added the description for the amount of time to detect setting errors.	8.2.4 8.2.5	
Added the description when outputting the No.7040 error message.	8.2.5	
Deleted the description of the RCI method.	3.2	J2S2-1588-03ENZ0(02)
Changed the work area from /tmp to /var/tmp.	10.4.3	
Changed the description of "-test" for the cfbbackup and cfbrestore commands.	11.13.1.1 11.13.2.1	

Revision	Location	Manual code
Deleted the descriptions of the following file formats: - SA_wtinps.cfg - SA_sspint.cfg - SA_pprci.cfg - SA_rccu.cfg	12.7	J2S2-1588-03ENZ0(03)
Added the descriptions of the following commands: - cldevparam - clovmmigrate - clovmmigratesetup - clsnmpmonctl - clsnmpsetup	12.8	

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). CF defines which nodes are in a given cluster. 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 for 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 activate interconnects, the problem with “split-brain” only occurs if all interconnects experience a 10-second outage simultaneously. Nevertheless, CF requires 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 have 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 and applications, be stopped on that node, so the reconfiguration process is neither trivial nor unobtrusive.



Interconnects should be redundant 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 choose 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.

For the IPv4 address, 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 the IPv6 address, the range where Unique Local IPv6 Unicast Addresses (RFC 4193) defined with the prefix FC00::7 is used as the address (Unique Local IPv6 Unicast Addresses) which can be allocated freely within the private network.

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.



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 Software Release Guide and Installation Guide* for more details.



Caution

Do not add CIP nodenames manually to the `/etc/hosts` or `/etc/inet/ipnodes` file because the CIP Wizard automatically updates the `/etc/hosts` and `/etc/inet/ipnodes` files on each node in the cluster.

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 "2.4.1 Management server configuration" in "PRIMECLUSTER Web-Based Admin View Operation Guide" 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 *Software Release Guide and Installation Guide* 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).

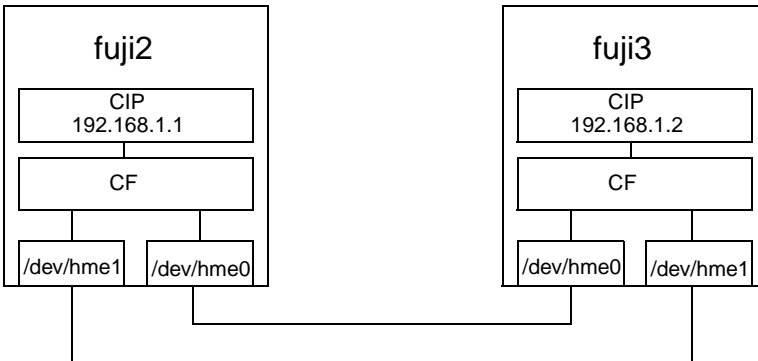


Figure 1: CIP diagram

CF over IP uses an IPv4 interface, provided by the operating system, as a CF interconnect. This is not operated on IPv6. 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.

- i** 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).

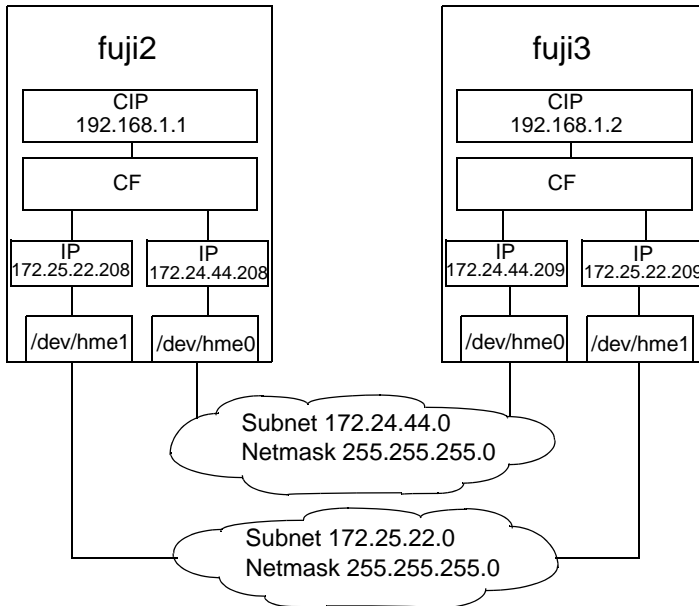


Figure 2: CF over IP diagram



Note

CF over IP is not supported in a Solaris 11 environment.

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 tuple 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.
- Duplication of 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 ]
```



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

In CF, cluster nodes execute commands on another node (`cfsh`), copy files from one node to another (`cfcp`) and there is the feature (CF Remote Services) to allow them. Because of this, these facilities are disabled by default.

The final step of the CF Configuration Wizard has two checkboxes. Checking one enables remote file copying and checking the other enables remote command execution.

`PRIMECLUSTER` has the exclusive feature for environment which does not support `rhosts`.

If the `rhosts` file is not used, it is necessary to enable the remote access by setting the parameters in `cluster.config` as below.

```
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 `hvrset` and, therefore, is not a fully functional alternative to the `rsh` interface.

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

2.1.4 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 `fujii2` and `fujii3`, and the cluster name is `FUJII`.

This example assumes that Web-Based Admin View configuration has already been done. `fujii2` is assumed to be configured as the primary management server for Web-Based Admin View, and `fujii3` 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
```

`fujii2` is a management server. Enter the following:

```
http://fujii2:8081/Plugin.cgi
```

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

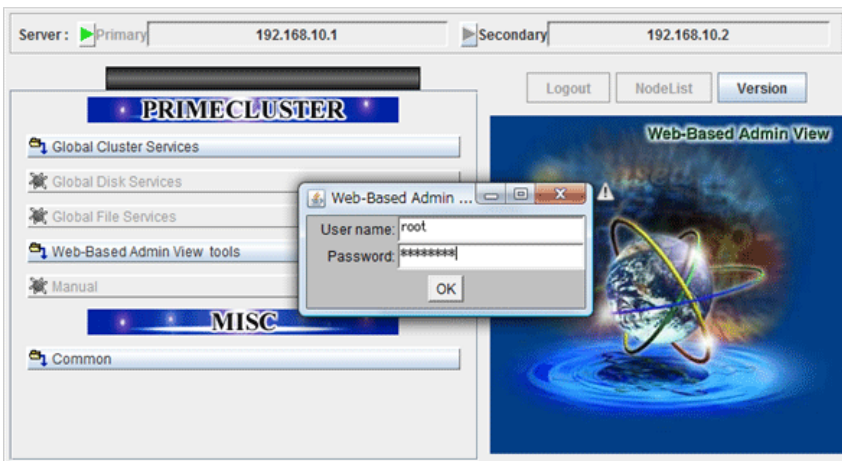


Figure 3: Login pop-up

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 `fujii2`. 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 `fujii2` 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 `fujii2` 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 "4.2.1 Assigning Users to Manage the Cluster" in "PRIME-CLUSTER Installation and Administration Guide."

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

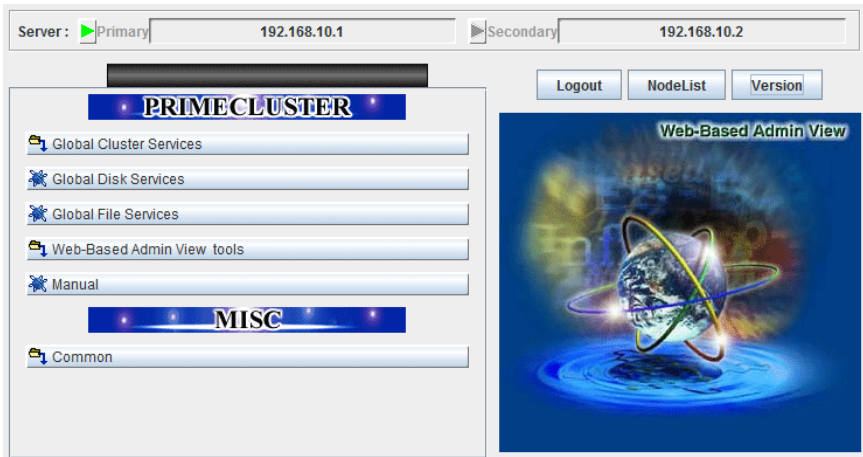


Figure 4: Main Web-Based Admin View window after login

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

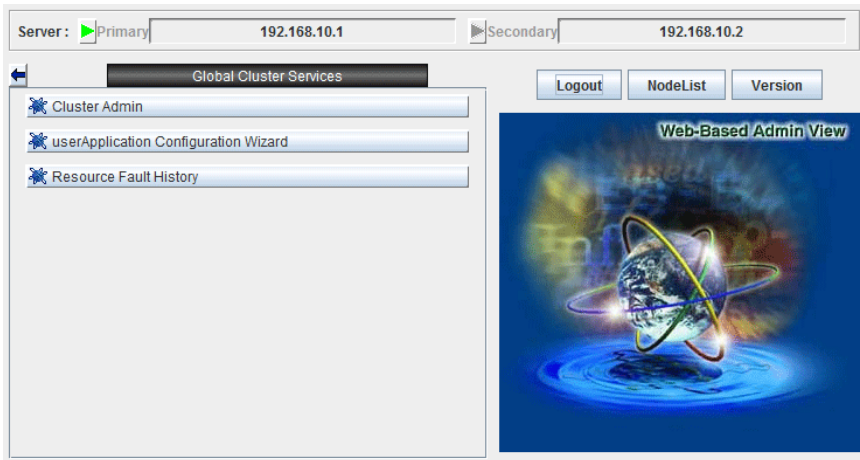


Figure 5: Global Cluster Services window in Web-Based Admin View

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).

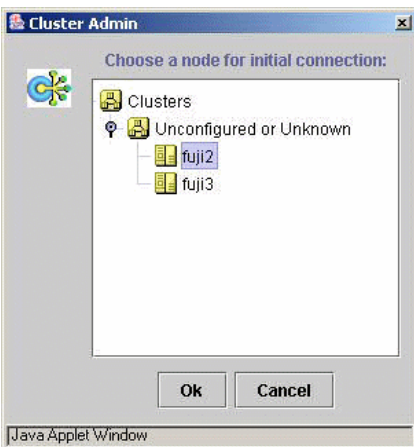


Figure 6: Initial connection pop-up

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.

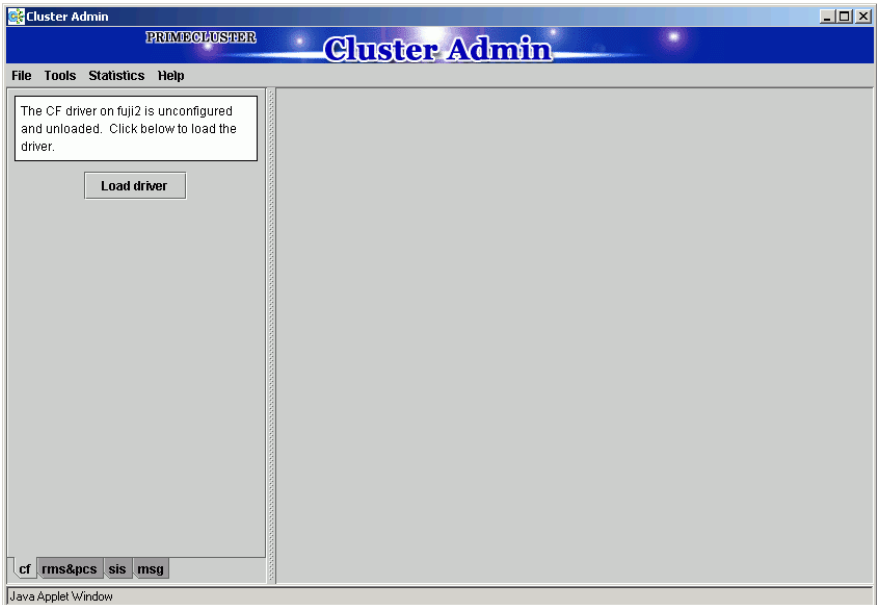


Figure 7: CF is unconfigured and unloaded

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).

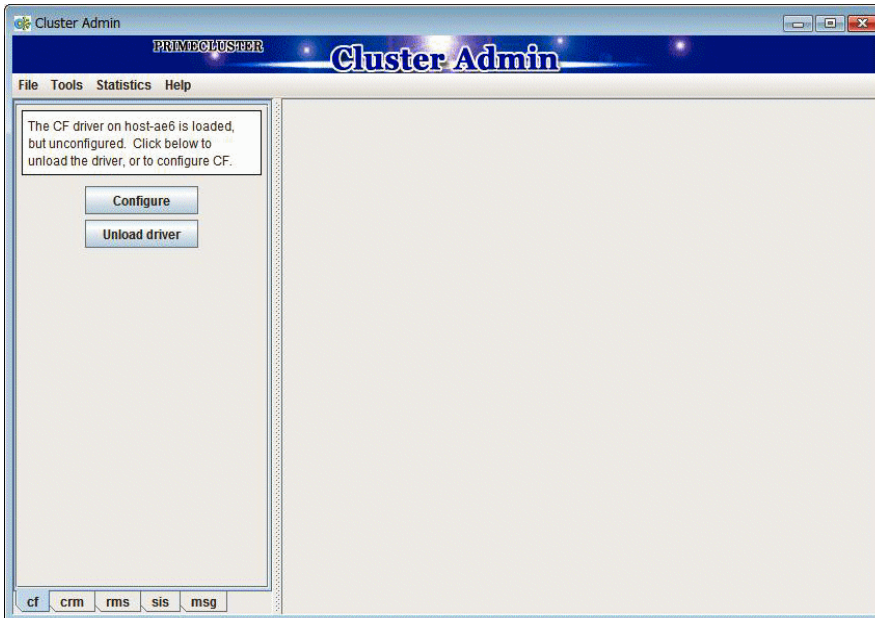


Figure 8: CF loaded but not configured

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

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

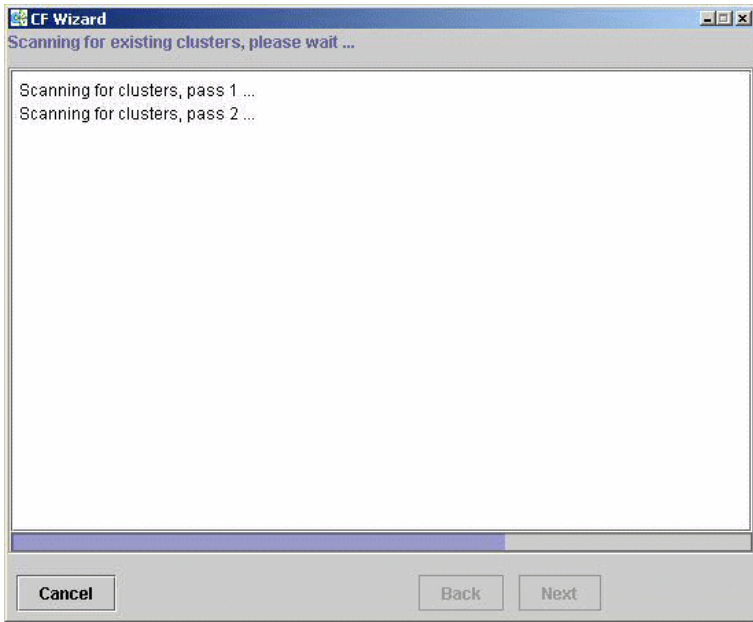


Figure 9: Scanning for clusters

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

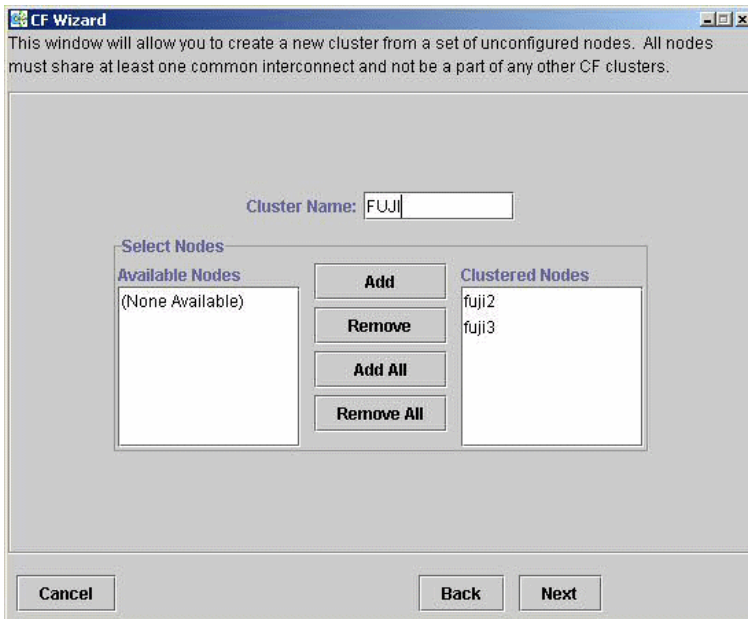


Figure 11: Selecting cluster nodes and the cluster name

This window lets you choose 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 "4.2 Preparations for Starting the Web-Based Admin View Screen" in "PRIMECLUSTER Installation and Administration Guide" 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.

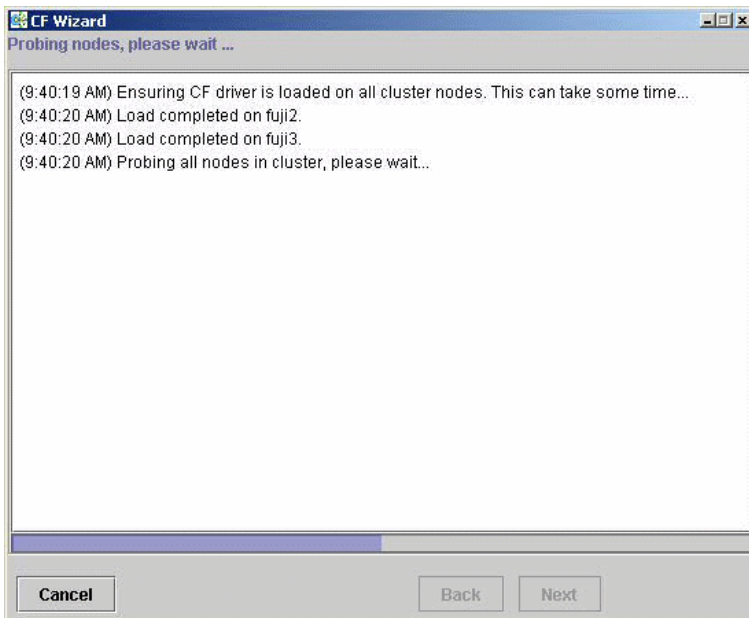


Figure 12: CF loads and pings

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.

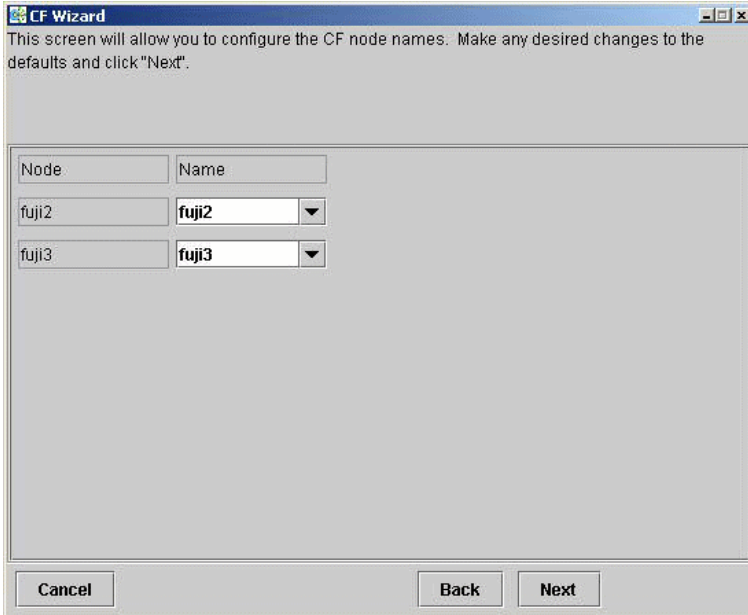


Figure 13: Edit CF node names

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).

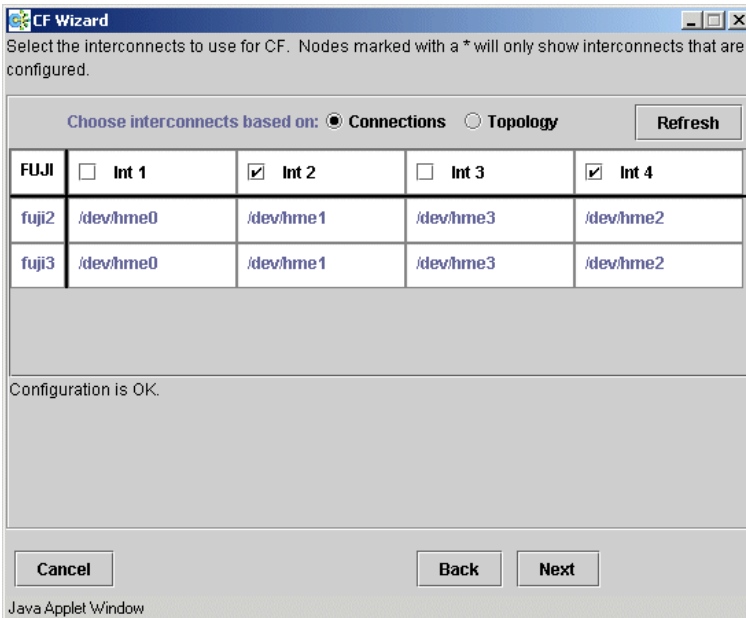


Figure 14: CF topology and connection table

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 `fujij2` and `fujij3` 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 `fujij2` or `fujij3`.

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 reprove 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).

CF over IP is not supported in a Solaris 11 environment.

Select one or more full interconnects in the CF topology and connection table, and click on *Next*.

The CIP Wizard window as shown in the Figure 16 is displayed.



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.

This screen will allow you to configure CF to run over IP. This is optional unless you chose no physical interconnects and is not required for many clusters. If needed, choose a number of IP interconnects, and interfaces for each node on each interconnect. If Auto Subnet Grouping is checked, changing one interface will change all others on the same interconnect to be consistent. You should normally leave this checked.

Enter desired number of IP interconnects:

Auto Subnet Grouping

-IP Interconnects

Interface	Interconnect 1
fuji2	172.25.219.83 [hme0] ▼
fuji3	172.25.219.84 [hme0] ▼

Buttons: Cancel, Back, Next

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.

**Note**

Since CF over IP is not supported in a Solaris 11 environment, the CIP Wizard window as shown in the Figure 15 is not displayed.

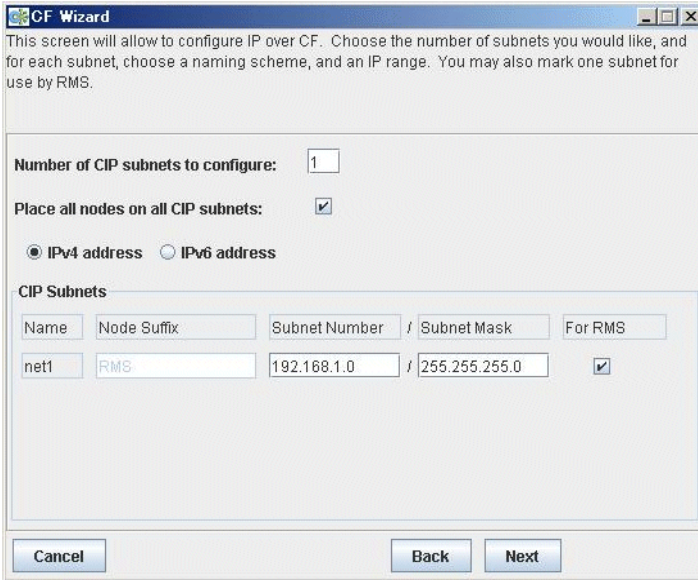


Only interfaces that are configured at system boot can be used for CF over IP.

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 or Figure 17).



The screenshot shows a window titled "CF Wizard" with a standard Windows title bar. Below the title bar is a text area containing the following instructions: "This screen will allow to configure IP over CF. Choose the number of subnets you would like, and for each subnet, choose a naming scheme, and an IP range. You may also mark one subnet for use by RMS." Below this text are several configuration options: "Number of CIP subnets to configure:" with a text box containing the number "1"; "Place all nodes on all CIP subnets:" with a checked checkbox; and two radio buttons for "IPv4 address" (selected) and "IPv6 address". A section titled "CIP Subnets" contains a table with five columns: "Name", "Node Suffix", "Subnet Number", "Subnet Mask", and "For RMS". The table has one row with the following values: "net1", "RMS", "192.168.1.0", "255.255.255.0", and a checked checkbox. At the bottom of the window are three buttons: "Cancel", "Back", and "Next".

Name	Node Suffix	Subnet Number	Subnet Mask	For RMS
net1	RMS	192.168.1.0	255.255.255.0	<input checked="" type="checkbox"/>

Figure 16: CIP Wizard window

CF Wizard

This screen will allow to configure IP over CF. Choose the number of subnets you would like, and for each subnet, choose a naming scheme, and an IP range. You may also mark one subnet for use by RMS.

Number of CIP subnets to configure:

Place all nodes on all CIP subnets:

IPv4 address IPv6 address

CIP Subnets

Name	Node Suffix	Network Prefix	Prefix Length	For RMS
net1	RMS	FD00:0:0:1::	64	<input checked="" type="checkbox"/>

Cancel Back Next

Figure 17: CIP Wizard window (IPv6)

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.

Set either IPv4 or IPv6 as the IP address to set to the CIP interface.

By selecting either of the *IPv4 address* or *IPv6 address* radio button, you can switch the window shown in Figure 16: CIP wizard (IPv4) window and Figure 17: CIP wizard (IPv6) window.

When using IPv4 for CIP interface

The following values are assigned for CIP interface:

- 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 *fuj i2* and *fuj i3*. This will result in the following configuration:

- On *fuj i2*, a CIP interface will be configured with the following:
IP nodename: *fuj i2RMS*
IP address: 192.168.1.1
Subnet Mask: 255.255.255.0
- On *fuj i3*, a CIP interface will be configured with the following:
IP nodename: *fuj i3RMS*
IP address: 192.168.1.2
Subnet Mask: 255.255.255.0

When using IPv6 for CIP interface

The following values are assigned for CIP interface:

- The IP address will be a unique IP number on the network prefix specified in the *Prefix* field. Interface ID 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 *Prefix* field for each CIP subnetwork requested. The default values are taken from the Unique Local Unicast Address range specified by RFC 4193. Note that the values entered in the *Prefix* field have 0 for their interface ID 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 *Node Suffix*. If the checkbox *For RMS* is selected, then the *Node 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 *Prefix Length* will be the value specified.

In Figure 17, 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 *Prefix* and *Prefix Length* 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`
IPv6 address : `FD00:0:0:1::1`
Prefix Length : 64
- On `fuji3`, a CIP interface will be configured with the following:
IP nodename : `fuji3RMS`
IPv6 address : `FD00:0:0:1::2`
Prefix Length : 64

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 automatically update `/etc/hosts` and `/etc/inet/ipnodes` 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 18).

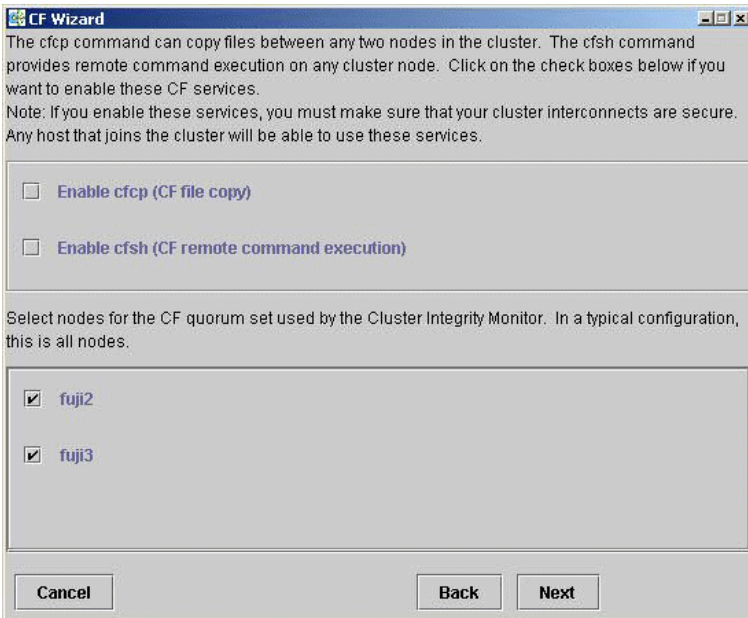


Figure 18: CIM configuration window

The CIM configuration window in Figure 18 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.

Do not add CIP nodenames manually to the `/etc/hosts` or `/etc/inet/ipnodes` file because the CIP Wizard automatically updates the `/etc/hosts` and `/etc/inet/ipnodes` files on each node in the cluster.

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 19).

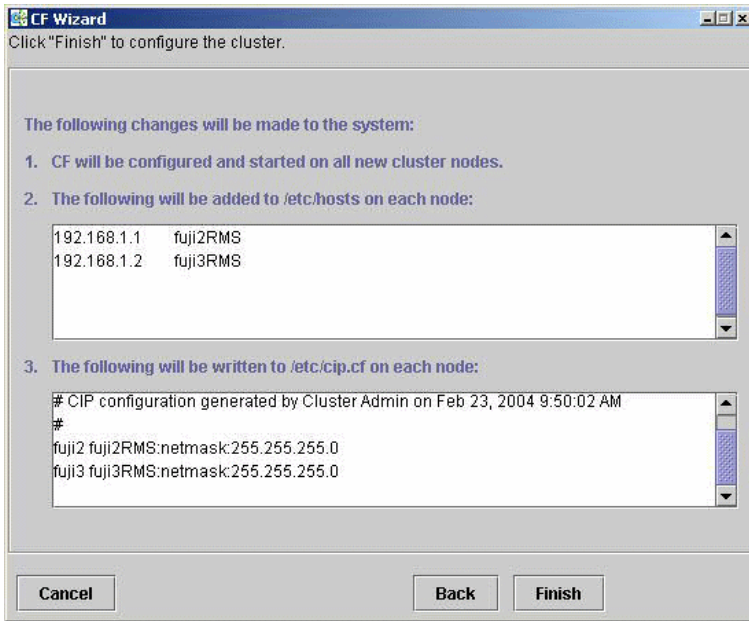


Figure 19: Summary window

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 20 is displayed while the configuration is being done.

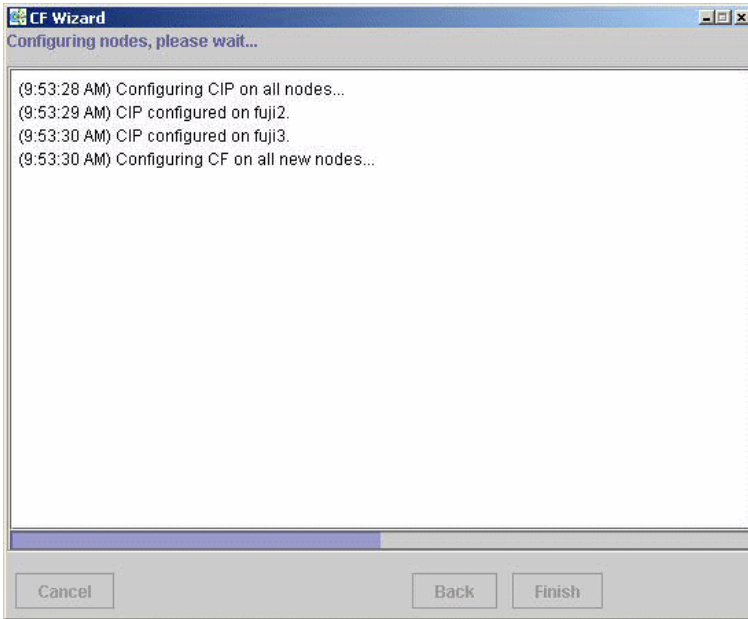


Figure 20: Configuration processing window

This window is updated after each configuration step. When configuration is complete, a pop-up appears announcing this fact (see Figure 21).

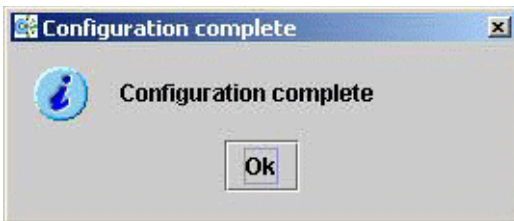


Figure 21: Configuration completion pop-up

Click on the *OK* button, and the pop-up is dismissed. The configuration processing window now has a *Finish* button (see Figure 22).

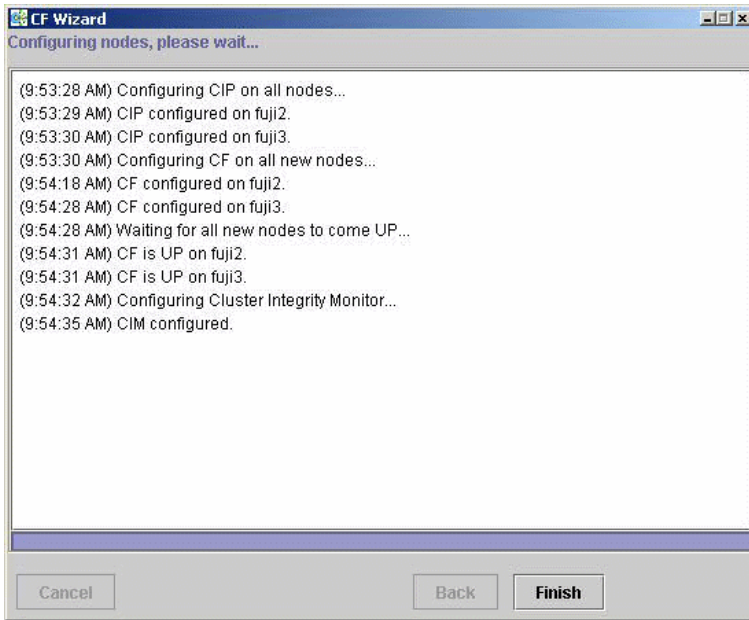


Figure 22: Configuration window after completion

You might see the following error message in the window shown in Figure 22:

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

Unless you are planning to use the dynamic hardware reconfiguration feature of SPARC Enterprise M-series, 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 22. 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 “Configuring the Shutdown Facility”).

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 23).

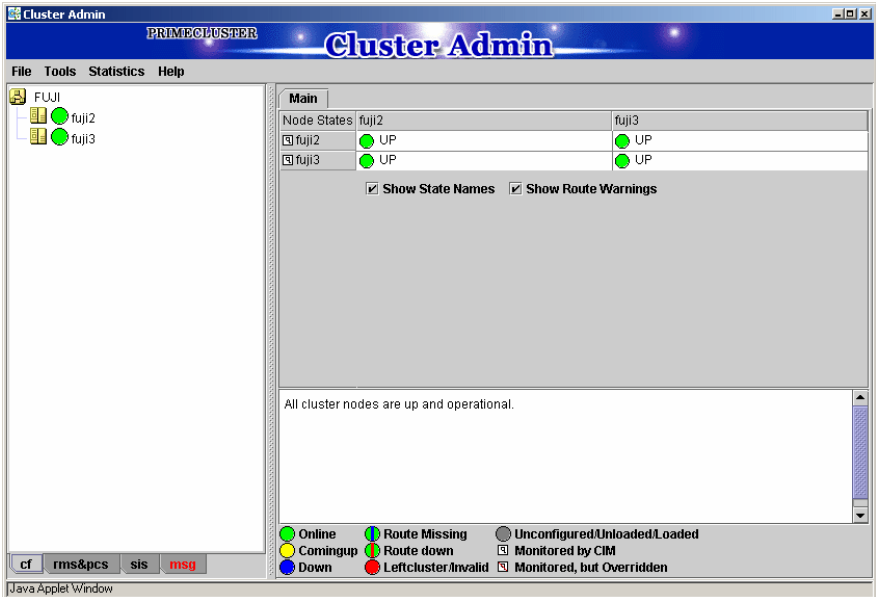


Figure 23: Main CF window

2.1.5 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 "PRIMECLUSTER Web-Based Admin View Operation Guide" 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, 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 . . . ] [IPv6]
```

- *cfname* tells what node the configuration information is for.
- *CIP_Interface_Info* gives information needed to configure a single CIP interface.

The `qip.cf` configuration file typically contains configuration information for all CIP interfaces on all nodes in the cluster.

- For IPv4, specify *CIP_Interface_Info* with the following format:

```
IPv4-Address[:Option[:Option...]]
```

Specify it without any spaces even around colons.

For *IPv4-Address*, specify as a number in Internet standard dotted-decimal notation or as the Host name.

When specifying with the Host name, it needs to be defined in `/etc/hosts`.

The IP address can also have additional options following it. These options are passed to the configuration command `ifconfig`. Each option is separated from the IP address and other option by colons (:).

- For IPv6, specify *CIP_Interface_Info* with the following format:

```
Hostname:"["IPv6-Address/prefix_length"]"
```

Specify it without any spaces around colons, slashes, and inside of each blankets "[", "]".

For *Hostname*, describe the Host name to specify the cip address.

For *IPv6-Address* and *prefix_length*, specify the IPv6 address expressed in the Internet standard colon-separated hexadecimal format and prefix length.

- When using the IPv6 address, specify "IPv6" in the end of the line.

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. 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.

After stopping all applications that use CIP, restart CIP by stopping and starting CIP.

For instructions on starting and stopping CF, see Section “Starting and stopping CF”.

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.

Refer to "3.4 Activating a configuration" in "PRIMECLUSTER Reliant Monitor Services (RMS) with Wizard Tools 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.

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

-  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_ccbrN.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_ccbrN`

`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 `CCBR00T/errrlog` log file contains specific error information when a plug-in fails. All the messages are time stamped.
- The `CCBR00T/plugin.blog` or `CCBR00T/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/MAW/MAWccbr/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 `CCBR00T/root` directory. They are copied from the `CCBR00T/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 `fujii2` we entered the following command to restore the configuration to backup 11.

```
fujii2# 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 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.

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 PRIMECLUSTER 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 *Software Release Guide and Installation Guide* 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.

Kernel parameter	Value required for Resource Database
<code>semsys:seminfo_semmni</code>	20
<code>shmsys:shminfo_shmmni</code>	30
<code>shmsys:shminfo_shmmax</code>	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:

$$DISKS \times (NODES+1) \times 2$$

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:

$$\text{Total resources} = (\text{remote resources} + \text{local resources}) \times 2776 + 1048576.$$

4. Selecting the value:

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:

$$\text{TotalResources} = (DISKS \times (NODES+1) \times 2 + LOCAL_DISKS) \times 2776 + 1048576$$

- `shminfo_shmmax` is defined in `/etc/system`
 - If the current value is greater than *TotalResources* and also greater than 4194394:
You do not need to change `shminfo_shmmax`.
 - If the current value is greater than *TotalResources* and less than 4194394:
You need to change `shminfo_shmmax` to 4194394.

- If neither of the above:
You need to change `shminfo_shmmax` to *TotalResources*.
- `shminfo_shmmax` is not defined in `/etc/system`
- If *TotalResources* is greater than the default value (8388608) of Solaris OS:
You need to change `shminfo_shmmax` to *TotalResources*.
- If *TotalResources* is the default value (8388608) of Solaris OS or less:
You do not need to change `shminfo_shmmax`.

Example:

To take Figure 24 as an example, the following article describes how to calculate the total resources.

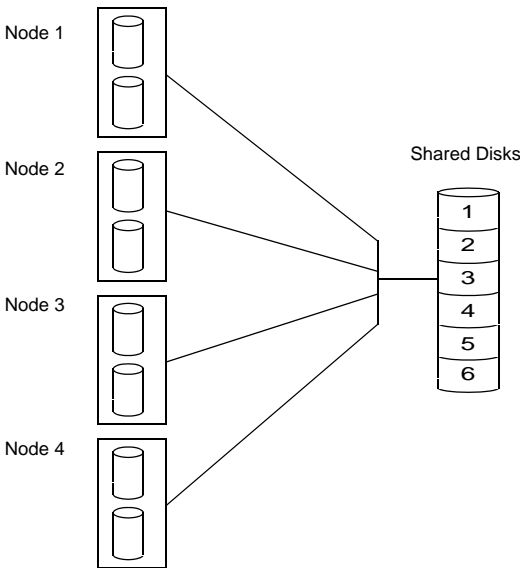


Figure 24: Cluster resource diagram

Referring to Figure 24, 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:

$$\text{Local resources} = 2 \times 4 = 8$$

3. Total resources:

$$(60+8) \times 2776 + 1048576 = 1237344$$

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:

```
cfnameRMS
```

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

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 (Only in Oracle Solaris 10 environment)

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/FJSCluster/etc/diskinfo` file that is setup is as follows:

```
# cat /etc/opt/FJSCluster/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 SPARC Enterprise M-series/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 SPARC Enterprise M-series/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
- VC MDB (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 `clmake-diskinfo`. 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`.



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/FJSCVcluster/bin/clautoconfig -r
```

3. Confirm registration.

Execute the `clgettree` command for confirmation as follows:

```
# /etc/opt/FJSCVcluster/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 (Only in Oracle Solaris 10 environment)

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 `StartingWaitTime`, 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 25 shows these steps as a flow chart.

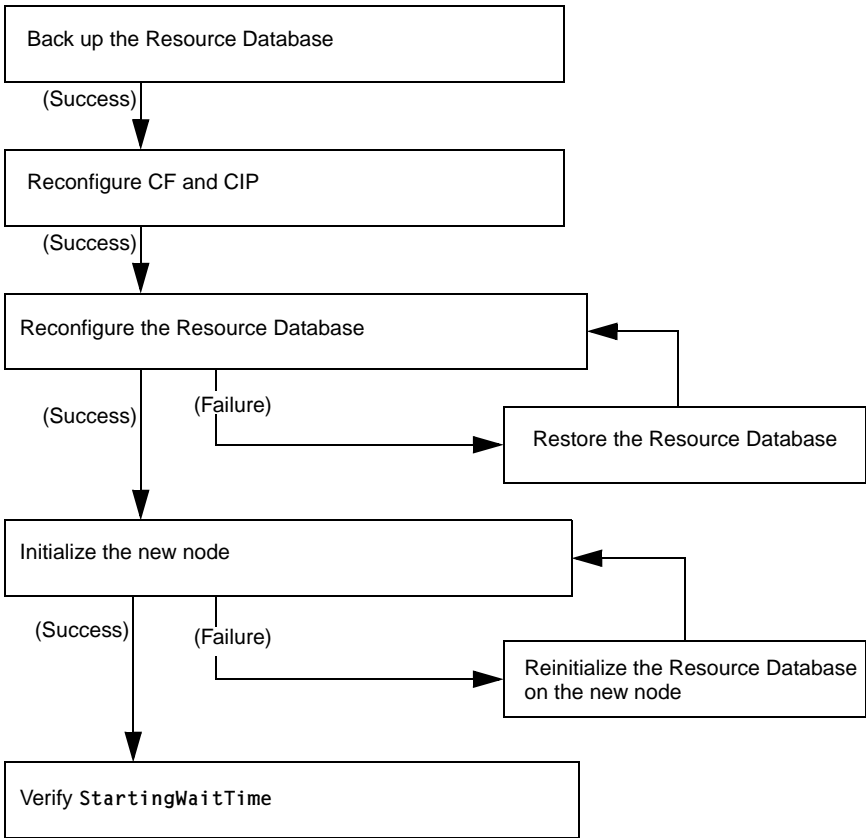


Figure 25: Adding a new node

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 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/FJSCluster/bin/clsetup -s file
```

file is the name of the backup file.

If we continue our example of adding `fujii4` 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
```



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  
# zfs mount -a
```

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 `fujii2` is a management server, enter the following:

```
http://fujii2:8081/Plugin.cgi
```

This brings up the Web-Based Admin View main window (see Figure 26).

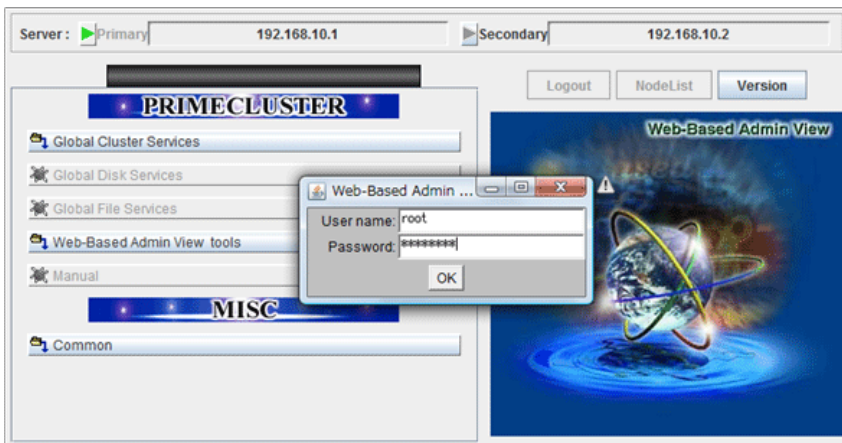



Figure 26: Main window

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 27).

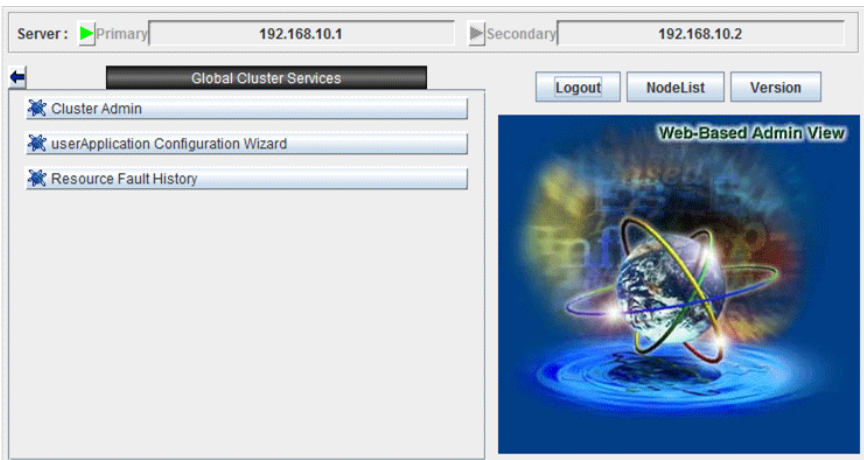


Figure 27: Cluster Admin start-up window

Click on the *Cluster Admin* button.

The *Choose a node for initial connection* window appears (see Figure 28).

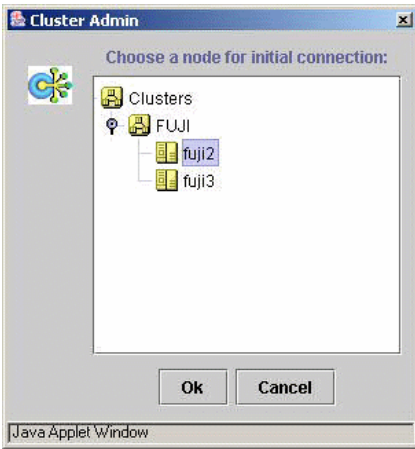


Figure 28: Initial connection choice window

Select a node and click on *Ok*.

The Cluster Admin main window appears (see Figure 29).

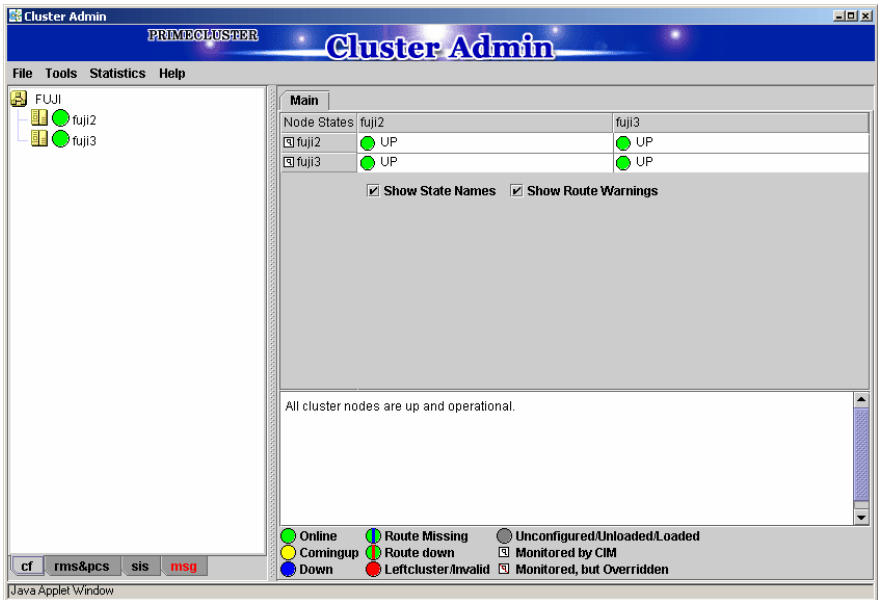


Figure 29: Cluster Admin main window

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.

i 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 29.

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 `fujii3` as seen by the node `fujii2`.

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 30).

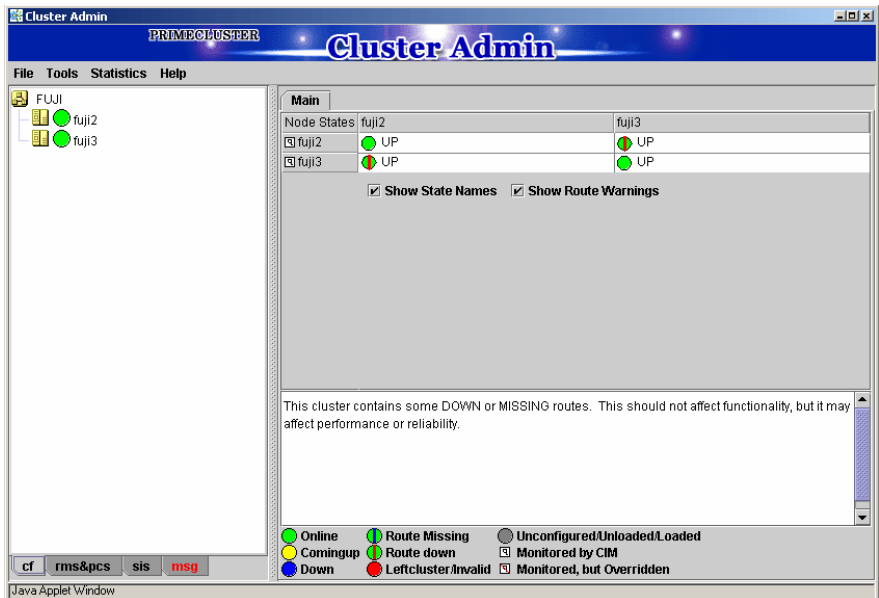


Figure 30: CF route DOWN

In this example, one of the network interfaces on `fujii2` has been unplugged. Cluster Admin, therefore, shows that a route is DOWN. Since `fujii3` cannot contact `fujii2` over that interface, it also shows that there is a route down on `fujii2`. 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 31).

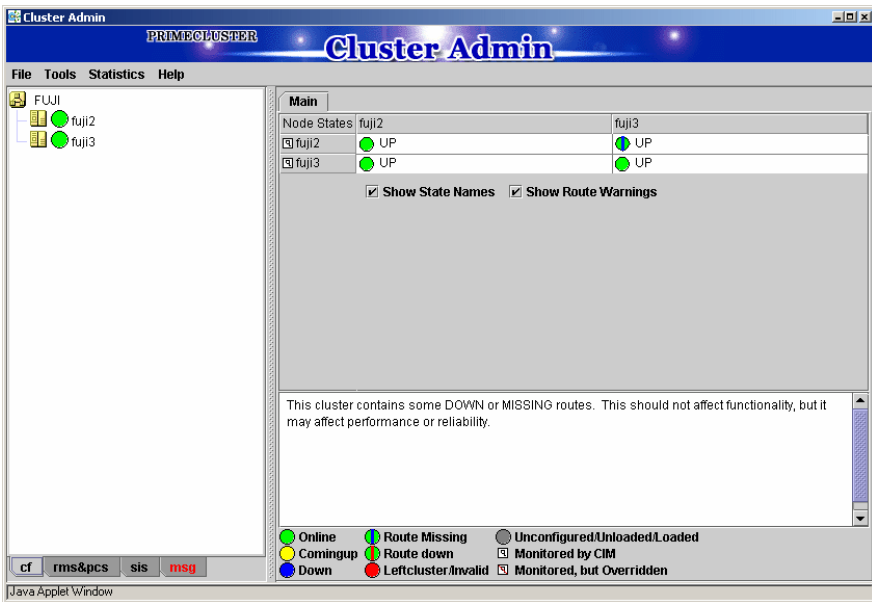


Figure 31: CF interface missing

In Figure 31, `fujii3` has a broken connection to `fujii2`, 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 32).

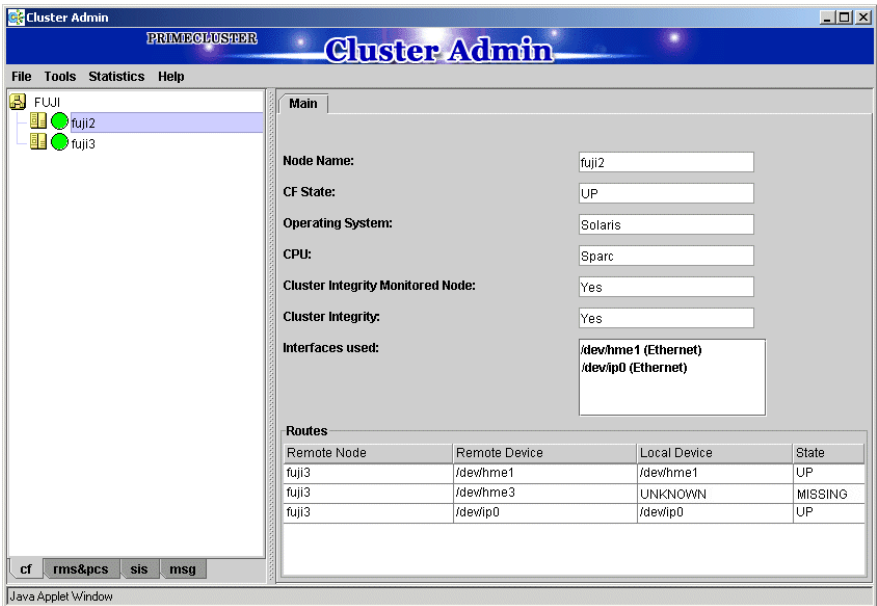


Figure 32: CF route table

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 33.

Main

Node Name:

CF State:

Operating System:

CPU:

Cluster Integrity Monitored Node:

Cluster Integrity:

Interfaces used:

Routes

Remote Node	Remote Device	Local Device	State
fuji3	/dew/hme1	/dew/hme1	UP
fuji3	/dew/hme3	/dew/hme3	UP
fuji3	/dew/ip0	/dew/ip0	UP

Figure 33: 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 34.

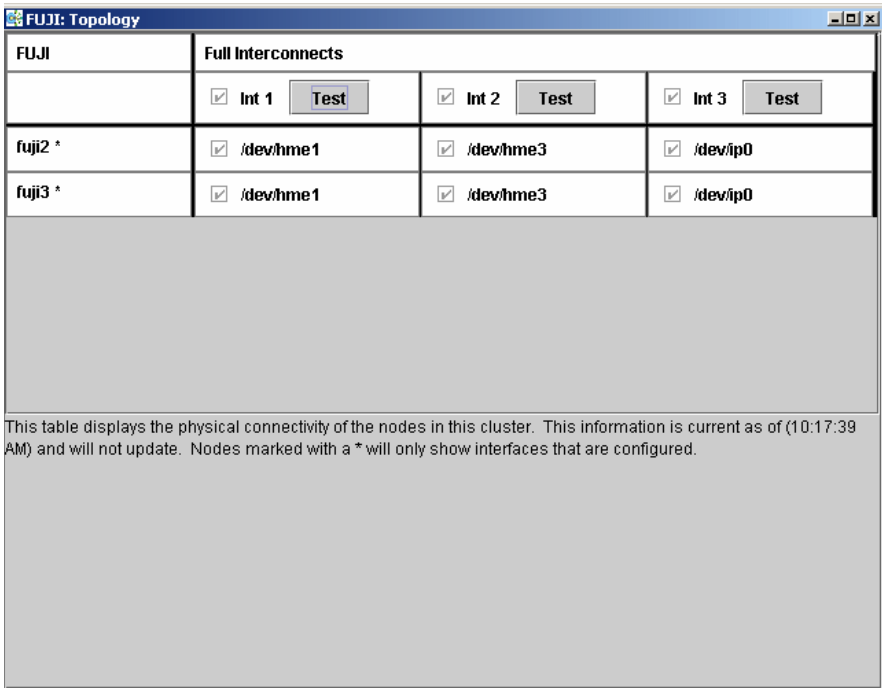


Figure 34: CF topology table

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 35).

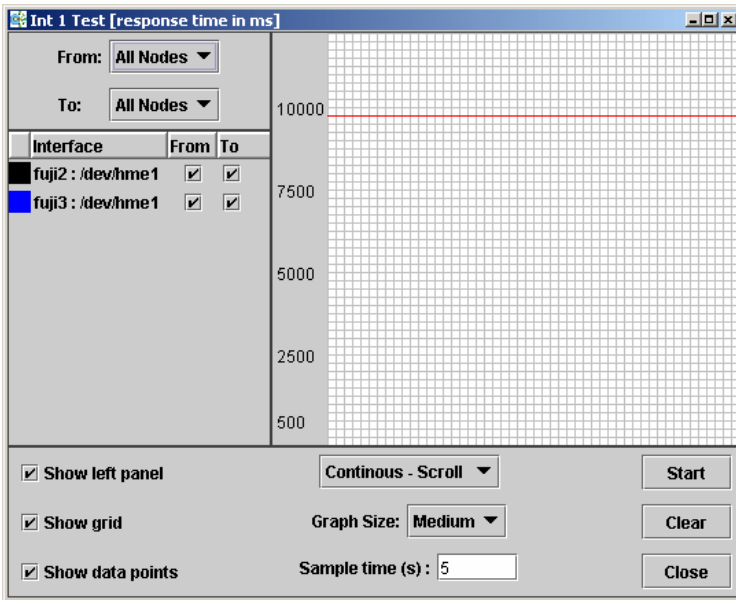


Figure 35: Response Time monitor

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.



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 36 shows the content-sensitive menu pop-up when you select *Start CF*.

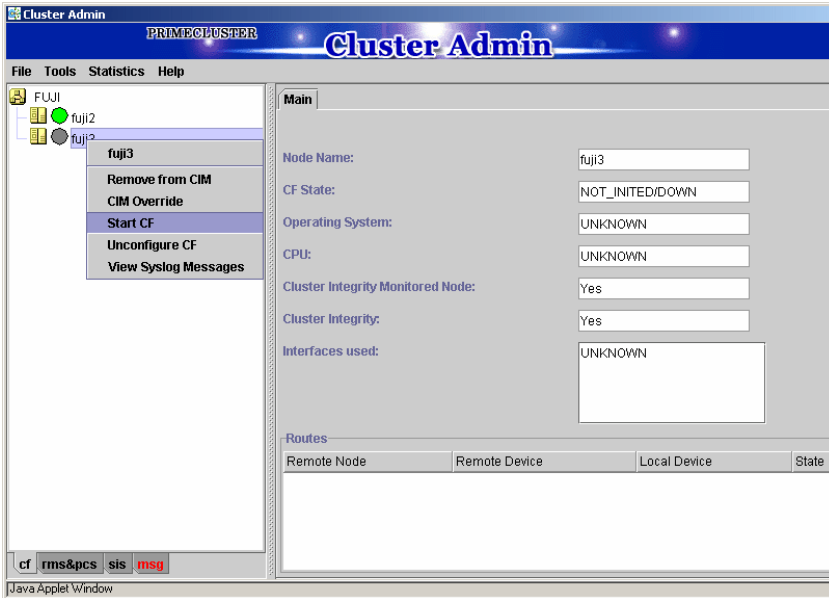


Figure 36: Starting CF

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 28. 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 37). The CF state must be UNLOADED or LOADED to start CF on a node.



Figure 37: 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 38). 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 38: 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 39).

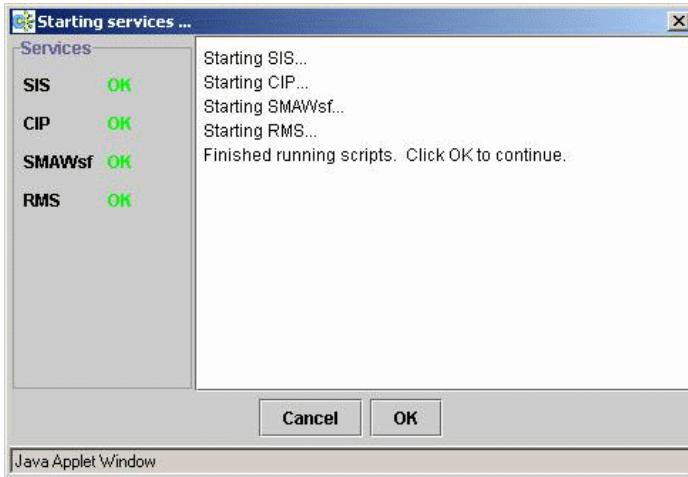


Figure 39: Start CF services status window

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 40).

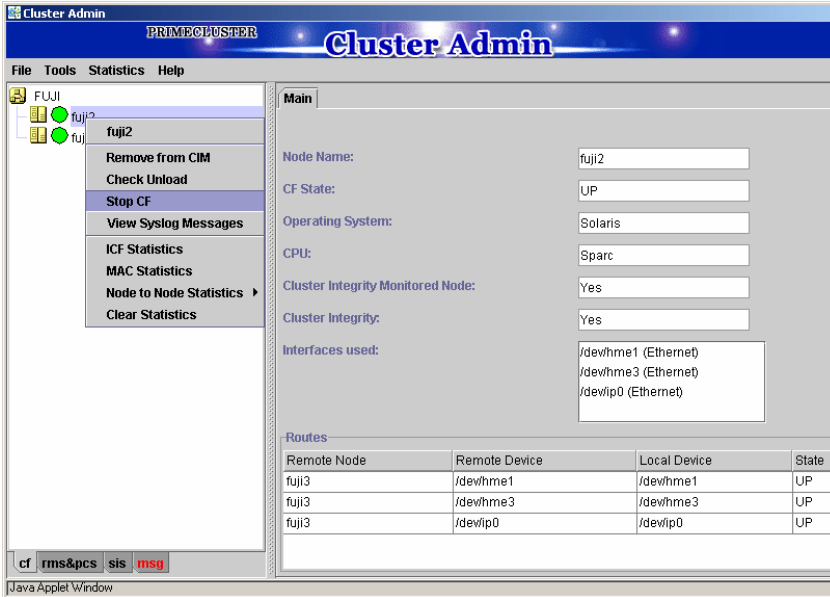


Figure 40: Stop CF

A confirmation pop-up appears (see Figure 41). Choose *Yes* to continue.

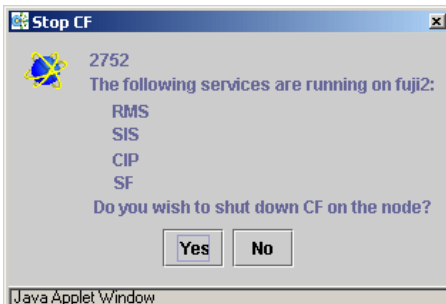


Figure 41: Stopping CF

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 42).

Figure 42 shows an example of the PRIMECLUSTER log viewer.

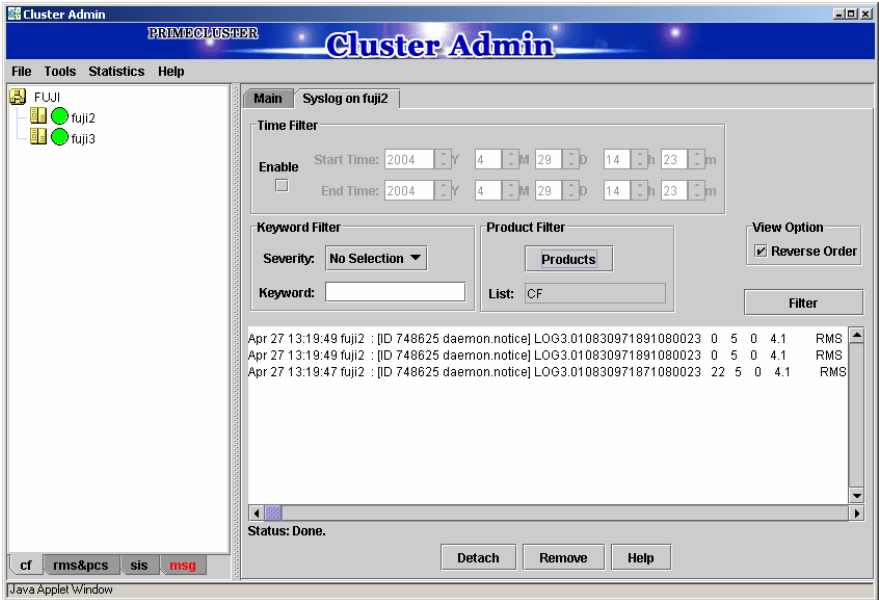


Figure 42: PRIMECLUSTER log viewer

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 43 shows the detached PRIMECLUSTER log viewer window.

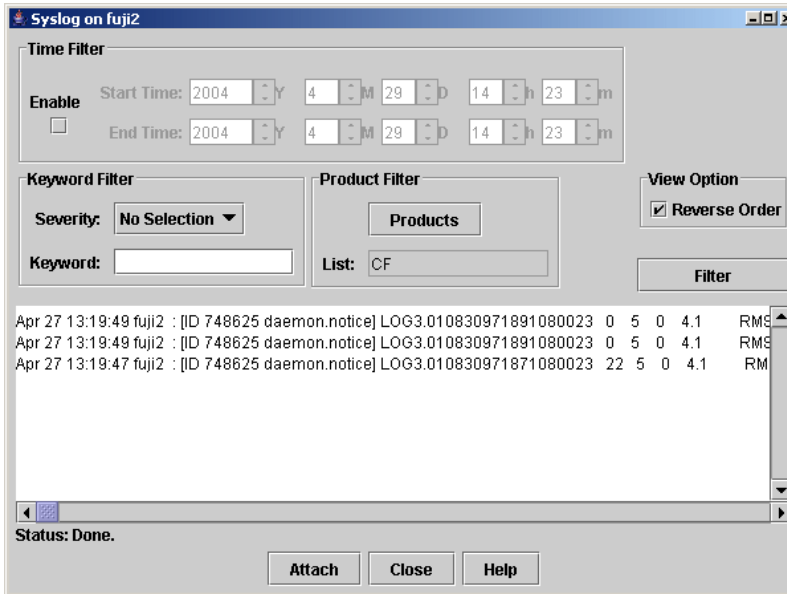


Figure 43: Detached PRIMECLUSTER log viewer

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 44).

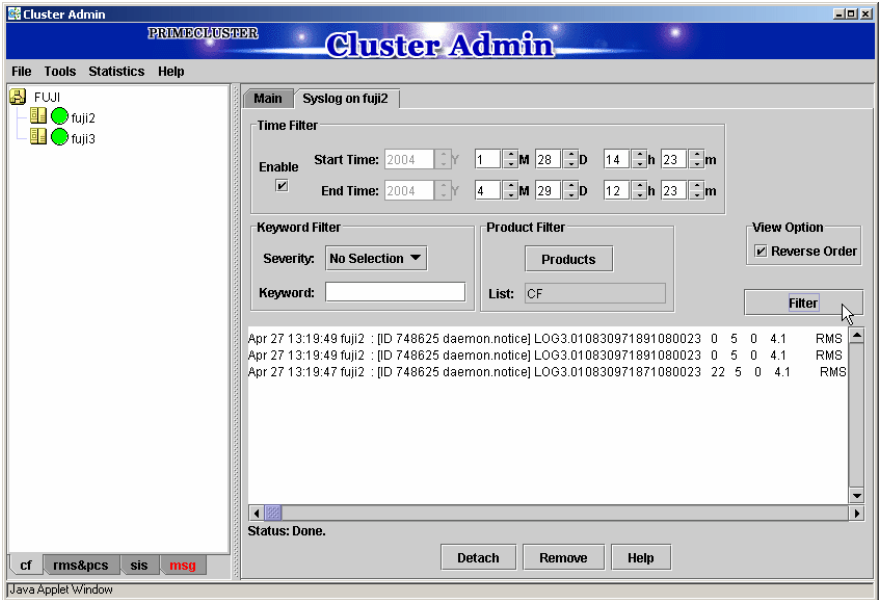


Figure 44: Search based on date/time

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 45).

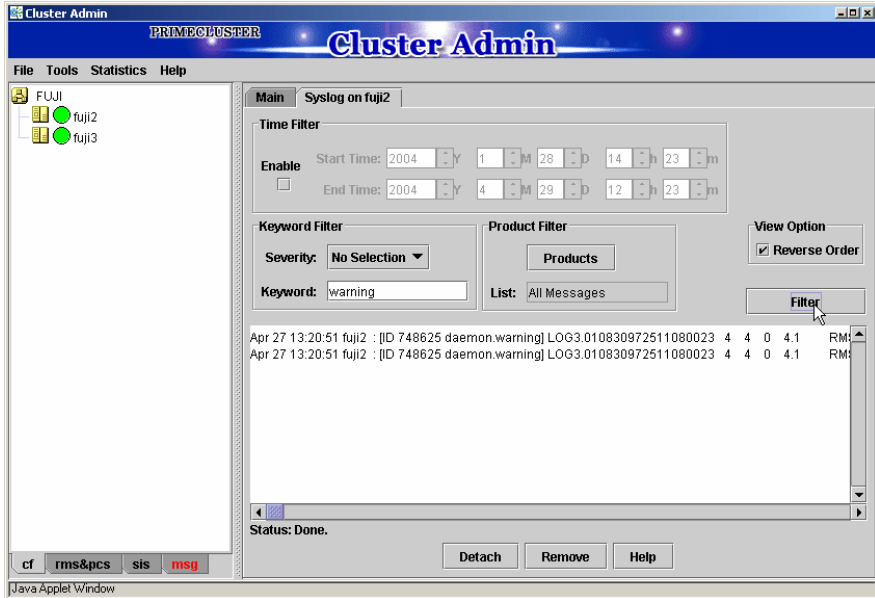


Figure 45: Search based on keyword

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 46 shows the log for a search based on severity level.

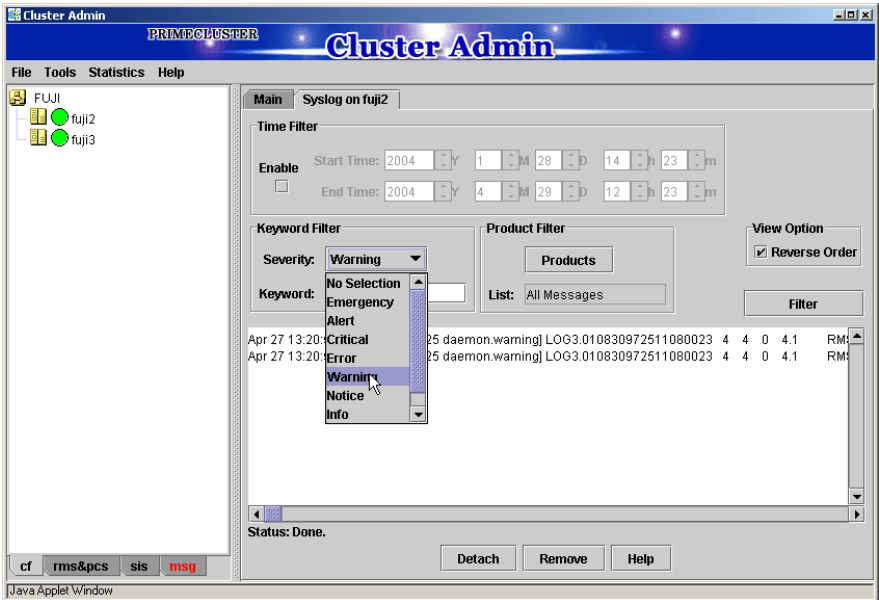


Figure 46: Search based on severity

Severity level	Severity description
<i>Emergency</i>	Systems cannot be used
<i>Alert</i>	Immediate action is necessary
<i>Critical</i>	Critical condition
<i>Error</i>	Error condition
<i>Warning</i>	Warning condition
<i>Notice</i>	Normal but important condition
<i>Info</i>	For information
<i>Debug</i>	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.

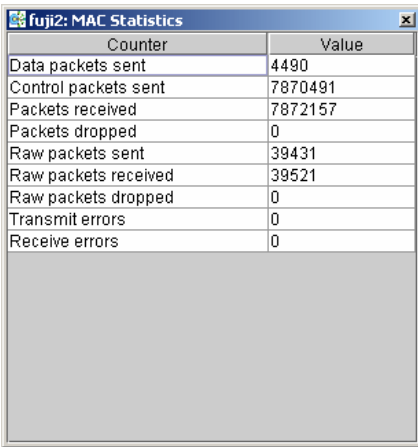
Figure 47 shows the display of ICF Statistics.

The screenshot shows a Java Applet window titled "fuji2: ICF Statistics". The window contains a table with two columns: "Counter" and "Value". The table lists various network-related statistics, including packet counts for transmit (xmit) and receive (rx) operations across different protocols like ICF, HTBT, SYN, and SQE. The values range from 0 to 9648. The window also includes a scrollbar on the right and a "Java Applet Window" label at the bottom.

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 47: ICF statistics

Figure 48 shows the display of MAC Statistics,



The screenshot shows a window titled "fuji2: MAC Statistics" with a close button in the top right corner. The window contains a table with two columns: "Counter" and "Value". The table lists various network statistics and their corresponding values.

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 48: MAC statistics

To display node to node statistics, choose *Node to Node Statistics* and click on the desired node (see Figure 49).

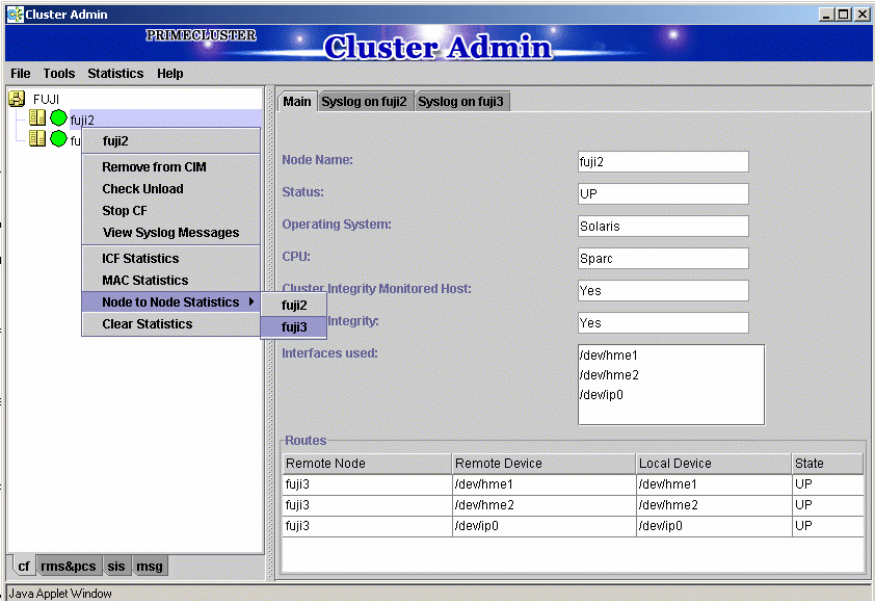


Figure 49: Selecting a node for node to node statistics

The window for Node to Node Statistics appears (see Figure 50).

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

Java Applet Window

Figure 50: 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 51).

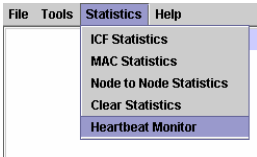


Figure 51: Selecting the Heartbeat monitor

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 52).

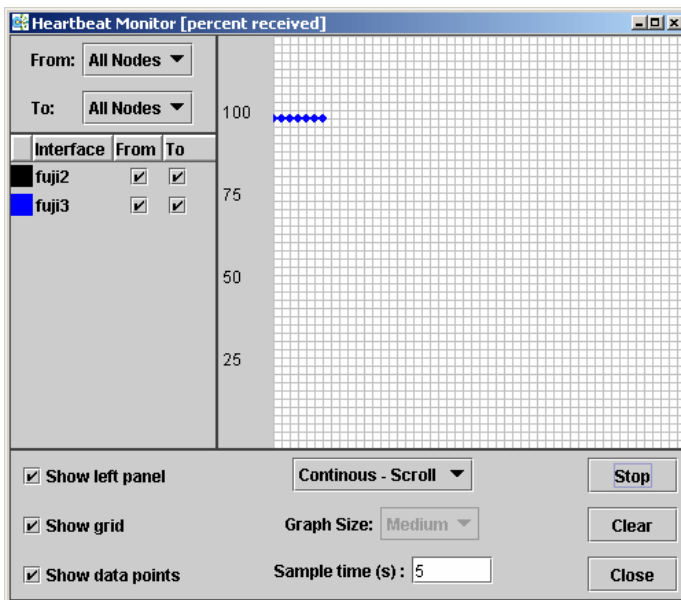


Figure 52: Heartbeat monitor

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 53).

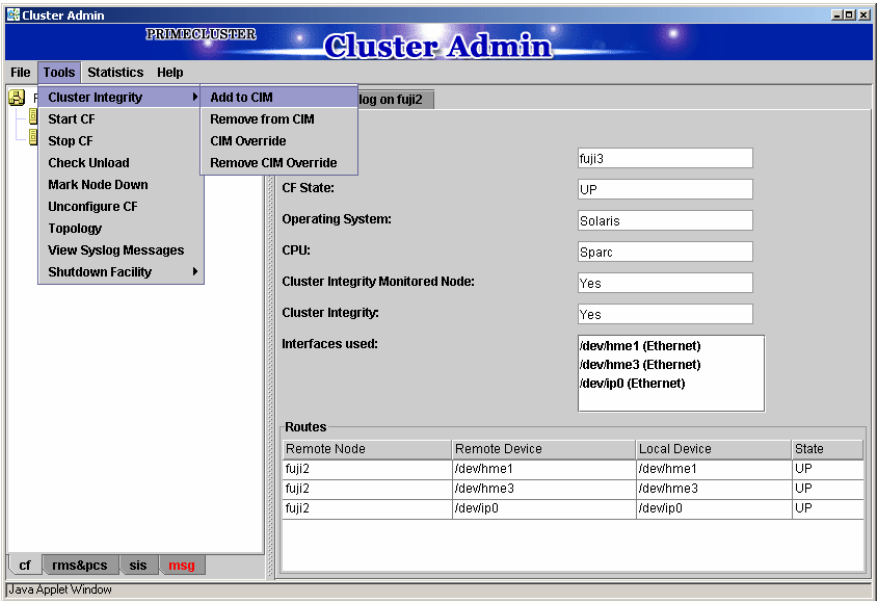


Figure 53: CIM options

The *Add to CIM* pop-up display appears. Choose the desired CF node and click on *Ok* (see Figure 54).

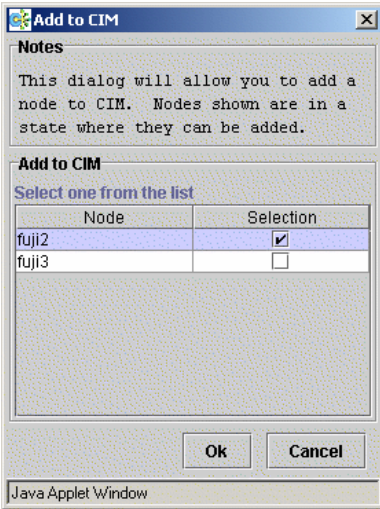


Figure 54: Add to CIM

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 55).

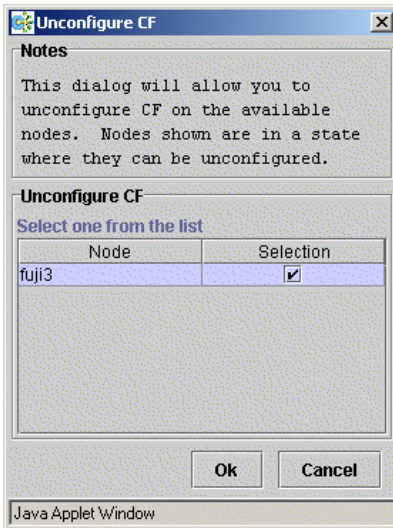


Figure 55: Unconfigure CF

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 56).

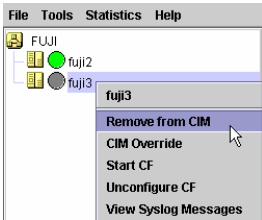


Figure 56: CIM Override

A confirmation pop-up appears (see Figure 57).

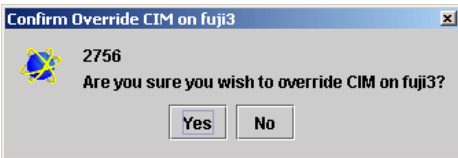


Figure 57: CIM Override confirmation

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 57).

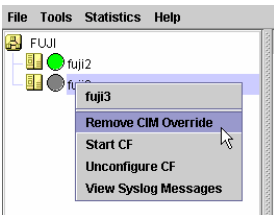


Figure 58: Remove CIM Override

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.



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 59.

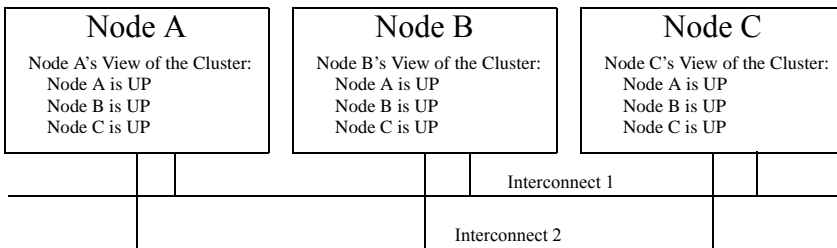


Figure 59: Three-node cluster with working connections

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 60.

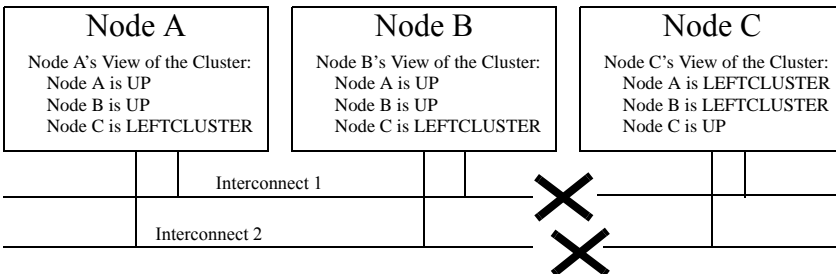


Figure 60: Three-node cluster where connection is lost

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.



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 60, 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.



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 61, 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.

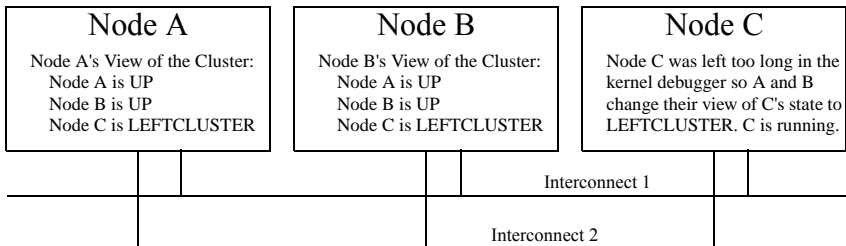


Figure 61: Node C placed in the kernel debugger too long

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 62.

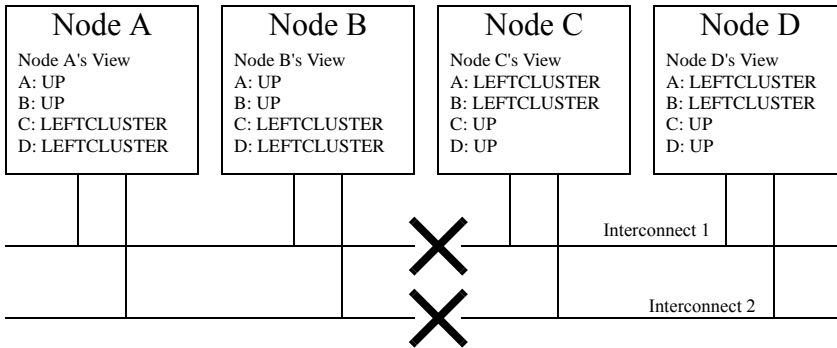


Figure 62: Four-node cluster with cluster partition

In Figure 62, 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 SPARC Enterprise M-series 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
	<input checked="" type="checkbox"/> Int 1	<input checked="" type="checkbox"/> Int 2	<input type="checkbox"/> Int 3	<input type="checkbox"/> Int 4	
<code>fuj i2</code>	<input checked="" type="checkbox"/> hme0 <input type="checkbox"/> hme2	<input checked="" type="checkbox"/> hme1	<input type="checkbox"/> hme3	<input type="checkbox"/> hme5	<input type="checkbox"/> hme4 <input type="checkbox"/> hme6
<code>fuj i3</code>	<input checked="" type="checkbox"/> hme0	<input checked="" type="checkbox"/> hme2	missing	<input type="checkbox"/> hme1	
<code>fuj i4</code>	<input checked="" type="checkbox"/> hme1	<input checked="" type="checkbox"/> hme2	<input type="checkbox"/> hme3	missing	<input type="checkbox"/> 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, `fujij2` 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 `fujij2`. In the above example, if `hme2` were selected for `fujij2`, 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 63).

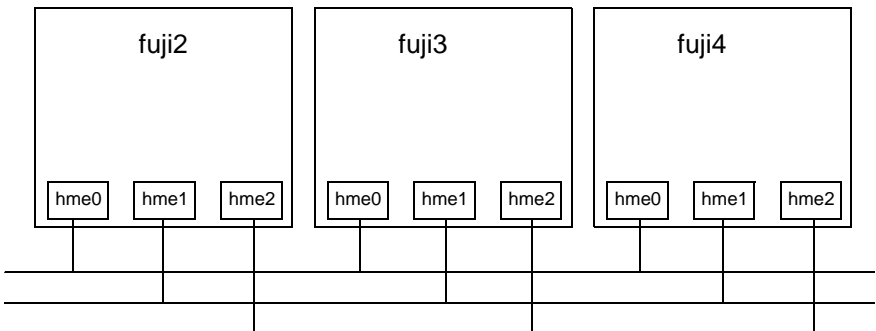


Figure 63: A three-node cluster with three full interconnects

The resulting topology table for Figure 63 is shown in Table 7.

FUJI	Full interconnects		
	Int 1	Int 2	Int 3
fuj i2	hme0	hme1	hme2
fuj i3	hme0	hme1	hme2
fuj i4	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, fuj i2's Ethernet connection for hme1 has been broken (see Figure 64).

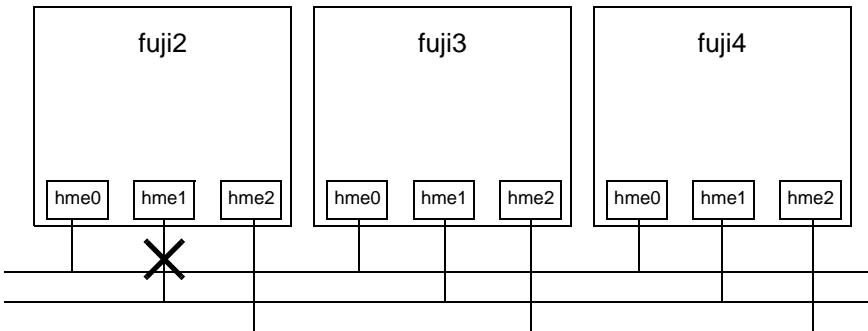


Figure 64: Broken Ethernet connection for hme1 on fuj i2

The resulting topology table for Figure 64 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.

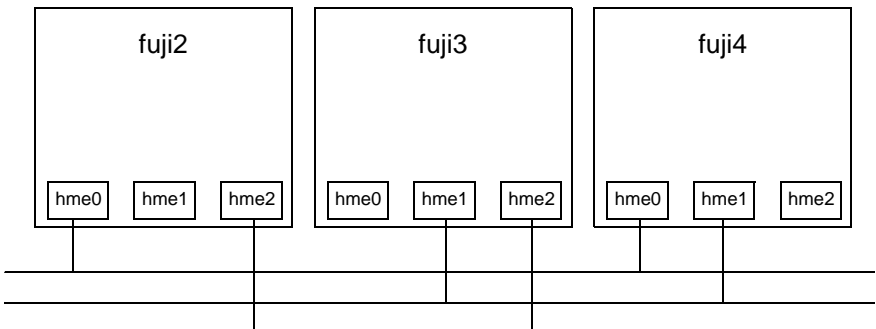


Figure 65: Cluster with no full interconnects

The resulting topology table for Figure 65 is shown in Table 9.

FUJI	Partial interconnects			Unconnected devices
	Int 1	Int 2	Int 3	
fujij2	hme0	missing	hme2	hme1
fujij3	missing	hme1	hme2	hme0
fujij4	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-brain 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

PRIMECLUSTER Shutdown Facility (SF) provides features to forcibly stop nodes where an error occurs in the cluster.

The SF is made up of the following four major components:

- Shutdown Daemon (SD)

Shutdown Daemon monitors the state of cluster nodes, collects the states, and provides the interface to request a shutdown manually or automatically. Also, a processing to solve a cluster partition state is performed.
- Shutdown Agents (SA)

Shutdown Agents guarantee the shutdown of other nodes. Though Shutdown Agents are attached to SF products, they vary depending on the architecture of cluster nodes for SF installation destination. SF provides the feature to shut down a node whether RMS is operating or not for each product of PRIMECLUSTER service layer.

- Monitoring Agent (MA)

Monitoring Agent monitors the state of cluster nodes by taking advantage of the characteristic of hardware and detects the node down immediately. When errors occur on other nodes, such as sudden system panic or power off, the error is reported to SF. Also, the feature as Shutdown Agents (SA) is provided to shut down nodes which errors occur.

- `sdtool(1M)` command

The `sdtool(1M)` is the command to provide I/F of Shutdown Daemon.

PRIMECLUSTER Shutdown Facility has the following features:

- It is possible to detect the shut down or cluster nodes immediately (monitoring agent).
- It is possible to shut down cluster nodes whether RMS is running or not.
- It is possible to shut down cluster nodes from any components of PRIME-CLUSTER service layer.

The first section explains the initial installation of SF products. The second and subsequent sections explain the configuration setup of SF. The last section explains the changes which need to be added to other products.

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
- XSCF SNMP— XSCF Simple Network Management Protocol
- ALOM—Advanced Lights Out Management
- ILOM—Integrated Lights Out Manager

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

SA	Name	Hardware
RCI	SA_pprcip, SA_pprcir	SPARC Enterprise M-series
XSCF	SA_xscfp, SA_xscfr, SA_rccu, SA_rccux	SPARC Enterprise M-series
XSCF SNMP	SA_xscfsnmpg0p, SA_xscfsnmpg1p, SA_xscfsnmpg0r, SA_xscfsnmpg1r, SA_xscfsnmp0r, SA_xscfsnmp1r	SPARC M-series
ALOM	SA_sunF	SPARC Enterprise T1000, T2000
ILOM	SA_ilomp, SA_ilomr	SPARC Enterprise T5120, T5220, T5140, T5240, T5440, SPARC T3 series

Table 10: Available SAs and MAs

8.2.1 RCI

RCI SA is the Shutdown Agent for SPARC Enterprise M-series.

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 a node failure is detected.

Shutdown Agent

There are two kinds of RCI SAs:

- SA_pprcip—panics the node through RCI.
- SA_pprcir—resets the node through RCI.

The RCI log files are as follows:

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

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 nodes, where the `sdtool` command was executed, and the other nodes in the following:

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

Cluster	Host	Agent	SA State	Shut State	Test State	Init State
node01		SA_pprcip.so	Idle	Unknown	Unknown	InitFailed
node01		SA_pprcir.so	Idle	Unknown	Unknown	InitFailed
node02		SA_pprcip.so	Idle	Unknown	Unknown	InitFailed

node02	SA_pprcir.so	Idle	Unknown	Unknown	InitFailed
node03	SA_pprcip.so	Idle	Unknown	Unknown	InitFailed
node03	SA_pprcir.so	Idle	Unknown	Unknown	InitFailed

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

- An RCI error is detected after 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 `node02`, where the `sdtool` command was executed, and the other nodes in the following:

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

Cluster Host	Agent	SA State	Shut State	Test State	Init State
node01	SA_pprcip.so	Idle	Unknown	TestWorked	InitWorked
node01	SA_pprcir.so	Idle	Unknown	TestWorked	InitWorked
node02	SA_pprcip.so	Idle	Unknown	TestFailed	InitWorked
node02	SA_pprcir.so	Idle	Unknown	TestFailed	InitWorked
node03	SA_pprcip.so	Idle	Unknown	TestWorked	InitWorked
node03	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.

8.2.2 XSCF

XSCF SA is the Shutdown Agent for SPARC Enterprise M-series.

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.

Setup and configuration

XSCF (eXtended System Control Facility) is a console MA that is supported on SPARC Enterprise M-series where XSCF is mounted. Refer to "5.1.2.2.1 Checking Console Configuration" in "PRIMECLUSTER Installation and Administration Guide" for complete details on XSCF.

Shutdown Agent

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

- SA_xscfp—panics the node through XSCF.
- SA_xscfr—resets the node through XSCF.
- SA_rccu—sends a control break signal to the node through XSCF.
- SA_rccux—sends a control break signal to the node through XSCF. (*)
*) XSCF has duplex configuration and does not use the takeover IP address of XSCF.

It is recommended that using XSCF with RCI. In this case, the priority of each agent is as follows:

- (1) RCI Panic (SA_pprcip)
- (2) XSCF Panic (SA_xscfp)
- (3) XSCF Break signal (SA_rccu, SA_rccux)
- (4) RCI Reset (SA_pprcir)
- (5) XSCF Reset (SA_xscfr)

The XSCF log files are as follows:

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

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

/var/opt/SMAWsf/1og/SA_rccu.log

/var/opt/SMAWsf/1og/SA_rccux.log



- The IP address of XSCF belongs to the same segment as the Administrative LAN.
However, if the network routing is configured, the IP address of XSCF does not need to belong to the same segment as the Administrative LAN of the cluster node.
- If XSCF is used for the console, the No.7040 error message might appear on the other nodes in the following cases:
 - Turning off a node for maintenance
 - Changing the network configuration of XSCF
 - Updating the XSCF firmwareIf the error message is displayed, take corrective action of the No.7040 error message after each operation is completed.
- After Shutdown Facility (SF) startup, it can take up to 30 seconds for the console Monitoring Agent to detect hardware failures such as RCCU or XSCF errors or a disconnected cable, and setting errors like incorrect IP addresses.

8.2.3 XSCF SNMP

XSCF SNMP SA is the Shutdown Agent for SPARC M-series.

For details on XSCF, see the "SPARC M-Series System Operation and Administration Guide."

Setup and configuration

The XSCF must be configured according to the "SPARC M-Series System Operation and Administration Guide."

Moreover, you must set the user name and password to allow the operation in XSCF.

For details, refer to "5.1.2.1.1 Checking XSCF Information" and "5.1.2.1.2 Setting SNMP" in "PRIMECLUSTER Installation and Administration Guide."

Shutdown Agent

There are six kinds of XSCF SNMP SAs:

- SA_xscfsnmpg0p—panics the domain by using XSCF-LAN#0
- SA_xscfsnmpg1p—panics the domain by using XSCF-LAN#1
- SA_xscfsnmpg0r—resets the domain by using XSCF-LAN#0
- SA_xscfsnmpg1r—resets the domain by using XSCF-LAN#1
- SA_xscfsnmp0r—resets PPAR by using XSCF-LAN#0 (Used only on the control domain)
- SA_xscfsnmp1r—resets PPAR by using XSCF-LAN#1 (Used only on the control domain)

The priority of each agent is as follows:

- (1) SA_xscfsnmpg0p
- (2) SA_xscfsnmpg1p
- (3) SA_xscfsnmpg0r
- (4) SA_xscfsnmpg1r
- (5) SA_xscfsnmp0r
- (6) SA_xscfsnmp1r

The XSCF log files are as follows:

```
/var/opt/SMAwsf/log/SA_xscfsnmpg0p.log
/var/opt/SMAwsf/log/SA_xscfsnmpg1p.log
/var/opt/SMAwsf/log/SA_xscfsnmpg0r.log
/var/opt/SMAwsf/log/SA_xscfsnmpg1r.log
/var/opt/SMAwsf/log/SA_xscfsnmp0r.log
/var/opt/SMAwsf/log/SA_xscfsnmp1r.log
```



- To make XSCF-LAN redundant, XSCF-LAN#0 and XSCF-LAN#1 should use different subnets.
- After Shutdown Facility (SF) startup, it can take up to 30 seconds to detect hardware failures such as XSCF errors or disconnected cable, and setting errors like incorrect IP addresses.

8.2.4 ALOM

ALOM SA is the Shutdown Agent for SPARC Enterprise T1000, T2000.

Setup and configuration

The ALOM must be configured according to the directions in the "Advanced Lights out Management (ALOM) CMT guide."

Moreover, you must set the user name and password to allow the operation in ALOM.

When using ALOM, check the configuration of ALOM by referring to "5.1.2.4.1 Checking Console Configuration" in "PRIMECLUSTER Installation and Administration Guide."

Shutdown Agent

- SA_sunF—sends a control break signal to the node through ALOM.

The ALOM log file is as follows:

```
/var/opt/SMAwsf/1og/SA_sunF.1og
```



- The IP address of ALOM belongs to the same segment as the Administrative LAN. However, if the network routing is configured, the IP address of ALOM does not need to belong to the same segment as the Administrative LAN of the cluster node.
- After Shutdown Facility (SF) startup, it can take up to 50 seconds to detect hardware failures such as ALOM errors or a disconnected cable, and setting errors like incorrect IP addresses.

8.2.5 ILOM

ILOM SA is the Shutdown Agent for SPARC Enterprise T5120, T5220, T5140, T5240, T5440, SPARC T3 series.

Setup and configuration

The ILOM must be configured according to the directions below:

- For ILOM 2.x
 - Integrated Lights Out Manager User's Guide
- For ILOM 3.0
 - Integrated Lights Out Manager (ILOM) 3.0 Concepts Guide
 - Integrated Lights Out Manager (ILOM) 3.0 Web Interface Procedures Guide
 - Integrated Lights Out Manager (ILOM) 3.0 CLI Procedures Guide
 - Integrated Lights Out Manager (ILOM) 3.0 Getting Started Guide

Moreover, you must set the user name and password to allow the operation in ILOM.

When using ILOM, check the configuration of ILOM by referring to "5.1.2.3.1 Checking Console Configuration" of the "PRIMECLUSTER *Installation and Administration Guide*."

Shutdown Agent

There are two kinds of ILOM SAs:

- SA_ilmop—panics the node through ILOM.
- SA_ilmor—resets the node through ILOM.

The ILOM log file is as follows:

```
/var/opt/SMAWsf/log/SA_ilmop.log  
/var/opt/SMAWsf/log/SA_ilmor.log
```



- The IP address of ILOM belongs to the same segment as the Administrative LAN.
However, if the network routing is configured, the IP address of ILOM does not need to belong to the same segment as the Administrative LAN of the cluster node.
- If ILOM is used for the console, the No.7040 error message might appear on the other nodes in the following cases:
 - Turning off a node for maintenance
 - Changing the network configuration of ILOM

- Updating the ILOM firmware

If the error message is displayed, take corrective action of the No.7040 error message after each operation is completed.

- After Shutdown Facility (SF) startup, it can take up to 30 seconds to detect hardware failures such as ILOM errors or a disconnected cable, and setting errors like incorrect IP addresses.

8.2.6 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
```

8.3 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 *Software Release Guide and Installation Guide*. 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 `ncsd.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.



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 handling, 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

Split-brain handling may be performed by the Shutdown Facility internal algorithm. This method uses 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.

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 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

For information on configuring the Shutdown Facility, refer to "5.1.2 Configuring the Shutdown Facility" of the PRIMECLUSTER *Installation and Administration Guide*.

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 `sdt00(1M)` command. The `sdt001(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:

```
# sdt001 -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 `rscd` 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 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.

This function is available for Solaris 10. It is not supported on Solaris 11.

9.1 Overview

i 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.

i 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 66.

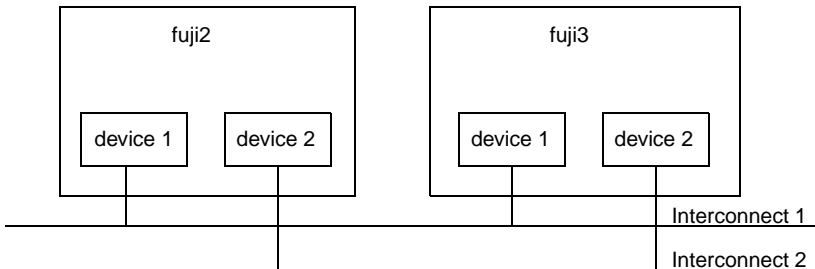


Figure 66: Conceptual view of CF interconnects

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 67.

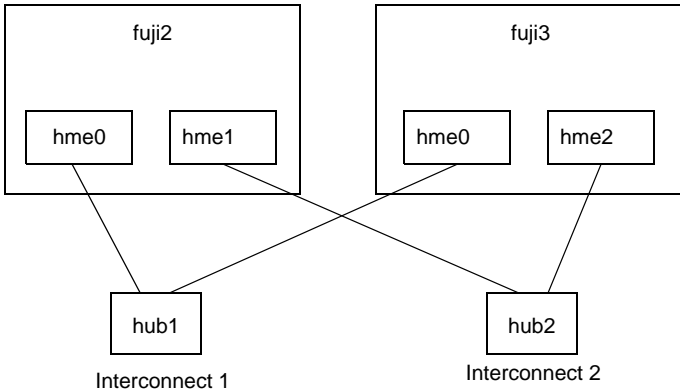


Figure 67: CF with Ethernet interconnects

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 68 shows a CF over IP configuration.

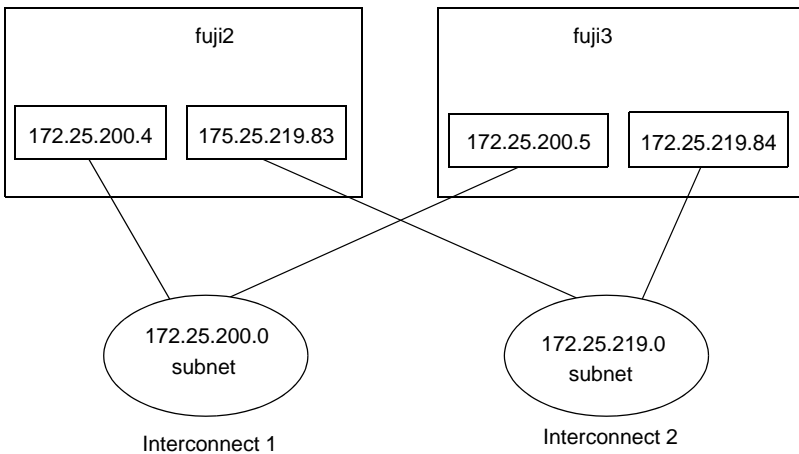


Figure 68: CF with IP interconnects

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.



- IPv4 address is used for CF over IP.
- CF is not allowed 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.

9.2 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 68, 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`.



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.



`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.

10 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 *Software Release Guide and Installation Guide*.

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.

10.1 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 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

10.2 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.

10.2.1 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 *PRIME-CLUSTER Software Release Guide and Installation Guide* 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      0s
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.



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 -e` to send an echo request to all the nodes of the cluster:

```
fuji2# cftool -e
```

```
Localdev Srcdev Address Cluster Node Number Joystate
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
```



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 Joystate
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-priv a fuji4-priv a 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-priv a fuji4-priv a 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.



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_tmbs 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 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)
```

10.3 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 "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 "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 "PRIMECLUSTER DR/PCI Hot Plug User's Guide" for details.
6. Configure CF routes for the replacement NIC as follows:

```
# cfrecon -a /dev/hme0
```

10.4 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.

10.4.1 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 `fjsnap` command cannot be executed because the system hangs, collect a system dump. Then start the system in single user mode, and execute the `fjsnap` command. To collect the system dump, input the abort key sequence (for example, Break signal) to forcibly stop the node to OBP mode, and then execute `sync`. For detailed instructions on forcibly stopping the node to OBP mode, see the "System Administration Guide" of the Solaris.
- 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.

10.4.2 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. For details on a system dump, see the "System Administration Guide" of the Solaris.

10.4.3 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 /var/tmp/scf.dump.tar ./FJSVhwr
```

- /var/opt/FJSVcs1/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*.



Refer to the *Enhanced Support Facility User's Guide* for details on SCF driver messages.

11 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 “rcquery messages” describes the `rcquery(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.

11.1 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.

11.1.1 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 either be a network device or an IP device like `/dev/ip[0-3]` followed by the IP-Address and Broadcast Address number.

11.1.2 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: #04xx: 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:

```
d1_attach: DL_ACCESS error
d1_attach: DL_ATTACH_REQ putmsg failed (errno)
d1_attach: DL_BADPPA error
d1_attach: DL_OUTSTATE error
d1_attach: DL_SYSERR error
d1_attach: getmsg for DL_ATTACH response failed (errno)
d1_attach: unknown error
d1_attach: unknown error hexvalue
d1_bind: DL_ACCESS error
d1_bind: DL_BADADDR error
d1_bind: DL_BIND_REQ putmsg failed (errno)
d1_bind: DL_BOUND error
d1_bind: DL_INITFAILED error
d1_bind: DL_NOADDR error
d1_bind: DL_NOAUTO error
d1_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 mclx device failed: /devices/
pseudo/icfn - devname (errno)
icf_devices_select: mcl_select_dev failed: /devices/pseudo/
icfn - devname (errno)
icf_devices_select: open of mclx device failed: /devices/
pseudo/icfn - devname (errno)
icf_devices_setup: calloc failed: devname
icf_devices_setup: failed to create mclx dev: /devices/pseudo/
icfn - devname (errno)
icf_devices_setup: failed to open /dev/kstat (errno)

```

```

icf_devices_setup: failed to open mclx device: /devices/
pseudo/icfn - devname (errno)
icf_devices_setup: failed to stat mclx device: /dev/mclx
(errno)
icf_devices_setup: failed to stat mclx 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: mcl_set_device_id failed: /devices/pseudo/
icfn - devname (errno)
icf_devices_setup: mclx_get_device_info failed: /devices/
pseudo/icfn - devname (errno)
icf_devices_setup: mclx device already linked: /devices/
pseudo/icfn - devname (errno)
icf_devices_setup: mclx not a device
mcl_select_device: MCL_IOC_SEL_DEV ioctl failed (errno)
mcl_set_device_id: MCL_IOC_SET_ID ioctl failed (errno)
mclx_get_device_info: MCLX_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, 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: #04xx: 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:

```
mclx_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 mclx device: /devices/pseudo/icfn
(errno)
OSDU_stop: failed to unlink mclx device: /devices/pseudo/icfn
(errno)
OSDU_stop: failed to unload cf_drv
OSDU_stop: failed to unload mcl module
OSDU_stop: failed to unload mclx driver
OSDU_stop: mclx_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: #04xx: 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:
#04xx: 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: #04xx: 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: #04xx: 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: #04xx: 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*)

11.2 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.

11.2.1 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
```

11.2.2 Error messages

`cipconfig -l`

`cipconfig: could not start CIP - detected a problem with CF.`
`cipconfig: cannot open mconn: #04xx: 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: #04xx: 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: #04xx: 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)
```


11.3 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.

11.3.1 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.

11.3.2 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: `#04xx`: 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: `#04xx`: 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: #04xx: 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: #xxx: 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: #04xx: generic: reason_text
```

```
cftool: cannot get the state of the local node: #04xx: 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: #04xx: generic: reason_text  
cftool: cannot get icf mac statistics: #04xx: 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: #xxx: service: reason_text  
cftool: cannot get node details: #xxx: 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: #04xx: 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: #xxx: 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: #04xx: generic: reason_text  
cftool: clear icf statistics: #04xx: 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: #04xx: generic: reason_text
cftool: unexpected error retrieving version: #04xx: 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.

11.4 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.

11.4.1 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 ]
```

11.4.2 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 `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 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.

11.5 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.

11.5.1 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
```

11.5.2 Error messages

```
rcqquery -v -l
failed to register user event
```

```
`# 0c0b: user level ENS event memory limit overflow`
```

The `rcquery(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.

11.6 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.

11.6.1 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.

11.7 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 transmission flushed
042b	REASON_MAX_ENTRY	generic	Maximum entries reached
042c	REASON_NO_CONFIGURATION	generic	No configuration exists
	<i>/* mrpc reasons */</i>		
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
	<i>/* ens reasons */</i>		
0c01	REASON_ENS_INFOTOOBIG	ens	Event information is too large
0c02	REASON_ENS_TOOSOON	ens	Attempt to post event before <code>ens_init</code>
0c03	REASON_ENS_NODEST	ens	Remote or local not specified in <code>howto</code>
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
	<i>/* nsm */</i>		
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
	<i>/* mrpc */</i>		
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
	<i>/* user events */</i>		
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
<i>/* node group */</i>			
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
<i>/* distributed mount services */</i>			
2001	REASON_DMS_INVALIDDCNG	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_NOMNTP	dms	No mount point specified
2008	REASON_DMS_NOBENT	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
	<i>/* join */</i>		
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
	<i>/* cfreg */</i>		
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
	<i>/* sens */</i>		
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
	<i>/* CFRS */</i>		
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_BADEXCSRCCONF	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_DSTABORTEEXEC	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
	<i>/* CFSF */</i>		
4001	REASON_CFSF_PENDING	cfsf	Invalid node down request with pending ICF failure
4002	REASON_MAX_REASON_VAL		Last reason

11.8 Error messages for different systems

Refer to the file `/usr/include/sys/errno.h` for the meaning of an ERRNO for a particular system.

11.9 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 <code>fork.(2)</code>
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 <code>exec(2)</code>). 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 <code>a.out(4)</code>).
9	EBADF	Bad file number Either a file descriptor refers to no open file, or a <code>read(2)</code> (respectively, <code>write(2)</code>) request is made to a file that is open only for writing (respectively, reading).
10	ECHILD	No child processes A <code>wait(2)</code> 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 <code>fork(2)</code> 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 <code>brk()</code> or <code>sbrk()</code> (see <code>brk(2)</code>), or one of the <code>exec</code> 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 <code>fork(2)</code> 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, <code>errno</code> potentially may be set to <code>EFAULT</code> 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 <code>mount(2)</code> 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 <code>link(2)</code> 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 <code>chdir(2)</code> 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 <code>signal(3C)</code> or <code>kill(2)</code> 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 <code>ioctl(2)</code> 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 <code>fcntl(2)</code> 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 <code>lseek(2)</code> 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 <code>msgrcv(2)</code>).
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 <code>msgctl(2)</code> , <code>semctl(2)</code> , and <code>shmctl(2)</code>).
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 <code>fcntl(2)</code>).
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 <code>write(2)</code> 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 <code>putmsg(2)</code> or <code>getmsg(2)</code> 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 <code>ioctl(2)</code> 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 <code>ioctl()</code> operation is indeterminate. This is also returned in the case of <code>_lwp_cond_timedwait(2)</code> or <code>cond_timedwait(2)</code> .
63	ENOSR	Out of stream resources During a STREAMS <code>open(2)</code> 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) L_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 <code>sendto(3N)</code> or <code>sendmsg(3N)</code> 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 <code>connect(3N)</code> or <code>send(3N)</code> request failed because the connected party did not properly respond after a period of time; or a <code>write(2)</code> or <code>fsync(3C)</code> request failed because a file is on an NFS file system mounted with the <code>soft</code> 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 <code>connect()</code>) 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

11.10 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.

FJSVc1uster:*severity:program:message-number:message*

<i>severity</i>	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.
<i>program</i>	Indicates the name of the Resource Database program that output this message.
<i>message-number</i>	Indicates the message number.
<i>message</i>	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

11.10.1 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

11.10.2 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.

11.10.3 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.

11.10.4 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 PRIME-CLUSTER 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 Software Release Guide and 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
dcm1ck 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 `clxec(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 *Software Release Guide and 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 (mp1b2048), 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 mp1b2048) 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 A11, 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 *Software Release Guide and 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.

11.11 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.

11.12 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*

<i>severity</i>	Message severity level. The levels of severity are as follows: Information (INFORMATION), Warning (WARNING), Error (ERROR). For details, refer to the table below.
<i>program</i>	Name of the program that output this message. The monitoring agent is output as DEV.
<i>message-number</i>	Message number.
<i>details</i>	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.

11.12.1 Information message

3040	The console monitoring agent has been started. (node: <i>nodename</i>)
3041	The console monitoring agent has been stopped. (node: <i>nodename</i>)
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 <i>targetnode</i> .
3045	The console monitoring agent cancelled to monitor Node <i>targetnode</i>

- 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*)

11.12.2 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.

11.12.3 Error message



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*)

Description:

This message indicates that an error for RCI is detected.

Corrective action:

An RCI transmission failure occurs between the node where the error message is output and *nodename* in the error message. Improper connection of RCI or a system error might be considered as the cause of the error.

Check the following:

- The RCI cable is connected.
- Operations such as firm reboot or firm up is performed on the RCI.

If these are the cause, take the corrective action. Then, execute the following commands on the node where the error message appears to restart the Shutdown Facility (SF) and the RCI monitoring agent (MA):

```
# /opt/SMAN/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrcimonctl stop
# /etc/opt/FJSVcluster/bin/clrcimonctl start
# /opt/SMAN/bin/sdtool -b
```

If this corrective action does not work, hardware failures such as the RCI cable and System Control Facility (hereafter, SCF) might be considered as the cause of the error.

Write down the error message, collect SCF dump and required information for troubleshooting, and contact field support (refer to the Section “Collecting troubleshooting information”).

Field support engineers restart the RCI monitoring agent (MA) and the Shutdown Facility (SF) after recovering hardware.

```
7004          The RCI monitoring agent has been stopped due to an
              RCI address error.
              (node:nodename address:address)
```

Description:

This message indicates that the RCI address is not correct.

Corrective action:

The following causes might be considered:

- The RCI address is not configured.
- The RCI address is duplicated.
- The RCI address of other node is changed while the RCI monitoring agent is running.

Write down the error message, collect SCF dump and required information for troubleshooting, and contact field support (refer to the Section “Collecting troubleshooting information”).

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 -c stat
```

After setting the correct RCI address, execute the following commands on the node where the error message appears to restart the RCI monitoring agent (MA) and the Shutdown Facility (SF):

```
# /opt/SMAW/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrcimonctl stop
# /etc/opt/FJSVcluster/bin/clrcimonctl start
# /opt/SMAW/bin/sdtool -b
```

```
7018          The console monitoring agent has been started.
```

Description:

This message indicates that the console monitoring agent has been started.

Corrective action:

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 commands on the node where this error message appeared to restart the console monitoring agent (MA) and the Shutdown Facility (SF):

```
# /opt/SMAW/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrccumonctl stop
# /etc/opt/FJSVcluster/bin/clrccumonctl start
# /opt/SMAW/bin/sdtool -b
```

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.
```

Description:

This message indicates that the RCI monitoring agent has been started.

Corrective action:

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 commands on the node where this error message appeared to restart the RCI monitoring agent (MA) and Shutdown Facility (SF):

```
# /opt/SMAW/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrcimonctl stop
# /etc/opt/FJSVcluster/bin/clrcimonctl start
# /opt/SMAW/bin/sdtool -b
```

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/FJSMadm/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 connection is not enabled.
 (node:*nodename* portno:*portnumber* detail:*code*)

Description:

This message indicates that the connection to the console is disconnected.

Corrective action:

Check the following:

<When the RCCU is used for the console>

- The RCCU is powered on.
- The normal lamp of the port connected to HUB and LAN cable is ON.
- The LAN cable is connected to the RCCU and HUB connectors.
- The load is not placed on the network of the system or RCCU.

<When the XSCF is used for the console>

- The normal lamp of the port connected to HUB and LAN cable is ON.
- 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".
- The load is not placed on the network of the system or XSCF.
- Operations such as firm reboot or firm up is not performed, or an event such as failover has not occurred on XSCF.

<When the ILOM is used for the console>

- The normal lamp of the port connected to HUB and LAN cable is ON.
- The LAN cable is connected to the network management (NET MGT) port and HUB connectors.
- The load is not placed on the network of the system or ILOM.
- Operations such as firm reboot or firm up is not performed on ILOM.

If any one of the above turns out to be the cause of the problem, take the corrective action. Then, execute the following commands on the node where the error message appeared to restart the Shutdown Facility (SF) and the console monitoring agent (MA):

```
# /opt/SMAW/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrccumonctl stop
# /etc/opt/FJSVcluster/bin/clrccumonctl start
# /opt/SMAW/bin/sdtool -b
```

If the problem has not yet been resolved, users should consider failures of network and hardware such as RCCU, XSCF, ILOM, 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*)

Description:

Connection to the console cannot be established during the console monitoring agent startup.

Corrective action:

Check the following:

<When the RCCU is used for the console>

- The IP address or host name of RCCU 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 on.
- The normal lamp of the port connected to HUB and LAN cable is ON.
- The LAN cable is connected to the RCCU and HUB connectors.
- The IP address of RCCU belongs to the same segment as the Administrative LAN.
- The console information of RCCU is correct. Use the `clrccusetup(1M)` command to check. If it is incorrect, register console information again using the `clrccusetup(1M)` command.

<When the XSCF is used for the console>

- The IP address or host name of XSCF is correct. Use the `clrcusetup(1M)` command to check. If the IP address or host name is incorrect, configure the console monitoring agent again.
- The normal lamp of the port connected to HUB and LAN cable is ON.
- The LAN cable connectors are connected to the XSCF's SCF-LAN port and HUB.
- 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".
- The IP address of XSCF belongs to the same segment as the Administrative LAN.
- The console information of XSCF is correct. Use the `clrcusetup(1M)` command to check. If it is incorrect, register console information again using the `clrcusetup(1M)` command.
- If SSH is used to connect to XSCF, the login user account for the Shutdown Facility is used to connect to XSCF from the cluster node via SSH connection, and also the user inquiry of the first SSH connection such as RSA Key Generation is complete.
- Operations such as firm reboot or firm up is not performed, or an event such as failover has not occurred on XSCF.

<When the ILOM is used for the console>

- The IP address or host name of ILOM is correct. Use the `clrcusetup(1M)` command to check. If the IP address or host name is incorrect, configure the console monitoring agent again.
- The normal lamp of the port connected to HUB and LAN cable is ON.
- The LAN cable is connected to the network management (NET MGT) port and HUB connectors.
- The console information of ILOM is correct. Use the `clrcusetup(1M)` command to check. If it is incorrect, register console information again using the `clrcusetup(1M)` command.

- For ILOM 3.0, the required privilege is not given to the login user account for the Shutdown Facility. For details on the privilege, refer to the PRIME-CLUSTER *Installation and Administration Guide*.
- The login user account for the Shutdown Facility is used to connect to ILOM from the cluster node via SSH connection, and also the user inquiry of the first SSH connection such as RSA Key Generation is complete.
- Operations such as firm reboot or firm up is not performed, or an event such as failover has not occurred on ILOM.

If any one of the above turns out to be the cause of the problem, take the corrective action. Then, execute the following commands on the node where the error message appeared to restart the Shutdown Facility (SF) and the console monitoring agent (MA):

```
# /opt/MAW/bin/sdtool -e
# /etc/opt/FJSVcluster/bin/clrccumonctl stop
# /etc/opt/FJSVcluster/bin/clrccumonctl start
# /opt/MAW/bin/sdtool -b
```

If the problem has not yet been resolved, users should consider failures of network and hardware such as RCCU, XSCF, ILOM, 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”.

```
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").

11.13 CCB messages

The CCB 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.

11.13.1 cfbackup warning/error messages

11.13.1.1 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      is not supported.
         -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`: ccb 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`.

11.13.1.2 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.

11.13.2 cfrestore warning/error messages

11.13.2.1 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  is not supported.
       -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.
       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: ccbp 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.

11.13.2.2 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/MAW/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/MAW/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.

12 Manual pages

This chapter lists the online manual pages for CCBR, CF, CIP, PAS, Resource Database, RMS, SF, Monitoring Agent, Web-Based Admin View, and RMS Wizards.

To display a manual page, type the following command:

```
$ man man_page_name
```

12.1 CCBR

System administration

`cfbackup`

save the cluster configuration information for a PRIMECLUSTER node

`cfrestore`

restore saved cluster configuration formation on a PRIMECLUSTER node

12.2 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

`rcquery`

get quorum state of the cluster

12.3 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

12.4 PAS

System administration

`mipcstat`
MIPC statistics

`clmstat`
CLM statistics

12.5 Resource Database



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

`clstarttrsc`
resource activation

`clstoprsc`
resource deactivation

`clsyncfile`
distribute a file between cluster nodes

User command

`clgettree`
display the tree information of the resource database

12.6 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
- hvrclv
 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

12.7 SF

System administration

- rcsd
 Shutdown Daemon of the Shutdown Facility

sdtool

interface tool for the Shutdown Daemon

File formats

rbsd.cfg

Configuration file for the Shutdown Daemon

SA_sunF.cfg

Configuration file for sunF system controller Shutdown Agent

12.8 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 operating environment of the 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

clovmmigrate

Changes the cluster configuration for performing the migration in Oracle VM Server for SPARC Environment

clovmmigratesetup

Registers, changes, deletes, or displays the guest domain information

clsnmpmonctl

Start, stop, or restart of the SNMP monitoring agent daemon, and display of daemon presence

clsnmpsetup

Registers, changes, deletes, or displays the SNMP monitoring information

12.9 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

12.10 RMS Wizards

RMS Wizards and RMS Application Wizards

RMS Wizards are documented as html pages in the `SMAWRhvd0` 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 Release information

This chapter explains primary changes in this manual.

No	VL	Edition	Section	Description
1	4.3A20	December 2012	Section "CF, CIP, and CIM configuration" Section "Differences between CIP and CF over IP" Section "Example of creating a cluster" Section "CIP configuration file"	Added descriptions of IPv6.
2	4.3A20	December 2012	Section "CF security"	Deleted descriptions about the cluster interconnect.
3	4.3A20	December 2012	Section "Example of creating a cluster" Section "Overview"	Stated the range of CF over IP support.
4	4.3A20	December 2012	Section "CIP configuration file"	Changed descriptions when adding the definition of CIP.
5	4.3A20	December 2012	Section "CIP configuration file"	Changed the condition to stop CIP.
6	4.3A20	December 2012	Section "XSCF SNMP"	Added "XSCF SNMP" to Shutdown Agent.
7	4.3A20	December 2012	All	Deleted the description of SIS.
8	4.3A20	February 2013	Section "Example of creating a cluster" Section "Starting Cluster Admin GUI and logging in"	Changed GUIs.

Table 12: Release information

No	VL	Edition	Section	Description
9	4.3A20	February 2013	Section "System dump"	Changed the description for collecting the system dump.

Table 12: Release information

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 power control

This function is provided by the Enhanced Support Facility (ESF), and it automatically switches the server power on and off.

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 PRIMECLUSTER 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`.

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)*.

Glossary

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).

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*.

mixed model cluster

A cluster system that is built from different SPARC Enterprise models. For example, one node is SPARC Enterprise M3000, and another node is SPARC Enterprise M4000. The models are divided into the following groups: SPARC T3-1/T3-2/T3-4, SPARC Enterprise T1000/T2000, SPARC Enterprise T5120/T5220/T5140/T5240/T5440, and SPARC Enterprise M3000/M4000/M5000/M8000/M9000.

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.

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*.

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*.

switching mode

LAN duplexing mode presented by GLS.

There is a total of five switching mode types: fast switching mode, NIC switching mode, GS/SURE linkage mode, multipath mode, and multilink Ethernet mode.

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)*.

synchronized power control

When the power of one node is turned in the cluster system, this function turns on all other powered-off nodes and disk array unit that are connected to nodes through RCI cables.

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

Abbreviations

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
RCI	Remote Cabinet Interface
RMS	Reliant Monitor Services
RTP	Reliant Telco Product
SA	Shutdown Agent
SAN	Storage Area Network
SD	Shutdown Daemon
SF	Shutdown Facility
SIS	Scalable Internet Services
VIP	Virtual Interface Provider

Figures

Figure 1:	CIP diagram	14
Figure 2:	CF over IP diagram	15
Figure 3:	Login pop-up	18
Figure 4:	Main Web-Based Admin View window after login	19
Figure 5:	Global Cluster Services window in Web-Based Admin View	20
Figure 6:	Initial connection pop-up	20
Figure 7:	CF is unconfigured and unloaded	21
Figure 8:	CF loaded but not configured	22
Figure 9:	Scanning for clusters	23
Figure 10:	Creating or joining a cluster	24
Figure 11:	Selecting cluster nodes and the cluster name	25
Figure 12:	CF loads and pings	26
Figure 13:	Edit CF node names	27
Figure 14:	CF topology and connection table	28
Figure 15:	CF over IP window	31
Figure 16:	CIP Wizard window	32
Figure 17:	CIP Wizard window (IPv6)	33
Figure 18:	CIM configuration window	36
Figure 19:	Summary window	38
Figure 20:	Configuration processing window	39
Figure 21:	Configuration completion pop-up	39
Figure 22:	Configuration window after completion	40
Figure 23:	Main CF window	41
Figure 24:	Cluster resource diagram	60

Figures

Figure 25:	Adding a new node	72
Figure 26:	Main window	80
Figure 27:	Cluster Admin start-up window	81
Figure 28:	Initial connection choice window	82
Figure 29:	Cluster Admin main window	83
Figure 30:	CF route DOWN	85
Figure 31:	CF interface missing	86
Figure 32:	CF route table	87
Figure 33:	CF node information	88
Figure 34:	CF topology table	89
Figure 35:	Response Time monitor	90
Figure 36:	Starting CF	92
Figure 37:	CF configured but not loaded	93
Figure 38:	Start CF services pop-up	94
Figure 39:	Start CF services status window	95
Figure 40:	Stop CF	96
Figure 41:	Stopping CF	97
Figure 42:	PRIMECLUSTER log viewer	99
Figure 43:	Detached PRIMECLUSTER log viewer	100
Figure 44:	Search based on date/time	101
Figure 45:	Search based on keyword	102
Figure 46:	Search based on severity	103
Figure 47:	ICF statistics	105
Figure 48:	MAC statistics	106
Figure 49:	Selecting a node for node to node statistics	107
Figure 50:	Node to Node statistics	108

Figure 51:	Selecting the Heartbeat monitor	109
Figure 52:	Heartbeat monitor	109
Figure 53:	CIM options	111
Figure 54:	Add to CIM	112
Figure 55:	Unconfigure CF	113
Figure 56:	CIM Override	114
Figure 57:	CIM Override confirmation	114
Figure 58:	Remove CIM Override	114
Figure 59:	Three-node cluster with working connections	116
Figure 60:	Three-node cluster where connection is lost	116
Figure 61:	Node C placed in the kernel debugger too long	119
Figure 62:	Four-node cluster with cluster partition	120
Figure 63:	A three-node cluster with three full interconnects	127
Figure 64:	Broken Ethernet connection for hme1 on fuji2	128
Figure 65:	Cluster with no full interconnects	129
Figure 66:	Conceptual view of CF interconnects	149
Figure 67:	CF with Ethernet interconnects	150
Figure 68:	CF with IP interconnects	150

Tables

Table 1: Kernel parameter values	58
Table 2: Local states	84
Table 3: Remote states	85
Table 4: PRIMECLUSTER log viewer severity levels	103
Table 5: Basic layout for the CF topology table	125
Table 6: Topology table with check boxes shown	126
Table 7: Topology table for 3 full interconnects	128
Table 8: Topology table with broken Ethernet connection	129
Table 9: Topology table with no full interconnects	130
Table 10: Available SAs and MAs	133
Table 11: Resource Database severity levels	231
Table 12: Release information	295

Index

- /etc/cip.cf 61
- /etc/hosts
 - CIP configuration 12
 - CIP Wizard 35
- /etc/system 58
- /usr/sbin/shutdown 76, 77
- /var/opt/SMAWsf/log/SA_xscfsnmp0r.
log 138
- /var/opt/SMAWsf/log/SA_xscfsnmp1r.
log 138
- /var/opt/SMAWsf/log/SA_xscfsnmpg0
p.log 138
- /var/opt/SMAWsf/log/SA_xscfsnmpg0
r.log 138
- /var/opt/SMAWsf/log/SA_xscfsnmpg1
p.log 138
- /var/opt/SMAWsf/log/SA_xscfsnmpg1
r.log 138
- A**
 - adding
 - new node 61
 - nodes 25
 - to CIM 112
 - ALOM
 - configuration 137, 139
 - SA_sunF 138, 139
 - Shutdown Agent 137, 139
 - automatic resource registration 67
- B**
 - backing up
 - configuration 44
 - Resource Database 73
 - broadcast messages 14
 - broken interconnects 115
- C**
 - CCBR
 - See* Cluster Configuration Backup
and Restore
 - CCBR commands
 - cfbackup 289
 - cfrestore 289
 - CCBRHOME directory 47
 - CF
 - See also* Cluster Foundation
 - CF commands
 - cfconfig 289
 - cfregd 289
 - cfset 289
 - cftool 289
 - rcqconfig 289
 - rcquery 289
 - CF driver 21
 - CF over IP 13, 30, 149
 - broadcast mask 149
 - CF Wizard 151
 - cftool -d 152
 - configure 151
 - devices 152
 - mixed configurations 151
 - scenarios 14
 - unique IP address 149
 - CF Registry
 - cfregd 51
 - user-level daemon 51
 - CF Remote Services 37
 - CF Wizard
 - bringing up 22
 - CF driver 124
 - CF over IP 30, 151
 - displaying interconnects 31
 - edit node names 27
 - error message 40
 - new cluster 24
 - new node on existing cluster 124
 - running 42
 - scanning for clusters 23
 - summary window 38

- CF/CIP Wizard, starting 13
- cfbackup 44, 289
- cfconfig 179, 289
- cfconfig -l 123
- cfconfig messages 172
- CFCP 16
- cfcop 17, 37
- cfrecon 167
- CFReg 54
- cfrestore 44, 289
- cfset 15, 289
 - CFCP 16
 - CFSH 16
 - CLUSTER_TIMEOUT 16
 - maximum entries 16
 - options 16
 - tune timeout 17
- CFSH 16
- cfsh 17, 37
- cftool 184, 289
- cftool -d 152
- cftool messages 183
- cftool -n 115
- CIM
 - See* Cluster Integrity Monitor
- CIP
 - See* Cluster Interconnect Protocol
- CIP commands
 - cip.cf 290
 - cipconfig 290
 - ciptool 290
- CIP Wizard
 - /etc/hosts 35
 - CIP interface 33
 - CIP names 35
 - Cluster Admin 12
 - configuration file 35
 - numbering 34
 - screen 32
 - starting 13
- cip.cf 42, 43, 290
- cipconfig 290
- cipconfig messages 180
- ciptool 290
- clautoconfig 63, 290
- clbackuprdb 73, 290
- cldeldevice 291
- cldevparam 293
- clexec 290
- clgettree 62, 68, 75, 76, 291
 - output 62
 - verify configuration 63
- clinitreset 62, 63, 76, 291
- clmtest 290
- clovmmigrate 293
- clovmmigratesetup 293
- clrccumonctl 293
- clrccusetup 293
- clrcimonctl 293
- clrestorerdb 77, 291
- clroot 19
- clsetparam 70, 291
- clsetup 62, 63, 74, 75, 76, 291
- clsnmpmonctl 293
- clsnmpsetup 293
- clstartpsc 291
- clstoppsc 291
- clsynfile 291
- cluster
 - additional node 58
 - avoiding single point of failure 11
 - CF states 84
 - CIP traffic 11
 - data file 51
 - interfaces 10
 - name 9
 - node in consistent state 52
 - number of interconnects 11
 - partition 119
- Cluster Admin 80, 81
 - administration 79
 - CF over IP 30
 - login window 20
 - main CF table 86
 - routes 85
 - starting 20, 80
 - starting CF 91
 - stopping CF 91

- Cluster Configuration Backup and Restore 44
 - ccbr.conf 46
 - CCBRHOME directory 47
 - cfbackup 44
 - cfrestore 44
 - configuration file 46, 48
 - OS files 49
 - root files 48
- Cluster Foundation
 - administration 79
 - configuration 9
 - connection table 28
 - dependency scripts 97
 - device driver 158
 - devices 125
 - driver load time 123
 - Heartbeat monitor 109
 - interface 10
 - IP interfaces 10
 - loading driver 21
 - log viewer 98
 - main table 83
 - node information 88
 - node name 10, 61
 - quorum set 37
 - Reason Code table 205
 - remote services 37
 - Response Time monitor 89
 - route tracking 85
 - runtime messages 200
 - security 17
 - topology table 28, 89, 123
 - unconfigure 113
- Cluster Integrity Monitor 52
 - adding a node 110
 - CF quorum set 37
 - cfcp 37
 - cfsh 37
 - configuration window 37
 - node state 52
 - options 111
 - override 114
 - override confirmation 114
 - quorum state 53
 - rcqconfig 53
- Cluster Interconnect Protocol
 - /etc/cip.cf 61
 - /etc/hosts 12
 - CF Wizard 61
 - configuration 11
 - configuration error 75
 - configuration file 42
 - configuration reset 76
 - configuration verification 75
 - defining 11
 - file format 42
 - interfaces 11
 - name 61, 62
 - ping command 62
 - properly configured 61
 - subnetwork 62
 - syntax 43
- CLUSTER_TIMEOUT 16
- collecting troubleshooting information 168
- COMINGUP state 97
- commands
 - CCBR 289
 - CF 289
 - CIP 290
 - PAS 290
 - Resource Database 290
- configuration
 - changing 54
 - hardware 73
 - restore 71
 - verify 76
 - See also* configuring 76
- configuring
 - CF 12
 - CF driver 22
 - CF over IP 151
 - CIM 52
 - CIP 11, 12, 33, 42
 - CIP with CF Wizard 61

Index

- NPS 141
- RCI 134
- resource database 61
- XSCF 136
- See also* configuration 76
- connection table 29
- contents, manual 1
- corrupt data 117
- creating
 - cluster, example 18
 - new cluster 24
- D**
- data, corrupt 117
- debugging 147
- default values, Solaris kernel 58
- defining virtual CIP interfaces 11
- devices
 - displayed 123
 - Ethernet 126
 - unconnected 28
- diagnostics 153
- disabling split-brain handling 143
- display statistics 104
- displayed devices 123
- documentation, related 2
- DOWN routes 85
- DOWN state 97, 116, 117
- E**
- editing
 - CF node names 27
 - cip.cf file 42
 - cluster.config file 15
- ERRNO table 217
- error messages 184
 - different systems 216
 - MA 270
 - rcqconfig 188
 - rcquery 199
 - Resource Database 234
- errors, CIP configuration 75
- Ethernet
 - CF drivers 40
 - CF networking 10
 - CF over IP 150
 - devices 126
 - example 128
 - Gigabit 10, 152
 - topology table 123
- eXtended System Control Facility 133
 - control port 136
 - different types 136
 - log files 136
 - SA_rccu 136
 - SA_rccux 136
 - SA_xscfp 136
 - SA_xscfr 136
 - shell port 136
- F**
- fjsnap 168
- fjsvwvbs 294
- fjsvwvcnf 294
- full interconnect 28, 125
- G**
- Gigabit Ethernet 152
- Global Disk Services 308
- Global File Services 308
- Global Link Services 308
- GUI
 - See* Cluster Admin
- H**
- HALT messages 232
- Heartbeat monitor 109
- hvassert 291
- hvcm 291
- hvconfig 291
- hvdisp 291
- hvdist 292
- hvdump 292
- hvenv.local 292
- hvgdmake 292
- hvlogclean 292
- hvrclv 292

hvreset 292
hvsetenv 292
hvshut 292
hvswitch 292
hvthrottle 292
hvutil 292

I

ICF statistics 105
ILOM
 configuration 139
 SA_ilomp 140
 SA_ilomr 140
 Shutdown Agent 140
information messages 232, 269
init command 115
Initial Connection Choice window 82
interconnects
 CF 10
 CF over IP 149
 Ethernet 126
 full 28
 IP 31
 IP subnetwork 150
 number of 11
 partial 28
 topology table 125
interfaces 10
 CIP 13
 missing 86
 network 86
Internet Protocol address
 CIP interface 33
INVALID state 97
IP interfaces 10
IP name, CIP interface 34
IP over CF 13
IP subnetwork 150

J

join problems 159
joining a running cluster 69

K

kernel parameters 58
keyword, search based on 102

L

Largest Sub-cluster Survival 145
LEFTCLUSTER 309
LEFTCLUSTER state 115, 118, 120,
 307, 309
 cluster partition 119
 description 116
 displaying 115
 in kernel debugger too long 118
 lost communications 117
 node state 311
 panic/hung node 118
 purpose 117
 recovering from 118
 shutdown agent 117
 troubleshooting 165
LOADED state 93
loading
 CF driver 21
 CF driver with CF Wizard 26
 CF duration 26
local file systems, mount 77
local states 84
login
 password 18
 window 20
low latency 10

M

MA
 See Monitoring Agents
MA commands
 cldevparam 293
 clrccumonctl 293
 clrccusetup 293
 clrcimonctl 293
MAC statistics 106
main CF table 83, 86
manual contents 1
manual pages

- display 289
- listing 289
- marking down nodes 97
- messages
 - alphabetical 201
 - CF 200
 - cfconfig 172
 - cftool 183
 - cipconfig 180
 - error 184
 - HALT 232
 - MA 268
 - rcqconfig 187
 - rcquery 199
 - SF 262
- mipcstat 290
- mirror virtual disks 310
- Monitoring Agents 132
 - delay detecting hardware failures 137
 - messages 268
 - RCI 134
 - RCI daemon 135
 - RCI error 135
- mountall 77
- Multi-path automatic generation 64

N

- names
 - CCBR 47
 - CCBRHOME directory 47
 - CF 88
 - CF cluster 125
 - cname 12, 74
 - CIP 75
 - cluster 9, 25, 88
 - configuration file 9
 - connections table 29
 - IP 34
 - plug-ins 45
 - tuple entries 16
 - user 18
 - Web-Based Admin View 10
 - with asterisk 124

- network
 - interfaces 86
 - outages 10
- Network Power Switch
 - configuration 141
 - setup 141
- Node to Node statistics 108
- nodes
 - adding 25
 - adding a new 71
 - details 88
 - in kernel debugger 115
 - joining a running cluster 69
 - marking down 97
 - panicked 115
 - shut down 97

O

- operating system files 49

P

- panicked nodes 115
- panics 138
- partial interconnects 28, 125
- PAS commands
 - clmtest 290
 - mipcstat 290
- passwords 18
- PCI Hot Plug 167
- plumb-up state 67
- privileged user ID 18
- pseudo device driver 318

Q

- quorum
 - CF 37
 - CIM override 114
 - reconfiguring 54
 - state 53

R

- RAID 316
- rc scripts 123
- RC_sf 147

- rc2.d directory 147
- rcqconfig 52, 53
- rcqconfig messages 187
- rcquery messages 199
- RC-script 147
- rcsd 292
- rcsd log 148
- rcsd.cfg 293
- rdb.tar.Z 73, 74
- Reason Code table 205
- reboot command 115
- rebooting
 - after cfrestore command 45
 - clusterwide 51
 - reboot command 115
 - shut down CF 115
- reconfiguring Resource Database 74
- registering hardware 63
- Remote Cabinet Interface 133
 - configuration 134
 - hardware setup 133
 - log file 134
 - setup 134
- remote states 84
- resets 138
- Resource Database 61
 - adding new node 71
 - backing up 73
 - clgettree 62
 - clsetup 74
 - configure on new node 75
 - initializing 71
 - kernel parameters 58
 - new node 71
 - plumb-up state 67
 - reconfiguring 71, 74
 - registering hardware 63, 67
 - restoring 76, 77
 - start up synchronization 69
 - StartingWaitTime 70
- Resource Database commands
 - clautoconfig 290
 - clbackuprdb 290
 - cldeldevice 291
 - clexec 290
 - clgettree 291
 - cliitreset 291
 - clrestorerdb 291
 - clsetparam 291
 - clsetup 291
 - clstarttrsc 291
 - clstoprsc 291
 - clsynfile 291
- Response Time monitor 89
- restoring
 - cluster configuration 289
 - Resource Database 76, 77
- RFC 1918 12
- RMS commands
 - hvassert 291
 - hvcm 291
 - hvconfig 291
 - hvdisp 291
 - hvdist 292
 - hvdump 292
 - hvenv.local 292
 - hvgdmake 292
 - hvlogclean 292
 - hvrclv 292
 - hvreset 292
 - hvsetenv 292
 - hvshut 292
 - hvswitch 292
 - hvthrottle 292
 - hvutil 292
- RMS Wizard Tools 145
- root 19
- root files 48
- route tracking 85
- S**
- SA
 - See* Shutdown Agents
- SA specific log files 148
- SA_ilomp 140
- SA_ilomr 140
- SA_rccu
 - XSCF 136

- SA_rccux
 - XSCF 136
- SA_sunF 138, 139
- SA_sunF.cfg 293
- SA_xscfp 136
- SA_xscfr 136
- saving
 - cfsbackup command 45, 289
 - PRIMECLUSTER
 - configuration 44
 - RMS configuration 291
- SD
 - See* Shutdown Daemon
- sdtool 293
- sdtool command 132, 147
- search
 - keyword 102
 - severity levels 103
 - time filter 101
- security
 - CF 17
- selecting devices 126
- setting up
 - RCI 134
- SF
 - See* Shutdown Facility
- SF commands
 - rcsd 292
 - sdtool 293
- SF Wizard 9
 - starting 40
- shutdown 77
- Shutdown Agents 131
 - with LEFTCLUSTER 117
- shutdown command 115
- Shutdown Daemon 131
- Shutdown Facility 9, 131
 - messages 262
 - node weight 145
 - RMS Wizard Tools 145
 - split-brain handling 142
 - starting and stopping 147
 - starting automatically 147
 - starting manually 147
 - stopping automatically 147
 - stopping manually 147
 - weight assignment 143
- ShutdownPriority attribute 143
- simple virtual disks 316
- single user mode 73
- SMAWcf 45
- Solaris ERRNO table 217
- special priority interfaces 11
- Specific Application Survival 145
- Specific Hardware Survival 145
- split-brain 142
 - handling 143
- LSS 145
- SAS 145
- SHS 145
- start up synchronization 69
 - new node 71
 - StartingWaitTime 76
- starting
 - CF 91, 92
 - CF Wizard 22
 - Cluster Admin 13
 - GUI 20
 - SF Wizard 40
 - Web-Based Admin View 18
- StartingWaitTime 69, 71
 - default value 69
 - value 70
- start-up window 80
- states
 - COMINGUP 84, 97
 - DOWN 85, 116, 117
 - INVALID 84, 97
 - LEFTCLUSTER 85, 115, 118, 120
 - LOADED 84, 93
 - table of 116
 - UNCONFIGURED 84
 - UNKNOWN 84, 85
 - UNLOADED 84
 - UP 84, 85, 116
- statistics, display CF 104
- stopping

- CF 91, 92
 - CF, third-party products 97
 - SF automatically 147
 - SF manually 147
 - valid CF states 97
 - subnet mask, CIP interface 34
 - synchronization phase 69
 - synchronization, start up 69
 - syslog window 99
 - system dump 168, 169
- T**
- table of states 116
 - third-party product, shut down 97
 - time filter, search 101
 - timeout, tune 17
 - timestamp 70
 - top window 81
 - topology table 123
 - basic layout 125
 - CF 28, 89
 - CF cluster name 125
 - CF driver 124
 - displayed devices 123
 - displaying 89
 - examples 127
 - flexibility 29
 - interconnects 125
 - Response Time monitor 89
 - selecting devices 126
 - troubleshooting 153
 - beginning 153
 - collecting information 168
 - diagnostics 153
 - join-related problems 158
 - symptoms and solutions 157
 - tunable parameters 15
 - tune timeout 17
 - tuple entries
 - name 16
 - value 16
- U**
- unconfigure CF 113
 - unconnected devices 28, 125
 - UNKNOWN state 84
 - UNLOADED state 93
 - UP state 116
 - updating CFReg 54
 - usage messages
 - cfconfig 172
 - cftool 183
 - cipconfig 181
 - rcqconfig 187
 - rcquery 199
 - user ID 18
 - user name 19
- V**
- virtual disks
 - mirror 310
 - simple 316
- W**
- warning messages
 - MA 270
 - Resource Database 233
 - Web-Based Admin View
 - known nodes 42
 - node list 21
 - starting 18
 - Web-Based Admin View commands
 - fjsvvbs 294
 - fjsvvvcnf 294
 - wvCntl 294
 - wvGetparam 294
 - wvSetparam 294
 - wvstat 294
 - wvCntl 294
 - wvGetparam 294
 - wvroot 19
 - wvSetparam 294
 - wvstat 294
- X**
- XSCF
 - configuration 136

Index

See eXtended System Control
Facility

Z

zfs mount 77