

Oracle® Solaris Cluster System Administration Guide

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Using This Documentation

The Oracle Solaris Cluster System Administration Guide provides procedures for administering an Oracle Solaris Cluster configuration on both SPARC and x86 based systems.

- **Overview** – Describes how to configure an Oracle Solaris Cluster configuration
- **Audience** – Technicians, system administrators, and authorized service providers
- **Required knowledge** – Advanced experience troubleshooting and replacing hardware

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Introduction to Administering Oracle Solaris Cluster

This chapter provides the following information about administering a global cluster and a zone cluster, and includes procedures for using Oracle Solaris Cluster administration tools:

- [“Overview of Administering Oracle Solaris Cluster” on page 24](#)
- [“Oracle Solaris OS Feature Restrictions” on page 25](#)
- [“Administration Tools” on page 26](#)
- [“Preparing to Administer the Cluster” on page 28](#)
- [“Administering the Cluster” on page 29](#)

All procedures in this guide are for use on the Oracle Solaris 11 Operating System.

A global cluster is composed of one or more global-cluster nodes. A global cluster can also include `solaris` or `solaris10` brand non-global zones that are not nodes but rather are configured with the HA for Zones data service.

A zone cluster is composed of one or more non-global zones of the `solaris`, `solaris10`, or `labeled` brand that are set with the `cluster` attribute. No other brand type is permitted in a zone cluster. A `labeled` brand zone cluster is only for use with the Trusted Extensions feature of Oracle Solaris software. You create a zone cluster by using the `clzonecluster` command, the `clsetup` utility, or the GUI.

You can run supported services on the zone cluster similar to a global cluster, with the isolation that is provided by Oracle Solaris zones. A zone cluster depends on, and therefore requires, a global cluster. A global cluster does not contain a zone cluster. A zone cluster has, at most, one zone-cluster node on a machine. A zone-cluster node continues to operate only as long as the global-cluster node on the same machine continues to operate. If a global-cluster node on a machine fails, all zone-cluster nodes on that machine fail as well. For general information about zone clusters, see [Oracle Solaris Cluster Concepts Guide](#).

Overview of Administering Oracle Solaris Cluster

The Oracle Solaris Cluster highly available environment ensures that critical applications are available to end users. The system administrator's job is to make sure that the Oracle Solaris Cluster configuration is stable and operational.

Familiarize yourself with the planning information in [Chapter 1, “Planning the Oracle Solaris Cluster Configuration,”](#) in *Oracle Solaris Cluster Software Installation Guide* and the *Oracle Solaris Cluster Concepts Guide* before beginning administration tasks. For instructions on creating a zone cluster, see [“Creating and Configuring a Zone Cluster”](#) in *Oracle Solaris Cluster Software Installation Guide*. Oracle Solaris Cluster administration is organized into tasks among the following manuals.

- Standard tasks, used to administer and maintain the global cluster or the zone cluster on a regular or even daily basis. These tasks are described in this guide. Some of these tasks can be done in the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.
- Data service tasks, such as installation, configuration, and changing properties. These tasks are described in the *Oracle Solaris Cluster Data Services Planning and Administration Guide*.
- Service tasks, such as adding or repairing storage or network hardware. These tasks are described in the *Oracle Solaris Cluster 4.2 Hardware Administration Manual*. You can add storage to your zone cluster using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

In general, you can perform Oracle Solaris Cluster administration tasks while the cluster is operational. If you need take a node out of the cluster or even shut down the node, you can do so while the rest of the nodes continue cluster operations. Unless otherwise indicated, Oracle Solaris Cluster administrative tasks should be performed in the global-cluster node. For those procedures that require the entire cluster to be shut down, minimize impact on the system by scheduling downtime outside normal working hours. If you plan to shut down the cluster or a cluster node, notify users in advance.

Working With a Zone Cluster

Two Oracle Solaris Cluster administrative commands (`cluster` and `clnode`) can also run in a zone cluster. However, the scope of these commands is limited to the zone cluster where the command is issued. For example, using the `cluster` command in the global-cluster node retrieves all information about the global cluster and all the zone clusters. Using the `cluster` command in a zone cluster retrieves information about that specific zone cluster.

When you use the `clzonecluster` command in a global-cluster node, the command affects all of the zone clusters in the global cluster. Zone cluster commands also affect all nodes on the zone cluster, even if a zone-cluster node is down when the command is issued.

Zone clusters support delegated administration of resources that are under Resource Group Manager (RGM) control. Therefore, zone cluster administrators can view, but not change, zone cluster dependencies that cross zone cluster boundaries. Only the administrator in a global-cluster node can create, modify, or delete dependencies that cross zone cluster boundaries.

The following list contains the major administrative tasks performed on a zone cluster.

- Starting and rebooting a zone cluster – See [Chapter 3, “Shutting Down and Booting a Cluster”](#). You can also boot and reboot a zone cluster using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).
- Adding a node to a zone cluster – See [Chapter 8, “Administering Cluster Nodes”](#).
- Removing a node from a zone cluster – See [“How to Remove a Node From a Zone Cluster” on page 218](#). You can also uninstall the software from a zone cluster node using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).
- Viewing the configuration of a zone cluster – See [“How to View the Cluster Configuration” on page 41](#). You can also view the configuration of a zone cluster by using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).
- Validating the configuration of a zone cluster – See [“How to Validate a Basic Cluster Configuration” on page 50](#).
- Stopping a zone cluster – See [Chapter 3, “Shutting Down and Booting a Cluster”](#). You can also shut down a zone cluster using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

Oracle Solaris OS Feature Restrictions

Do not enable or disable the following Oracle Solaris Cluster services by using the Service Management Facility (SMF) management interface.

TABLE 1-1 Oracle Solaris Cluster Services

Oracle Solaris Cluster Services	FMRI
pnm	svc:/system/cluster/pnm:default
cl_event	svc:/system/cluster/cl_event:default
cl_eventlog	svc:/system/cluster/cl_eventlog:default
rpc_pmf	svc:/system/cluster/rpc_pmf:default
rpc_fed	svc:/system/cluster/rpc_fed:default
rgm	svc:/system/cluster/rgm:default
scdpm	svc:/system/cluster/scdpm:default
cl_ccra	svc:/system/cluster/cl_ccra:default

Oracle Solaris Cluster Services	FMRI
scsymon_srv	svc:/system/cluster/scsymon_srv:default
spm	svc:/system/cluster/spm:default
cl_svc_cluster_milestone	svc:/system/cluster/cl_svc_cluster_milestone:default
cl_svc_enable	svc:/system/cluster/cl_svc_enable:default
network-multipathing	svc:/system/cluster/network-multipathing

Administration Tools

You can perform administrative tasks for an Oracle Solaris Cluster configuration by using the command line or the Oracle Solaris Cluster Manager GUI. The following section provides an overview of the GUI and command-line tools.

Graphical User Interface

Oracle Solaris Cluster software supports GUI tools that you can use to perform various administrative tasks on your cluster. See [Chapter 13, “Using the Oracle Solaris Cluster GUI”](#) for more information. You can also get GUI log-in instructions at [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

GUI: Following are some of the tasks that you can perform in the GUI:

- Create and update a zone cluster
- Create resources and resource groups
- Add a file system or shared storage to a zone cluster
- Manage nodes in a global cluster or a zone cluster
- Add and manage quorum devices and servers
- Add and manage NAS storage devices, and manage disks and device groups
- Manage Geographic Edition partnerships

Command-Line Interface

You can perform most Oracle Solaris Cluster administration tasks interactively through the `clsetup` utility. Whenever possible, administration procedures in this guide use the `clsetup` utility.

You can administer the following Main Menu items through the `clsetup` utility.

- Quorum

- Resource groups
- Data Services
- Cluster interconnect
- Device groups and volumes
- Private hostnames
- New nodes
- Zone cluster
- Other cluster tasks

Other commands that you use to administer an Oracle Solaris Cluster configuration are provided in the following list. See the man pages for more detailed information.

[if_mpadm\(1M\)](#)

Switches IP addresses from one adapter to another in an IP Network Multipathing group.

[claccess\(1CL\)](#)

Manages Oracle Solaris Cluster access policies for adding nodes.

[cldevice\(1CL\)](#)

Manages Oracle Solaris Cluster devices.

[cldevicegroup\(1CL\)](#)

Manages Oracle Solaris Cluster device groups.

[clinterconnect\(1CL\)](#)

Manages the Oracle Solaris Cluster interconnect.

[clnasdevice\(1CL\)](#)

Manages access to NAS devices for an Oracle Solaris Cluster configuration.

[clnode\(1CL\)](#)

Manages Oracle Solaris Cluster nodes.

[clquorum\(1CL\)](#)

Manages Oracle Solaris Cluster quorum.

[clreslogicalhostname\(1CL\)](#)

Manages Oracle Solaris Cluster resources for logical host names.

[clresource\(1CL\)](#)

Manages resources for Oracle Solaris Cluster data services.

[clresourcegroup\(1CL\)](#)

Manages resources for Oracle Solaris Cluster data services.

`clresourcetype(1CL)`

Manages resources for Oracle Solaris Cluster data services.

`clressharedaddress(1CL)`

Manages Oracle Solaris Cluster resources for shared addresses.

`clsetup(1CL)`

Creates a zone cluster and interactively configures an Oracle Solaris Cluster configuration.

`clsnmphost(1CL)`

Administers Oracle Solaris Cluster SNMP hosts.

`clsnmpmib(1CL)`

Administers Oracle Solaris Cluster SNMP MIB.

`clsnmpuser(1CL)`

Administers Oracle Solaris Cluster SNMP users.

`cltelemetryattribute(1CL)`

Configures system resource monitoring.

`cluster(1CL)`

Manages the global configuration and the global status of the Oracle Solaris Cluster configuration.

`clzonecluster(1CL)`

Creates and modifies a zone cluster.

In addition, you can use commands to administer the volume manager portion of an Oracle Solaris Cluster configuration. These commands depend on the specific volume manager that your cluster uses.

Preparing to Administer the Cluster

This section describes how to prepare to administer your cluster.

Documenting an Oracle Solaris Cluster Hardware Configuration

Document the hardware aspects that are unique to your site as your Oracle Solaris Cluster configuration is scaled. To reduce administration, refer to your hardware documentation when

you change or upgrade the cluster. Labeling cables and connections between the various cluster components can also make administration easier.

Reduce the time required by a third-party service provider when servicing your cluster by keeping records of your original cluster configuration, and subsequent changes.

Using an Administrative Console

You can use either a dedicated workstation or a workstation connected through a management network as the *administrative console*, to administer the active cluster. For instructions on accessing the Oracle Solaris Cluster Manager GUI, see the [Oracle Solaris Cluster Software Installation Guide](#).

The administrative console is not a cluster node. The administrative console is used for remote access to the cluster nodes, either over the public network or through a network-based terminal concentrator.

Oracle Solaris Cluster does not require a dedicated administrative console, but using a console provides the following benefits:

- Enables centralized cluster management by grouping console and management tools on the same machine
- Provides potentially quicker problem resolution by Enterprise Services or your service provider

Backing Up the Cluster

Back up your cluster on a regular basis. Even though Oracle Solaris Cluster software provides a highly available environment, with mirrored copies of data on the storage devices, Oracle Solaris Cluster software is not a replacement for regular backups. An Oracle Solaris Cluster configuration can survive multiple failures, but does not protect against user or program error, or catastrophic failure. Therefore, you must have a backup procedure in place to protect against data loss.

The following information should be included as part of your backup.

- All file system partitions
- All database data if you are running DBMS data services
- Disk partition information for all cluster disks

Administering the Cluster

[Table 1-2](#) provides a starting point for administering your cluster.

TABLE 1-2 Oracle Solaris Cluster Administration Tools

Task	Tool	Instructions
Log in to the cluster remotely	Use the Oracle Solaris <code>pconsole</code> utility from the command line to log into the cluster remotely.	“Logging Into the Cluster Remotely” on page 31 “How to Connect Securely to Cluster Consoles” on page 31
Configure the cluster interactively	Use the <code>clzonecluster</code> command or the <code>clsetup</code> utility.	“How to Access the Cluster Configuration Utilities” on page 32
Display Oracle Solaris Cluster release number and version information	Use the <code>clnode</code> command with the <code>show - rev - v -node</code> subcommand and option.	“How to Display Oracle Solaris Cluster Release and Version Information” on page 33
Display installed resources, resource groups, and resource types	Use the following commands to display the resource information: <ul style="list-style-type: none"> ■ <code>clresource</code> ■ <code>clresourcegroup</code> ■ <code>clresourcetype</code> 	“How to Display Configured Resource Types, Resource Groups, and Resources” on page 35
Monitor cluster components graphically	Use Oracle Solaris Cluster Manager.	See online help
Administer some cluster components graphically	Use Oracle Solaris Cluster Manager or the Oracle Solaris Cluster module for Sun Management Center, which is available only with Oracle Solaris Cluster on SPARC based systems.	For Oracle Solaris Cluster Manager, see online help. For Sun Management Center, see documentation.
Check the status of cluster components	Use the <code>cluster</code> command with the <code>status</code> subcommand.	“How to Check the Status of Cluster Components” on page 37
Check the status of IPMP groups on the public network	For a global cluster, use the <code>clnode status</code> command with the <code>-m</code> option. For a zone cluster, use the <code>clzonecluster</code> command with the <code>show</code> subcommand.	“How to Check the Status of the Public Network” on page 40
View the cluster configuration	For a global cluster, use the <code>cluster</code> command with the <code>show</code> subcommand. For a zone cluster, use the <code>clzonecluster</code> command with the <code>show</code> subcommand.	“How to View the Cluster Configuration” on page 41
View and display the configured NAS devices	For a global cluster or a zone cluster, use the <code>clzonecluster</code> command with the <code>show</code> subcommand.	<code>clnasdevice(1CL)</code>
Check global mount points or verify the cluster configuration	For a global cluster, use the <code>cluster</code> command with the <code>check</code> subcommand.	“How to Validate a Basic Cluster Configuration” on page 50

Task	Tool	Instructions
	For a zone cluster, use the <code>clzonecluster verify</code> command.	
Look at the contents of Oracle Solaris Cluster command logs	Examine the <code>/var/cluster/logs/ commandlog</code> file.	“How to View the Contents of Oracle Solaris Cluster Command Logs” on page 57
Look at Oracle Solaris Cluster system messages	Examine the <code>/var/adm/messages</code> file.	<p>“Viewing System Messages” in <i>Troubleshooting System Administration Issues in Oracle Solaris 11.2</i></p> <p>You can also see a node's system messages in the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see “How to Access Oracle Solaris Cluster Manager” on page 290.</p>
Monitor the status of Solaris Volume Manager	Use the <code>metastat</code> command.	Solaris Volume Manager Administration Guide

Logging Into the Cluster Remotely

You can use the Parallel Console Access (`pconsole`) utility from the command line to log into the cluster remotely. The `pconsole` utility is part of the Oracle Solaris `terminal/pconsole` package. Install the package by executing `pkg install terminal/pconsole`. The `pconsole` utility creates a host terminal window for each remote host that you specify on the command line. The utility also opens a central, or master, console window that propagates what you input there to each of the connections that you open.

The `pconsole` utility can be run from within X Windows or in console mode. Install `pconsole` on the machine that you will use as the administrative console for the cluster. If you have a terminal server that allows you to connect to specific port numbers on the IP address of the server, you can specify the port number in addition to the hostname or IP address as `terminal-server:portnumber`.

See the `pconsole(1)` man page for more information.

How to Connect Securely to Cluster Consoles

If your terminal concentrator or system controller supports `ssh`, you can use the `pconsole` utility to connect to the consoles of those systems. The `pconsole` utility is part of the Oracle Solaris `terminal/pconsole` package and is installed when you install that package. The `pconsole` utility creates a host terminal window for each remote host that you specify on the command line. The utility also opens a central, or master, console window that propagates what you input there to each of the connections that you open. See the `pconsole(1)` man page for more information.

▼ How to Access the Cluster Configuration Utilities

The `clsetup` utility enables you to interactively create a zone cluster, and configure quorum, resource groups, cluster transports, private hostnames, device groups, and new node options for the global cluster. The `clzonecluster` utility performs similar configuration tasks for a zone cluster. For more information, see the [clsetup\(1CL\)](#) and [clzonecluster\(1CL\)](#) man pages.

You can also accomplish this procedure by using the Oracle Solaris Cluster Manager GUI. See the Oracle Solaris Cluster Manager online help for more information.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- 1. Assume the root role on an active member node of a global cluster.**

Perform all steps of this procedure from a node of the global cluster.

- 2. Start the configuration utility.**

```
phys-schost# clsetup
```

- **For a global cluster, start the utility with the `clsetup` command.**

```
phys-schost# clsetup
```

The `q` is displayed.

- **For a zone cluster, start the utility with the `clzonecluster` command. The zone cluster in this example is `sczone`.**

```
phys-schost# clzonecluster configure sczone
```

You can view the available actions in the utility with the following option:

```
clzc:sczone> ?
```

You can also use the interactive `clsetup` utility to create a zone cluster or add a file system or storage device in the cluster scope. All other zone cluster configuration tasks are performed with the `clzonecluster configure` command. See the [Oracle Solaris Cluster Software Installation Guide](#) for instructions on using the `clsetup` utility.

- 3. Choose your configuration from the menu.**

Follow the onscreen instructions to complete a task. For more detail, see the instructions in [“Creating and Configuring a Zone Cluster” in *Oracle Solaris Cluster Software Installation Guide*](#).

See Also See the `clsetup` or `clzonecluster` online help man pages for more information.

▼ How to Display Oracle Solaris Cluster Release and Version Information

You do not need to be logged in as the root role to perform this procedure. Perform all steps of this procedure from a node of the global cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

● Display Oracle Solaris Cluster release and version information:

```
phys-schost# clnode show-rev -v -node
```

This command displays Oracle Solaris Cluster release number and version strings for all Oracle Solaris Cluster packages.

Example 1-1 Displaying Oracle Solaris Cluster Release and Version Information

The following example displays the cluster's release information and version information for the packages that shipped with Oracle Solaris Cluster 4.2.

```
phys-schost# clnode show-rev
4.2
```

```
phys-schost# clnode show-rev -v
```

```
Oracle Solaris Cluster 4.2 for Solaris 11 sparc
ha-cluster/data-service/apache           :4.2-0.30
ha-cluster/data-service/dhcp             :4.2-0.30
ha-cluster/data-service/dns              :4.2-0.30
ha-cluster/data-service/goldengate       :4.2-0.30
ha-cluster/data-service/glassfish-message-queue :4.2-0.30
ha-cluster/data-service/ha-ldom          :4.2-0.30
ha-cluster/data-service/ha-zones         :4.2-0.30
ha-cluster/data-service/iplanet-web-server :4.2-0.30
ha-cluster/data-service/jd-edwards-enterpriseone :4.2-0.30
ha-cluster/data-service/mysql            :4.2-0.30
```

ha-cluster/data-service/nfs	:4.2-0.30
ha-cluster/data-service/obiee	:4.2-0.30
ha-cluster/data-service/oracle-database	:4.2-0.30
ha-cluster/data-service/oracle-ebs	:4.2-0.30
ha-cluster/data-service/oracle-external-proxy	:4.2-0.30
ha-cluster/data-service/oracle-http-server	:4.2-0.30
ha-cluster/data-service/oracle-pmn-server	:4.2-0.30
ha-cluster/data-service/oracle-traffic-director	:4.2-0.30
ha-cluster/data-service/peoplesoft	:4.2-0.30
ha-cluster/data-service/postgresql	:4.2-0.30
ha-cluster/data-service/samba	:4.2-0.30
ha-cluster/data-service/sap-livecache	:4.2-0.30
ha-cluster/data-service/sapdb	:4.2-0.30
ha-cluster/data-service/sapnetweaver	:4.2-0.30
ha-cluster/data-service/siebel	:4.2-0.30
ha-cluster/data-service/sybase	:4.2-0.30
ha-cluster/data-service/timesten	:4.2-0.30
ha-cluster/data-service/tomcat	:4.2-0.30
ha-cluster/data-service/weblogic	:4.2-0.30
ha-cluster/developer/agent-builder	:4.2-0.30
ha-cluster/developer/api	:4.2-0.30
ha-cluster/geo/geo-framework	:4.2-0.30
ha-cluster/geo/manual	:4.2-0.30
ha-cluster/geo/replication/availability-suite	:4.2-0.30
ha-cluster/geo/replication/data-guard	:4.2-0.30
ha-cluster/geo/replication/sbp	:4.2-0.30
ha-cluster/geo/replication/srdf	:4.2-0.30
ha-cluster/geo/replication/zfs-sa	:4.2-0.30
ha-cluster/group-package/ha-cluster-data-services-full	:4.2-0.30
ha-cluster/group-package/ha-cluster-framework-full	:4.2-0.30
ha-cluster/group-package/ha-cluster-framework-l10n	:4.2-0.30
ha-cluster/group-package/ha-cluster-framework-minimal	:4.2-0.30
ha-cluster/group-package/ha-cluster-framework-scm	:4.2-0.30
ha-cluster/group-package/ha-cluster-framework-slm	:4.2-0.30
ha-cluster/group-package/ha-cluster-full	:4.2-0.30
ha-cluster/group-package/ha-cluster-geo-full	:4.2-0.30
ha-cluster/group-package/ha-cluster-geo-incorporation	:4.2-0.30
ha-cluster/group-package/ha-cluster-incorporation	:4.2-0.30
ha-cluster/group-package/ha-cluster-minimal	:4.2-0.30
ha-cluster/group-package/ha-cluster-quorum-server-full	:4.2-0.30
ha-cluster/group-package/ha-cluster-quorum-server-l10n	:4.2-0.30
ha-cluster/ha-service/derby	:4.2-0.30
ha-cluster/ha-service/gds	:4.2-0.30
ha-cluster/ha-service/gds2	:4.2-0.30
ha-cluster/ha-service/logical-hostname	:4.2-0.30
ha-cluster/ha-service/smf-proxy	:4.2-0.30
ha-cluster/ha-service/telemetry	:4.2-0.30
ha-cluster/library/cacao	:4.2-0.30
ha-cluster/library/ucmm	:4.2-0.30
ha-cluster/locale	:4.2-0.30
ha-cluster/release/name	:4.2-0.30
ha-cluster/service/management	:4.2-0.30
ha-cluster/service/management/slm	:4.2-0.30
ha-cluster/service/quorum-server	:4.2-0.30

ha-cluster/service/quorum-server/locale	:4.2-0.30
ha-cluster/service/quorum-server/manual/locale	:4.2-0.30
ha-cluster/storage/svm-mediator	:4.2-0.30
ha-cluster/system/cfgchk	:4.2-0.30
ha-cluster/system/core	:4.2-0.30
ha-cluster/system/dsconfig-wizard	:4.2-0.30
ha-cluster/system/install	:4.2-0.30
ha-cluster/system/manual	:4.2-0.30
ha-cluster/system/manual/data-services	:4.2-0.30
ha-cluster/system/manual/locale	:4.2-0.30
ha-cluster/system/manual/manager	:4.2-0.30
ha-cluster/system/manual/manager-glassfish3	:4.2-0.30

▼ How to Display Configured Resource Types, Resource Groups, and Resources

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also view resources and resource groups through the Oracle Solaris Cluster Manager GUI. Refer to [Chapter 13, “Using the Oracle Solaris Cluster GUI”](#). For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

Before You Begin Users other than the `root` role require `solaris.cluster.read` RBAC authorization to use this subcommand.

- **Display the cluster's configured resource types, resource groups, and resources.**

```
phys-schost# cluster show -t resource, resourcetype, resourcegroup
```

Perform all steps of this procedure from a node of the global cluster. For information about individual resources, resource groups, and resource types, use the `show` subcommand with one of the following commands:

- `resource`
- `resource group`
- `resourcetype`

Example 1-2 Displaying Configured Resource Types, Resource Groups, and Resources

The following example shows the resource types (RT Name), resource groups (RG Name), and resources (RS Name) configured for the cluster schost.

```
phys-schost# cluster show -t resource, resourcetype, resourcegroup

=== Registered Resource Types ===

Resource Type:                SUNW.sctelemetry
RT_description:                sctelemetry service for Oracle Solaris Cluster
RT_version:                    1
API_version:                   7
RT_basedir:                    /usr/cluster/lib/rgm/rt/sctelemetry
Single_instance:              True
Proxy:                          False
Init_nodes:                    All potential masters
Installed_nodes:               <All>
Failover:                       False
Pkglist:                       <NULL>
RT_system:                      True
Global_zone:                   True

=== Resource Groups and Resources ===

Resource Group:                tel-rg
RG_description:                <NULL>
RG_mode:                        Failover
RG_state:                       Managed
Failback:                       False
Nodelist:                       phys-schost-2 phys-schost-1

--- Resources for Group tel-rg ---

Resource:                       tel-res
Type:                           SUNW.sctelemetry
Type_version:                    4.0
Group:                            tel-rg
R_description:
Resource_project_name:          default
Enabled{phys-schost-2}:         True
Enabled{phys-schost-1}:         True
Monitored{phys-schost-2}:       True
Monitored{phys-schost-1}:       True

Resource Type:                SUNW.qfs
RT_description:                SAM-QFS Agent on Oracle Solaris Cluster
RT_version:                    3.1
API_version:                   3
RT_basedir:                    /opt/SUNWsamfs/sc/bin
Single_instance:              False
Proxy:                          False
Init_nodes:                    All potential masters
```

```

Installed_nodes:          <All>
Failover:                 True
Pkglist:                  <NULL>
RT_system:                False
Global_zone:              True

=== Resource Groups and Resources ===
Resource Group:           qfs-rg
RG_description:           <NULL>
RG_mode:                  Failover
RG_state:                  Managed
Failback:                 False
Nodelist:                  phys-schost-2 phys-schost-1

--- Resources for Group qfs-rg ---
Resource:                  qfs-res
Type:                      SUNW.qfs
Type_version:              3.1
Group:                     qfs-rg
R_description:
Resource_project_name:     default
Enabled{phys-schost-2}:    True
Enabled{phys-schost-1}:    True
Monitored{phys-schost-2}:  True
Monitored{phys-schost-1}:  True

```

▼ How to Check the Status of Cluster Components

You can also accomplish this procedure by using the Oracle Solaris Cluster Manager GUI. See the Oracle Solaris Cluster Manager online help for more information. The `cluster status` command and Oracle Solaris Cluster Manager also show the status of a zone cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

Before You Begin Users other than the `root` role require `solaris.cluster.read` RBAC authorization to use the `status` subcommand.

- **Check the status of cluster components.**

```
phys-schost# cluster status
```

Perform all steps of this procedure from a node of the global cluster.

Example 1-3 Checking the Status of Cluster Components

The following example provides a sample of status information for cluster components returned by the `cluster status` command.

```

phys-schost# cluster status
=== Cluster Nodes ===

--- Node Status ---

Node Name                               Status
-----
phys-schost-1                           Online
phys-schost-2                           Online

=== Cluster Transport Paths ===

Endpoint1          Endpoint2          Status
-----
phys-schost-1:nge1  phys-schost-4:nge1  Path online
phys-schost-1:e1000g1  phys-schost-4:e1000g1  Path online

=== Cluster Quorum ===

--- Quorum Votes Summary ---

Needed  Present  Possible
-----
3        3        4

--- Quorum Votes by Node ---

Node Name      Present  Possible  Status
-----
phys-schost-1  1        1        Online
phys-schost-2  1        1        Online

--- Quorum Votes by Device ---

Device Name      Present  Possible  Status
-----
/dev/did/rdisk/d2s2  1        1        Online
/dev/did/rdisk/d8s2  0        1        Offline

=== Cluster Device Groups ===

--- Device Group Status ---

Device Group Name  Primary      Secondary  Status

```

```

-----
schost-2          phys-schost-2  -          Degraded
    
```

--- Spare, Inactive, and In Transition Nodes ---

```

Device Group Name  Spare Nodes  Inactive Nodes  In Transition Nodes
-----
schost-2          -           -           -
    
```

=== Cluster Resource Groups ===

```

Group Name      Node Name      Suspended      Status
-----
test-rg         phys-schost-1  No             Offline
                phys-schost-2  No             Online

test-rg         phys-schost-1  No             Offline
                phys-schost-2  No             Error--stop failed

test-rg         phys-schost-1  No             Online
                phys-schost-2  No             Online
    
```

=== Cluster Resources ===

```

Resource Name    Node Name      Status          Message
-----
test_1           phys-schost-1  Offline         Offline
                phys-schost-2  Online          Online

test_1           phys-schost-1  Offline         Offline
                phys-schost-2  Stop failed     Faulted

test_1           phys-schost-1  Online          Online
                phys-schost-2  Online          Online
    
```

```

Device Instance      Node          Status
-----
/dev/did/rdisk/d2    phys-schost-1  Ok

/dev/did/rdisk/d3    phys-schost-1  Ok
                    phys-schost-2  Ok

/dev/did/rdisk/d4    phys-schost-1  Ok
                    phys-schost-2  Ok

/dev/did/rdisk/d6    phys-schost-2  Ok
    
```

=== Zone Clusters ===

```

--- Zone Cluster Status ---

Name      Node Name   Zone HostName  Status   Zone Status
-----
sczone    schost-1    sczone-1       Online   Running
          schost-2    sczone-2       Online   Running
    
```

▼ How to Check the Status of the Public Network

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

To check the status of the IP Network Multipathing groups, use the command with the `clnode status` command.

Before You Begin Users other than the root role require `solaris.cluster.read` RBAC authorization to use this subcommand.

You can also use the Oracle Solaris Cluster Manager GUI to check the status of the node. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

- **Check the status of cluster components.**

```
phys-schost# clnode status -m
```

Perform all steps of this procedure from a node of the global cluster.

Example 1-4 Checking the Public Network Status

The following example provides a sample of status information for cluster components returned by the `clnode status` command.

```

% clnode status -m
--- Node IPMP Group Status ---

Node Name      Group Name   Status   Adapter   Status
-----
phys-schost-1  test-rg     Online   nge2      Online
phys-schost-2  test-rg     Online   nge3      Online
    
```


▼ How to View the Cluster Configuration

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also view a cluster's configuration through the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

Before You Begin Users other than the root role require `solaris.cluster.read` RBAC authorization to use the `status` subcommand.

- **View the configuration of a global cluster or zone cluster.**

```
% cluster show
```

Perform all steps of this procedure from a node of the global cluster.

Running the `cluster show` command from a global-cluster node shows detailed configuration information about the cluster and information for zone clusters, if you have configured them.

You can also use the `clzonecluster show` command to view the configuration information for just the zone cluster. Properties for a zone cluster include zone-cluster name, IP type, autoboot, and zone path. The `show` subcommand runs inside a zone cluster, and applies only to that particular zone cluster. Running the `clzonecluster show` command from a zone-cluster node retrieves status only about the objects visible to that specific zone cluster.

To display more information about the `cluster` command, use the verbose options. See the [`cluster\(1CL\)`](#) man page for details. See the [`clzonecluster\(1CL\)`](#) man page for more information about `clzonecluster`.

Example 1-5 Viewing the Global Cluster Configuration

The following example lists configuration information about the global cluster. If you have a zone cluster configured, it also lists that information.

```
phys-schost# cluster show

=== Cluster ===

Cluster Name:                cluster-1
clusterid:                   0x4DA2C888
installmode:                 disabled
heartbeat_timeout:          10000
heartbeat_quantum:           1000
```

```

private_netaddr:          172.11.0.0
private_netmask:         255.255.248.0
max_nodes:                64
max_privatenets:         10
num_zoneclusters:        12
udp_session_timeout:     480
concentrate_load:        False
global_fencing:          prefer3
Node List:                phys-schost-1
Node Zones:              phys_schost-2:za
    
```

=== Host Access Control ===

```

Cluster name:            clustser-1
Allowed hosts:           phys-schost-1, phys-schost-2:za
Authentication Protocol: sys
    
```

=== Cluster Nodes ===

```

Node Name:               phys-schost-1
Node ID:                  1
Enabled:                  yes
privatehostname:         clusternode1-priv
reboot_on_path_failure:  disabled
globalzoneshares:        3
defaultpsetmin:          1
quorum_vote:              1
quorum_defaultvote:      1
quorum_resv_key:         0x43CB1E1800000001
Transport Adapter List:  net1, net3
    
```

--- Transport Adapters for phys-schost-1 ---

```

Transport Adapter:       net1
Adapter State:           Enabled
Adapter Transport Type:  dlpi
Adapter Property(device_name): net
Adapter Property(device_instance): 1
Adapter Property(lazy_free): 1
Adapter Property(dlpi_heartbeat_timeout): 10000
Adapter Property(dlpi_heartbeat_quantum): 1000
Adapter Property(nw_bandwidth): 80
Adapter Property(bandwidth): 10
Adapter Property(ip_address): 172.16.1.1
Adapter Property(netmask): 255.255.255.128
Adapter Port Names:      0
Adapter Port State(0):   Enabled
    
```

```

Transport Adapter:       net3
Adapter State:           Enabled
Adapter Transport Type:  dlpi
Adapter Property(device_name): net
Adapter Property(device_instance): 3
Adapter Property(lazy_free): 0
    
```

```

Adapter Property(dlpi_heartbeat_timeout): 10000
Adapter Property(dlpi_heartbeat_quantum): 1000
Adapter Property(nw_bandwidth): 80
Adapter Property(bandwidth): 10
Adapter Property(ip_address): 172.16.0.129
Adapter Property(netmask): 255.255.255.128
Adapter Port Names: 0
Adapter Port State(0): Enabled

--- SNMP MIB Configuration on phys-schost-1 ---

SNMP MIB Name: Event
State: Disabled
Protocol: SNMPv2

--- SNMP Host Configuration on phys-schost-1 ---

--- SNMP User Configuration on phys-schost-1 ---

SNMP User Name: foo
Authentication Protocol: MD5
Default User: No

Node Name: phys-schost-2:za
Node ID: 2
Type: cluster
Enabled: yes
privatehostname: clusternode2-priv
reboot_on_path_failure: disabled
globalzoneshares: 1
defaultpsetmin: 2
quorum_vote: 1
quorum_defaultvote: 1
quorum_resv_key: 0x43CB1E1800000002
Transport Adapter List: e1000g1, nge1

--- Transport Adapters for phys-schost-2 ---

Transport Adapter: e1000g1
Adapter State: Enabled
Adapter Transport Type: dlpi
Adapter Property(device_name): e1000g
Adapter Property(device_instance): 2
Adapter Property(lazy_free): 0
Adapter Property(dlpi_heartbeat_timeout): 10000
Adapter Property(dlpi_heartbeat_quantum): 1000
Adapter Property(nw_bandwidth): 80
Adapter Property(bandwidth): 10
Adapter Property(ip_address): 172.16.0.130
Adapter Property(netmask): 255.255.255.128
Adapter Port Names: 0
Adapter Port State(0): Enabled

Transport Adapter: nge1

```

```

Adapter State:                               Enabled
Adapter Transport Type:                       dlpi
Adapter Property(device_name):                nge
Adapter Property(device_instance):            3
Adapter Property(lazy_free):                  1
Adapter Property(dlpi_heartbeat_timeout):     10000
Adapter Property(dlpi_heartbeat_quantum):     1000
Adapter Property(nw_bandwidth):               80
Adapter Property(bandwidth):                  10
Adapter Property(ip_address):                 172.16.1.2
Adapter Property(netmask):                    255.255.255.128
Adapter Port Names:                           0
Adapter Port State(0):                        Enabled

--- SNMP MIB Configuration on phys-schost-2 ---

SNMP MIB Name:                               Event
State:                                        Disabled
Protocol:                                    SNMPv2

--- SNMP Host Configuration on phys-schost-2 ---

--- SNMP User Configuration on phys-schost-2 ---

=== Transport Cables ===

Transport Cable:                             phys-schost-1:e1000g1,switch2@1
Cable Endpoint1:                             phys-schost-1:e1000g1
Cable Endpoint2:                             switch2@1
Cable State:                                  Enabled

Transport Cable:                             phys-schost-1:nge1,switch1@1
Cable Endpoint1:                             phys-schost-1:nge1
Cable Endpoint2:                             switch1@1
Cable State:                                  Enabled

Transport Cable:                             phys-schost-2:nge1,switch1@2
Cable Endpoint1:                             phys-schost-2:nge1
Cable Endpoint2:                             switch1@2
Cable State:                                  Enabled

Transport Cable:                             phys-schost-2:e1000g1,switch2@2
Cable Endpoint1:                             phys-schost-2:e1000g1
Cable Endpoint2:                             switch2@2
Cable State:                                  Enabled

=== Transport Switches ===

Transport Switch:                             switch2
Switch State:                                 Enabled
Switch Type:                                  switch
Switch Port Names:                            1 2
Switch Port State(1):                         Enabled
Switch Port State(2):                         Enabled

```

```

Transport Switch:          switch1
Switch State:             Enabled
Switch Type:              switch
Switch Port Names:       1 2
Switch Port State(1):    Enabled
Switch Port State(2):    Enabled

=== Quorum Devices ===

Quorum Device Name:      d3
Enabled:                 yes
Votes:                   1
Global Name:             /dev/did/rdisk/d3s2
Type:                    shared_disk
Access Mode:             scsi3
Hosts (enabled):        phys-schost-1, phys-schost-2

Quorum Device Name:      qs1
Enabled:                 yes
Votes:                   1
Global Name:             qs1
Type:                    quorum_server
Hosts (enabled):        phys-schost-1, phys-schost-2
Quorum Server Host:     10.11.114.83
Port:                    9000

=== Device Groups ===

Device Group Name:       testdg3
Type:                    SVM
failback:                no
Node List:               phys-schost-1, phys-schost-2
preferenced:             yes
numsecondaries:          1
diskset name:            testdg3

=== Registered Resource Types ===

Resource Type:           SUNW.LogicalHostname:2
RT_description:          Logical Hostname Resource Type
RT_version:              4
API_version:             2
RT_basedir:              /usr/cluster/lib/rgm/rt/hafoip
Single_instance:         False
Proxy:                   False
Init_nodes:              All potential masters
Installed_nodes:         <All>
Failover:                True
Pkglist:                 <NULL>
RT_system:               True
Global_zone:             True

```

```

Resource Type: SUNW.SharedAddress:2
RT_description: HA Shared Address Resource Type
RT_version: 2
API_version: 2
RT_basedir: /usr/cluster/lib/rgm/rt/hascip
Single_instance: False
Proxy: False
Init_nodes: <Unknown>
Installed_nodes: <All>
Failover: True
Pkglist: <NULL>
RT_system: True
Global_zone: True
Resource Type: SUNW.HAStoragePlus:4
RT_description: HA Storage Plus
RT_version: 4
API_version: 2
RT_basedir: /usr/cluster/lib/rgm/rt/hastorageplus
Single_instance: False
Proxy: False
Init_nodes: All potential masters
Installed_nodes: <All>
Failover: False
Pkglist: <NULL>
RT_system: True
Global_zone: True
Resource Type: SUNW.haderby
RT_description: haderby server for Oracle Solaris Cluster
RT_version: 1
API_version: 7
RT_basedir: /usr/cluster/lib/rgm/rt/haderby
Single_instance: False
Proxy: False
Init_nodes: All potential masters
Installed_nodes: <All>
Failover: False
Pkglist: <NULL>
RT_system: True
Global_zone: True
Resource Type: SUNW.sctelemetry
RT_description: sctelemetry service for Oracle Solaris Cluster
RT_version: 1
API_version: 7
RT_basedir: /usr/cluster/lib/rgm/rt/sctelemetry
Single_instance: True
Proxy: False
Init_nodes: All potential masters
Installed_nodes: <All>
Failover: False
Pkglist: <NULL>
RT_system: True
Global_zone: True
=== Resource Groups and Resources ===

```

```

Resource Group:          HA_RG
RG_description:         <Null>
RG_mode:                Failover
RG_state:               Managed
Failback:               False
Nodelist:               phys-schost-1 phys-schost-2

```

```
--- Resources for Group HA_RG ---
```

```

Resource:               HA_R
Type:                   SUNW.HASStoragePlus:4
Type_version:           4
Group:                  HA_RG
R_description:
Resource_project_name:  SCSLM_HA_RG
Enabled{phys-schost-1}: True
Enabled{phys-schost-2}: True
Monitored{phys-schost-1}: True
Monitored{phys-schost-2}: True

```

```

Resource Group:        cl-db-rg
RG_description:       <Null>
RG_mode:              Failover
RG_state:             Managed
Failback:             False
Nodelist:             phys-schost-1 phys-schost-2

```

```
--- Resources for Group cl-db-rg ---
```

```

Resource:               cl-db-rs
Type:                   SUNW.haderby
Type_version:           1
Group:                  cl-db-rg
R_description:
Resource_project_name:  default
Enabled{phys-schost-1}: True
Enabled{phys-schost-2}: True
Monitored{phys-schost-1}: True
Monitored{phys-schost-2}: True

```

```

Resource Group:        cl-tlmtry-rg
RG_description:       <Null>
RG_mode:              Scalable
RG_state:             Managed
Failback:             False
Nodelist:             phys-schost-1 phys-schost-2

```

```
--- Resources for Group cl-tlmtry-rg ---
```

```

Resource:               cl-tlmtry-rs
Type:                   SUNW.sctelemetry
Type_version:           1
Group:                  cl-tlmtry-rg

```

```

R_description:
Resource_project_name:                default
Enabled{phys-schost-1}:               True
Enabled{phys-schost-2}:               True
Monitored{phys-schost-1}:             True
Monitored{phys-schost-2}:             True

=== DID Device Instances ===

DID Device Name:                       /dev/did/rdisk/d1
Full Device Path:                       phys-schost-1:/dev/rdisk/c0t2d0
Replication:                             none
default_fencing:                         global

DID Device Name:                       /dev/did/rdisk/d2
Full Device Path:                       phys-schost-1:/dev/rdisk/c1t0d0
Replication:                             none
default_fencing:                         global

DID Device Name:                       /dev/did/rdisk/d3
Full Device Path:                       phys-schost-2:/dev/rdisk/c2t1d0
Full Device Path:                       phys-schost-1:/dev/rdisk/c2t1d0
Replication:                             none
default_fencing:                         global

DID Device Name:                       /dev/did/rdisk/d4
Full Device Path:                       phys-schost-2:/dev/rdisk/c2t2d0
Full Device Path:                       phys-schost-1:/dev/rdisk/c2t2d0
Replication:                             none
default_fencing:                         global

DID Device Name:                       /dev/did/rdisk/d5
Full Device Path:                       phys-schost-2:/dev/rdisk/c0t2d0
Replication:                             none
default_fencing:                         global

DID Device Name:                       /dev/did/rdisk/d6
Full Device Path:                       phys-schost-2:/dev/rdisk/c1t0d0
Replication:                             none
default_fencing:                         global

=== NAS Devices ===

Nas Device:                             nas_filer1
Type:                                    sun_uss
nodeIPs{phys-schost-2}:                 10.134.112.112
nodeIPs{phys-schost-1}:                 10.134.112.113
User ID:                                 root

```

Example 1-6 Viewing the Zone Cluster Configuration

The following example lists the properties of the zone cluster configuration with RAC.

```
% clzonecluster show
```



```
=== Zone Clusters ===
```

```
Zone Cluster Name:          sczone
zonename:                   sczone
zonepath:                   /zones/sczone
autoboot:                   TRUE
ip-type:                    shared
enable_priv_net:           TRUE
```

```
--- Solaris Resources for sczone ---
```

```
Resource Name:             net
address:                   172.16.0.1
physical:                  auto
```

```
Resource Name:             net
address:                   172.16.0.2
physical:                  auto
```

```
Resource Name:             fs
dir:                       /local/ufs-1
special:                   /dev/md/ds1/dsk/d0
raw:                       /dev/md/ds1/rdisk/d0
type:                      ufs
options:                   [logging]
```

```
Resource Name:             fs
dir:                       /gz/db_qfs/CrsHome
special:                   CrsHome
raw:
type:                      samfs
options:                   []
```

```
Resource Name:             fs
dir:                       /gz/db_qfs/CrsData
special:                   CrsData
raw:
type:                      samfs
options:                   []
```

```
Resource Name:             fs
dir:                       /gz/db_qfs/OraHome
special:                   OraHome
raw:
type:                      samfs
options:                   []
```

```
Resource Name:             fs
dir:                       /gz/db_qfs/OraData
special:                   OraData
raw:
type:                      samfs
options:                   []
```

```
--- Zone Cluster Nodes for sczone ---  
  
Node Name:                sczone-1  
physical-host:            sczone-1  
hostname:                 lzzone-1  
  
Node Name:                sczone-2  
physical-host:            sczone-2  
hostname:                 lzzone-2
```

You can also view the NAS devices that are configured for global or zone clusters, by using the `clnasdevice show` subcommand or the Oracle Solaris Cluster Manager. See the [clnasdevice\(1CL\)](#) man page for more information.

▼ How to Validate a Basic Cluster Configuration

The `cluster` command uses the `check` subcommand to validate the basic configuration that is required for a global cluster to function properly. If no checks fail, `cluster check` returns to the shell prompt. If a check fails, `cluster check` produces reports in either the specified or the default output directory. If you run `cluster check` against more than one node, `cluster check` produces a report for each node and a report for multinode checks. You can also use the `cluster list-checks` command to display a list of all available cluster checks.

In addition to basic checks, which run without user interaction, the command can also run interactive checks and functional checks. Basic checks are run when the `-k` *keyword* option is not specified.

- Interactive checks require information from the user that the checks cannot determine. The check prompts the user for the needed information, for example, the firmware version number. Use the `-k interactive` keyword to specify one or more interactive checks.
- Functional checks exercise a specific function or behavior of the cluster. The check prompts for user input, such as which node to fail over to, as well as confirmation to begin or continue the check. Use the `-k functional check-id` keyword to specify a functional check. Perform only one functional check at a time.

Note - Because some functional checks involve interrupting cluster service, do not start any functional check until you have read the detailed description of the check and determined whether you need to first take the cluster out of production. To display this information, use the following command:

```
% cluster list-checks -v -C checkID
```

You can run the `cluster check` command in verbose mode with the `-v` flag to display progress information.

Note - Run `cluster check` after performing an administration procedure that might result in changes to devices, volume management components, or the Oracle Solaris Cluster configuration.

Running the `clzonecluster(1CL)` command from the global-cluster node runs a set of checks to validate the configuration that is required for a zone cluster to function properly. If all checks pass, `clzonecluster verify` returns to the shell prompt and you can safely install the zone cluster. If a check fails, `clzonecluster verify` reports on the global-cluster nodes where the verification failed. If you run `clzonecluster verify` against more than one node, a report is produced for each node and a report for multinode checks. The `verify` subcommand is not allowed inside a zone cluster.

1. Assume the root role on an active member node of a global cluster.

```
phys-schost# su
```

Perform all steps of this procedure from a node of the global cluster.

2. Ensure that you have the most current checks.

a. Go to the Patches & Updates tab of [My Oracle Support](#).

b. In the Advanced Search, select `solaris cluster` as the Product and type `check` in the Description field.

The search locates Oracle Solaris Cluster software updates that contain checks.

c. Apply any software updates that are not already installed on your cluster.

3. Run basic validation checks.

```
phys-schost# cluster check -v -o outputdir
```

`-v` Verbose mode

`-o outputdir` Redirects output to the `outputdir` subdirectory.

This command runs all available basic checks. No cluster functionality is affected.

4. Run interactive validation checks.

```
phys-schost# cluster check -v -k interactive -o outputdir
```

`-k interactive` Specifies running interactive validation checks.

The command runs all available interactive checks and prompts you for needed information about the cluster. No cluster functionality is affected.

5. Run functional validation checks.

a. List all available functional checks in nonverbose mode.

```
phys-schost# cluster list-checks -k functional
```

b. Determine which functional checks perform actions that would interfere with cluster availability or services in a production environment.

For example, a functional check might trigger a node panic or a failover to another node.

```
phys-schost# cluster list-checks -v -C check-ID
```

`-C check-ID` Specifies a specific check.

c. If the functional check that you want to perform might interrupt cluster functioning, ensure that the cluster is not in production.

d. Start the functional check.

```
phys-schost# cluster check -v -k functional -C check-ID -o outputdir
```

`-k functional` Specifies running functional validation checks.

Respond to prompts from the check to confirm that the check should run, and for any information or actions you must perform.

e. Repeat Step c and Step d for each remaining functional check to run.

Note - For record-keeping purposes, specify a unique *outputdir* subdirectory name for each check you run. If you reuse an *outputdir* name, output for the new check overwrites the existing contents of the reused *outputdir* subdirectory.

6. If you have a zone cluster configured, verify the configuration of the zone cluster to see if a zone cluster can be installed.

```
phys-schost# clzonecluster verify zoneclustername
```

7. Make a recording of the cluster configuration for future diagnostic purposes.

See [“How to Record Diagnostic Data of the Cluster Configuration”](#) in *Oracle Solaris Cluster Software Installation Guide* .

Example 1-7 Checking the Global Cluster Configuration With All Basic Checks Passing

The following example shows `cluster check` run in verbose mode against nodes `phys-schost-1` and `phys-schost-2` with all checks passing.

```
phys-schost# cluster check -v -h phys-schost-1, phys-schost-2

cluster check: Requesting explorer data and node report from phys-schost-1.
cluster check: Requesting explorer data and node report from phys-schost-2.
cluster check: phys-schost-1: Explorer finished.
cluster check: phys-schost-1: Starting single-node checks.
cluster check: phys-schost-1: Single-node checks finished.
cluster check: phys-schost-2: Explorer finished.
cluster check: phys-schost-2: Starting single-node checks.
cluster check: phys-schost-2: Single-node checks finished.
cluster check: Starting multi-node checks.
cluster check: Multi-node checks finished
```

Example 1-8 Listing Interactive Validation Checks

The following example lists all interactive checks that are available to run on the cluster. Example output shows a sampling of possible checks; actual available checks vary for each configuration.

```
# cluster list-checks -k interactive
Some checks might take a few moments to run (use -v to see progress)...
I6994574 : (Moderate) Fix for GLDv3 interfaces on cluster transport vulnerability applied?
```

Example 1-9 Running a Functional Validation Check

The following example first shows the verbose listing of functional checks. The verbose description is then listed for the check `F6968101`, which indicates that the check would disrupt cluster services. The cluster is taken out of production. The functional check is then run with verbose output logged to the `funct.test.F6968101.12Jan2011` subdirectory. Example output shows a sampling of possible checks; actual available checks vary for each configuration.

```
# cluster list-checks -k functional
F6968101 : (Critical) Perform resource group switchover
F6984120 : (Critical) Induce cluster transport network failure - single adapter.
F6984121 : (Critical) Perform cluster shutdown
F6984140 : (Critical) Induce node panic
# cluster list-checks -v -C F6968101
F6968101: (Critical) Perform resource group switchover
Keywords: SolarisCluster3.x, functional
Applicability: Applicable if multi-node cluster running live.
Check Logic: Select a resource group and destination node. Perform
'/usr/cluster/bin/clresourcegroup switch' on specified resource group
either to specified node or to all nodes in succession.
Version: 1.2
Revision Date: 12/10/10
```

Take the cluster out of production

```
# cluster list-checks -k functional -C F6968101 -o funct.test.F6968101.12Jan2011
F6968101
  initializing...
  initializing xml output...
  loading auxiliary data...
  starting check run...
    pschost1, pschost2, pschost3, pschost4:    F6968101.... starting:
Perform resource group switchover
```

=====

>>> Functional Check

'Functional' checks exercise cluster behavior. It is recommended that you do not run this check on a cluster in production mode.' It is recommended that you have access to the system console for each cluster node and observe any output on the consoles while the check is executed.

If the node running this check is brought down during execution the check must be rerun from this same node after it is rebooted into the cluster in order for the check to be completed.

Select 'continue' for more details on this check.

- 1) continue
- 2) exit

choice: 1

=====

>>> Check Description <<<

Follow onscreen directions

Example 1-10 Checking the Global Cluster Configuration With a Failed Check

The following example shows the node `phys-schost-2` in the cluster named `suncluster` minus the mount point `/global/phys-schost-1`. Reports are created in the output directory `/var/cluster/logs/cluster_check/<timestamp>`.

```
phys-schost# cluster check -v -h phys-schost-1,
phys-schost-2 -o /var/cluster/logs/cluster_check/Dec5/
```

```
cluster check: Requesting explorer data and node report from phys-schost-1.
cluster check: Requesting explorer data and node report from phys-schost-2.
cluster check: phys-schost-1: Explorer finished.
cluster check: phys-schost-1: Starting single-node checks.
cluster check: phys-schost-1: Single-node checks finished.
cluster check: phys-schost-2: Explorer finished.
```

```

cluster check: phys-schost-2: Starting single-node checks.
cluster check: phys-schost-2: Single-node checks finished.
cluster check: Starting multi-node checks.
cluster check: Multi-node checks finished.
cluster check: One or more checks failed.
cluster check: The greatest severity of all check failures was 3 (HIGH).
cluster check: Reports are in /var/cluster/logs/cluster_check/<Dec5>.
#
# cat /var/cluster/logs/cluster_check/Dec5/cluster_check-results.suncluster.txt
...
=====
= ANALYSIS DETAILS =
=====
-----
CHECK ID : 3065
SEVERITY : HIGH
FAILURE  : Global filesystem /etc/vfstab entries are not consistent across
all Oracle Solaris Cluster 4.x nodes.
ANALYSIS : The global filesystem /etc/vfstab entries are not consistent across
all nodes in this cluster.
Analysis indicates:
FileSystem '/global/phys-schost-1' is on 'phys-schost-1' but missing from 'phys-schost-2'.
RECOMMEND: Ensure each node has the correct /etc/vfstab entry for the
filesystem(s) in question.
...
#

```

▼ How to Check the Global Mount Points

The `cluster` command includes checks that examine the `/etc/vfstab` file for configuration errors with the cluster file system and its global mount points. See the [cluster\(1CL\)](#) man page for more information.

Note - Run `cluster check` after making cluster configuration changes that have affected devices or volume management components.

1. Assume the root role on an active member node of a global cluster.

Perform all steps of this procedure from a node of the global cluster.

```
% su
```

2. Verify the global cluster configuration.

```
phys-schost# cluster check
```

Example 1-11 Checking the Global Mount Points

The following example shows the node `phys-schost-2` of the cluster named `suncluster` minus the mount point `/global/schost-1`. Reports are being sent to the output directory, `/var/cluster/logs/cluster_check/<timestamp>/`.

```
phys-schost# cluster check -v1 -h phys-schost-1,phys-schost-2 -o
/var/cluster//logs/cluster_check/Dec5/

cluster check: Requesting explorer data and node report from phys-schost-1.
cluster check: Requesting explorer data and node report from phys-schost-2.
cluster check: phys-schost-1: Explorer finished.
cluster check: phys-schost-1: Starting single-node checks.
cluster check: phys-schost-1: Single-node checks finished.
cluster check: phys-schost-2: Explorer finished.
cluster check: phys-schost-2: Starting single-node checks.
cluster check: phys-schost-2: Single-node checks finished.
cluster check: Starting multi-node checks.
cluster check: Multi-node checks finished.
cluster check: One or more checks failed.
cluster check: The greatest severity of all check failures was 3 (HIGH).
cluster check: Reports are in /var/cluster/logs/cluster_check/Dec5.
#
# cat /var/cluster/logs/cluster_check/Dec5/cluster_check-results.suncluster.txt

...
=====
= ANALYSIS DETAILS =
=====
-----
CHECK ID : 3065
SEVERITY : HIGH
FAILURE  : Global filesystem /etc/vfstab entries are not consistent across
all Oracle Solaris Cluster 4.x nodes.
ANALYSIS : The global filesystem /etc/vfstab entries are not consistent across
all nodes in this cluster.
Analysis indicates:
FileSystem '/global/phys-schost-1' is on 'phys-schost-1' but missing from 'phys-schost-2'.
RECOMMEND: Ensure each node has the correct /etc/vfstab entry for the
filesystem(s) in question.
...
#
# cat /var/cluster/logs/cluster_check/Dec5/cluster_check-results.phys-schost-1.txt

...
=====
= ANALYSIS DETAILS =
=====
-----
CHECK ID : 1398
SEVERITY : HIGH
FAILURE  : An unsupported server is being used as an Oracle Solaris Cluster 4.x node.
ANALYSIS : This server may not be qualified to be used as an Oracle Solaris Cluster 4.x
node.
```


Only servers that have been qualified with Oracle Solaris Cluster 4.0 are supported as Oracle Solaris Cluster 4.x nodes.

RECOMMEND: Because the list of supported servers is always being updated, check with your Oracle representative to get the latest information on what servers are currently supported and only use a server that is supported with Oracle Solaris Cluster 4.x.
...
#

▼ How to View the Contents of Oracle Solaris Cluster Command Logs

The `/var/cluster/logs/commandlog` ASCII text file contains records of selected Oracle Solaris Cluster commands that are executed in a cluster. The logging of commands starts automatically when you set up the cluster and ends when you shut down the cluster. Commands are logged on all nodes that are up and booted in cluster mode.

Commands that are not logged in this file include those commands that display the configuration and current state of the cluster.

Commands that are logged in this file include those commands that configure and change the current state of the cluster:

- `claccess`
- `cldevice`
- `cldevicegroup`
- `clinterconnect`
- `clnasdevice`
- `clnode`
- `clquorum`
- `clreslogicalhostname`
- `clresource`
- `clresourcegroup`
- `clresourcetype`
- `clressharedaddress`
- `clsetup`
- `clsnmpghost`
- `clsnmpmib`
- `clsnmpuser`
- `cltelemetryattribute`

- cluster
- clzonecluster
- scdidadm

Records in the `commandlog` file can contain the following elements:

- Date and timestamp
- Name of the host from which the command was executed
- Process ID of the command
- Login name of the user who executed the command
- Command that the user executed, including all options and operands

Note - Command options are quoted in the `commandlog` file so that you can readily identify them and copy, paste, and execute them in the shell.

- Exit status of the executed command

Note - If a command aborts abnormally with unknown results, the Oracle Solaris Cluster software does *not* show an exit status in the `commandlog` file.

By default, the `commandlog` file is regularly archived once a week. To change the archiving policies for the `commandlog` file, on each node in the cluster, use the `crontab` command. See the [`crontab\(1\)`](#) man page for more information.

Oracle Solaris Cluster software maintains up to eight previously archived `commandlog` files on each cluster node at any given time. The `commandlog` file for the current week is named `commandlog`. The most recent complete week's file is named `commandlog.0`. The oldest complete week's file is named `commandlog.7`.

● **View the contents of the current week's `commandlog` file, one screen at a time.**

```
phys-schost# more /var/cluster/logs/commandlog
```

Example 1-12 Viewing the Contents of Oracle Solaris Cluster Command Logs

The following example shows the contents of the `commandlog` file that are displayed by the `more` command.

```
more -lines10 /var/cluster/logs/commandlog
11/11/2006 09:42:51 phys-schost-1 5222 root START - clsetup
11/11/2006 09:43:36 phys-schost-1 5758 root START - clrg add "app-sa-1"
11/11/2006 09:43:36 phys-schost-1 5758 root END 0
11/11/2006 09:43:36 phys-schost-1 5760 root START - clrg set -y
```

```
"RG_description=Department Shared Address RG" "app-sa-1"  
11/11/2006 09:43:37 phys-schost-1 5760 root END 0  
11/11/2006 09:44:15 phys-schost-1 5810 root START - clrg online "app-sa-1"  
11/11/2006 09:44:15 phys-schost-1 5810 root END 0  
11/11/2006 09:44:19 phys-schost-1 5222 root END -20988320  
12/02/2006 14:37:21 phys-schost-1 5542 jbloggs START - clrg -c -g "app-sa-1"  
-y "RG_description=Joe Bloggs Shared Address RG"  
12/02/2006 14:37:22 phys-schost-1 5542 jbloggs END 0
```


Oracle Solaris Cluster and RBAC

This chapter describes role-based access control (RBAC) in relation to Oracle Solaris Cluster. Topics covered include:

- [“Setting Up and Using RBAC With Oracle Solaris Cluster” on page 61](#)
- [“Oracle Solaris Cluster RBAC Rights Profiles” on page 61](#)
- [“Creating and Assigning an RBAC Role With an Oracle Solaris Cluster Management Rights Profile” on page 63](#)
- [“Modifying a User's RBAC Properties” on page 64](#)

Setting Up and Using RBAC With Oracle Solaris Cluster

Use the following table to determine the documentation to consult about setting up and using RBAC. Specific steps that you follow to set up and use RBAC with Oracle Solaris Cluster software are provided later in this chapter.

Task	Instructions
Learn more about RBAC	Chapter 1, “About Using Rights to Control Users and Processes,” in <i>Securing Users and Processes in Oracle Solaris 11.2</i>
Set up, manage elements, and use RBAC	Chapter 3, “Assigning Rights in Oracle Solaris,” in <i>Securing Users and Processes in Oracle Solaris 11.2</i>
Learn more about RBAC elements and tools	Chapter 8, “Reference for Oracle Solaris Rights,” in <i>Securing Users and Processes in Oracle Solaris 11.2</i>

Oracle Solaris Cluster RBAC Rights Profiles

Selected Oracle Solaris Cluster commands and options that you issue at the command line use RBAC for authorization. Oracle Solaris Cluster commands and options that require RBAC authorization will require one or more of the following authorization levels. Oracle Solaris Cluster RBAC rights profiles apply to nodes in a global cluster.

`solaris.cluster.read` Authorization for list, show, and other read operations.

`solaris.cluster.admin` Authorization to change the state of a cluster object.

`solaris.cluster.modify` Authorization to change properties of a cluster object.

For more information about the RBAC authorization required by an Oracle Solaris Cluster command, see the command man page.

RBAC rights profiles include one or more RBAC authorizations. You can assign these rights profiles to users or to roles to give them different levels of access to Oracle Solaris Cluster. Oracle provides the following rights profiles with Oracle Solaris Cluster software.

Note - The RBAC rights profiles listed in the following table continue to support the old RBAC authorizations as defined in previous Oracle Solaris Cluster releases.

Rights Profile	Includes Authorizations	Role Identity Permission
Oracle Solaris Cluster Commands	None, but includes a list of Oracle Solaris Cluster commands that run with <code>euid=0</code>	<p>Execute selected Oracle Solaris Cluster commands that you use to configure and manage a cluster, including the following subcommands for all of the Oracle Solaris Cluster commands:</p> <ul style="list-style-type: none"> ■ list ■ show ■ status <p><code>scha_control</code></p> <p><code>scha_resource_get</code></p> <p><code>scha_resource_setstatus</code></p> <p><code>scha_resourcegroup_get</code></p> <p><code>scha_resourcetype_get</code></p>
Basic Oracle Solaris User	<p>This existing Oracle Solaris rights profile contains Oracle Solaris authorizations, as well as the following:</p> <p><code>solaris.cluster.read</code></p>	<p>Perform list, show, and other read operations for Oracle Solaris Cluster commands, as well as access the Oracle Solaris Cluster Manager GUI.</p>
Cluster Operation	<p>This rights profile is specific to Oracle Solaris Cluster software and contains the following authorizations:</p> <p><code>solaris.cluster.read</code></p> <p><code>solaris.cluster.admin</code></p>	<p>Perform list, show, export, status, and other read operations., as well as access the Oracle Solaris Cluster Manager GUI.</p> <p>Change the state of cluster objects.</p>

Rights Profile	Includes Authorizations	Role Identity Permission
System Administrator	This existing Oracle Solaris rights profile contains the same authorizations that the Cluster Management profile contains.	Perform the same operations that the Cluster Management role identity can perform, in addition to other system administration operations.
Cluster Management	This rights profile contains the same authorizations that the Cluster Operation profile contains, as well as the following authorization: solaris.cluster.modify	Perform the same operations that the Cluster Operation role identity can perform, as well as change properties of a cluster object.

Creating and Assigning an RBAC Role With an Oracle Solaris Cluster Management Rights Profile

Use this task to create a new RBAC role with an Oracle Solaris Cluster Management Rights Profile and to assign users to this new role.

▼ How to Create a Role From the Command Line

1. Select a method for creating a role:

- For roles in the local scope, use the `roleadd` command to specify a new local role and its attributes. For more information, see the [roleadd\(1M\)](#) man page.
- Alternatively, for roles in the local scope, edit the `user_attr` file to add a user with `type=role`. For more information, see the [user_attr\(4\)](#) man page.
Use this method only for emergencies.
- For roles in a name service, use the `roleadd` and `rolemod` commands to specify the new role and its attributes. For more information, see the [roleadd\(1M\)](#) and [rolemod\(1M\)](#) man pages.
This command requires authentication by the root role that is capable of creating other roles. You can apply the `roleadd` command to all name services. This command runs as a client of the Solaris Management Console server.

2. Start and stop the name service cache daemon.

New roles do not take effect until the name service cache daemon is restarted. As root, type the following text:

```
# /etc/init.d/nscd stop
# /etc/init.d/nscd start
```

Example 2-1 Creating a Custom Operator Role by Using the `smrole` Command

The following sequence demonstrates how a role is created with the `smrole` command. In this example, a new version of the Operator role is created that has assigned to it the standard Operator rights profile and the Media Restore rights profile.

```
% su primaryadmin
# /usr/sadm/bin/smrole add -H myHost -- -c "Custom Operator" -n oper2 -a johnDoe \
-d /export/home/oper2 -F "Backup/Restore Operator" -p "Operator" -p "Media Restore"
```

Authenticating as user: primaryadmin

Type `/?` for help, pressing `<enter>` accepts the default denoted by `[]`
Please enter a string value for: password :: `<type primaryadmin password>`

Loading Tool: com.sun.admin.usermgr.cli.role.UserMgrRoleCli from myHost
Login to myHost as user primaryadmin was successful.
Download of com.sun.admin.usermgr.cli.role.UserMgrRoleCli from myHost was successful.

Type `/?` for help, pressing `<enter>` accepts the default denoted by `[]`
Please enter a string value for: password :: `<type oper2 password>`

```
# /etc/init.d/nscd stop
# /etc/init.d/nscd start
```

To view the newly created role (and any other roles), use `smrole` with the `list` option, as follows:

```
# /usr/sadm/bin/smrole list --
```

Authenticating as user: primaryadmin

Type `/?` for help, pressing `<enter>` accepts the default denoted by `[]`
Please enter a string value for: password :: `<type primaryadmin password>`

Loading Tool: com.sun.admin.usermgr.cli.role.UserMgrRoleCli from myHost
Login to myHost as user primaryadmin was successful.
Download of com.sun.admin.usermgr.cli.role.UserMgrRoleCli from myHost was successful.

root	0	Super-User
primaryadmin	100	Most powerful role
sysadmin	101	Performs non-security admin tasks
oper2	102	Custom Operator

Modifying a User's RBAC Properties

You can modify a user's RBAC properties by using either the user accounts tool or the command line. To modify a user's RBAC properties, see [“How to Modify a User's RBAC Properties From the Command Line” on page 65](#). Choose one of the following procedures.

- [“How to Modify a User's RBAC Properties by Using the User Accounts Tool” on page 65](#)

- [“How to Modify a User's RBAC Properties From the Command Line” on page 65](#)

▼ How to Modify a User's RBAC Properties by Using the User Accounts Tool

Before You Begin To modify a user's properties, you must run the User Tool Collection as root user or assume a role that has the System Administrator rights profile assigned to it.

1. Start the User Accounts tool.

To run the user accounts tool, start the Solaris Management Console, as described in [“Using Your Assigned Administrative Rights” in *Securing Users and Processes in Oracle Solaris 11.2*](#). Open the User Tool Collection and click the User Accounts icon.

After the User Accounts tool starts, the icons for the existing user accounts are displayed in the view pane.

2. Click the User Account icon to be changed and select Properties from the Action menu (or double-click the user account icon).

3. Click the appropriate tab in the dialog box for the property to be changed, as follows:

- To change the roles that are assigned to the user, click the Roles tab and move the role assignment to be changed to the appropriate column: Available Roles or Assigned Roles.
- To change the rights profiles that are assigned to the user, click the Rights tab and move it to the appropriate column: Available Rights or Assigned Rights.

Note - Avoid assigning rights profiles directly to users. The preferred approach is to require users to assume roles in order to perform privileged applications. This strategy discourages users from abusing privileges.

▼ How to Modify a User's RBAC Properties From the Command Line

1. Assume a role that provides `solaris.cluster.modify` RBAC authorization.

2. Choose the appropriate command:

- To change user properties that are assigned to a user who is defined in the local scope or in an LDAP repository, use the `usermod` command. For more information, see the [`usermod\(1M\)`](#) man page.

- Alternatively, to change the authorizations, roles, or rights profiles that are assigned to a user who is defined in the local scope, edit the `user_attr` file.

Use this method for emergencies only.

- To manage roles locally or in a name service such as an LDAP repository, use the `roleadd` or `rolemod` commands. For more information, see the [roleadd\(1M\)](#) or [rolemod\(1M\)](#) man pages.

These commands require authentication as the `root` role that is capable of changing user files. You can apply these commands to all name services. See [“Commands That Are Used for Managing Users, Roles, and Groups”](#) in *Managing User Accounts and User Environments in Oracle Solaris 11.2*.

The Forced Privilege and Stop Rights profiles that ship with Oracle Solaris 11 cannot be modified.

Shutting Down and Booting a Cluster

This chapter provides information about and procedures for shutting down and booting a global cluster, a zone cluster, and individual nodes.

- [“Overview of Shutting Down and Booting a Cluster” on page 67](#)
- [“Shutting Down and Booting a Single Node in a Cluster” on page 82](#)
- [“Repairing a Full /var File System” on page 95](#)

For a high-level description of the related procedures in this chapter, see [“How to Boot a Node in Noncluster Mode” on page 93](#) and [Table 3-2](#).

Overview of Shutting Down and Booting a Cluster

The Oracle Solaris Cluster `cluster shutdown` command stops global cluster services in an orderly fashion and cleanly shuts down an entire global cluster. You can use the `cluster shutdown` command when moving the location of a global cluster, or to shut down the global cluster if an application error causes data corruption. The `clzonecluster halt` command stops a zone cluster that is running on a specific node or an entire zone cluster on all configured nodes. (You can also use the `cluster shutdown` command within a zone cluster.) For more information, see the `cluster(1CL)` man page.

In the procedures in this chapter, `phys-schost#` reflects a global-cluster prompt. The `clzonecluster` interactive shell prompt is `clzc:schost>`.

Note - Use the `cluster shutdown` command to ensure proper shutdown of the entire global cluster. The Oracle Solaris `shutdown` command is used with the `clnode evacuate` command to shut down individual nodes. For more information, see [“How to Shut Down a Cluster” on page 68](#), [“Shutting Down and Booting a Single Node in a Cluster” on page 82](#), or the `clnode(1CL)` man page.

You can also evacuate a node using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

The `cluster shutdown` and the `clzonecluster halt` commands stop all nodes in a global cluster or zone cluster, respectively, by performing the following actions:

1. Takes all running resource groups offline.
2. Unmounts all cluster file systems for a global cluster or a zone cluster.
3. The `cluster shutdown` command shuts down active device services on a global cluster or a zone cluster.
4. The `cluster shutdown` command runs `init 0` and brings all nodes on the cluster to the OpenBoot™ PROM `ok` prompt on a SPARC based system or the `Press any key to continue` message on the GRUB menu of an x86 based system. For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#) . The `clzonecluster halt` command performs the `zoneadm -z zoneclustername halt` command to stop (but not shut down) the zones of the zone cluster.

Note - If necessary, you can boot a node in noncluster mode so that the node does not participate in cluster membership. Noncluster mode is useful when installing cluster software or for performing certain administrative procedures. See [“How to Boot a Node in Noncluster Mode” on page 93](#) for more information.

TABLE 3-1 Task List: Shutting Down and Booting a Cluster

Task	Instructions
Stop the cluster.	“How to Shut Down a Cluster” on page 68
Start the cluster by booting all nodes. The nodes must have a working connection to the cluster interconnect to attain cluster membership.	“How to Boot a Cluster” on page 71
Reboot the cluster.	“How to Reboot a Cluster” on page 75

▼ How to Shut Down a Cluster

You can shut down a global cluster, a zone cluster, or all zone clusters.



Caution - Do not use `send brk` on a cluster console to shut down a global-cluster node or a zone-cluster node. The command is not supported within a cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **(x86 only) If your global cluster or zone cluster is running Oracle Real Application Clusters (RAC), shut down all instances of the database on the cluster you are shutting down.**

Refer to the Oracle RAC product documentation for shutdown procedures.

2. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on any node in the cluster.**

Perform all steps in this procedure from a node of the global cluster.

3. **Shut down the global cluster, the zone cluster, or all zone clusters.**

- **Shut down the global cluster. This action also shuts down all zone clusters.**

```
phys-schost# cluster shutdown -g0 -y
```

- **Shut down a specific zone cluster.**

```
phys-schost# clzonecluster halt zoneclustername
```

- **Shut down all zone clusters.**

```
phys-schost# clzonecluster halt +
```

You can also use the `cluster shutdown` command within a zone cluster to shut down that particular zone cluster.

4. **Verify that all nodes on the global cluster or zone cluster are showing the `ok` prompt on a SPARC based system or a GRUB menu on an x86 based system.**

Do not power off any nodes until all nodes are at the `ok` prompt on a SPARC based system or in a boot subsystem on an x86 based system.

- **Check the status of one or more global-cluster nodes from another global-cluster node which is still up and running in the cluster.**

```
phys-schost# cluster status -t node
```

- **Use the `status` subcommand to verify that the zone cluster was shut down.**

```
phys-schost# clzonecluster status
```

5. **If necessary, power off the nodes of the global cluster.**

Example 3-1 Shutting Down a Zone Cluster

The following example shuts down a zone cluster called `sczone`.

```
phys-schost# clzonecluster halt sczone
```

```
Waiting for zone halt commands to complete on all the nodes of the zone cluster "sczone"...
Sep  5 19:06:01 schost-4 cl_runtime: NOTICE: Membership : Node 2 of cluster 'sczone' died.
Sep  5 19:06:01 schost-4 cl_runtime: NOTICE: Membership : Node 4 of cluster 'sczone' died.
Sep  5 19:06:01 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster 'sczone' died.
Sep  5 19:06:01 schost-4 cl_runtime: NOTICE: Membership : Node 1 of cluster 'sczone' died.
phys-schost#
```

Example 3-2 SPARC: Shutting Down a Global Cluster

The following example shows the console output when normal global-cluster operation is stopped and all nodes are shut down, enabling the ok prompt to be shown. The `-g 0` option sets the shutdown grace period to zero, and the `-y` option provides an automatic yes response to the confirmation question. Shutdown messages also appear on the consoles of the other nodes in the global cluster.

```
phys-schost# cluster shutdown -g0 -y
Wed Mar 10 13:47:32 phys-schost-1 cl_runtime:
WARNING: CMM monitoring disabled.
phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
System services are now being stopped.
/etc/rc0.d/K05initrgm: Calling clnode evacuate
The system is down.
syncing file systems... done
Program terminated
ok
```

Example 3-3 x86: Shutting Down a Global Cluster

The following example shows the console output when normal global-cluster operation is stopped and all nodes are shut down. In this example, the ok prompt is not displayed on all of the nodes. The `-g 0` option sets the shutdown grace period to zero, and the `-y` option provides an automatic yes response to the confirmation question. Shutdown messages also appear on the consoles of the other nodes in the global cluster.

```
phys-schost# cluster shutdown -g0 -y
May  2 10:32:57 phys-schost-1 cl_runtime:
WARNING: CMM: Monitoring disabled.
root@phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
System services are now being stopped.
/etc/rc0.d/K05initrgm: Calling clnode evacuate
failfasts already disabled on node 1
Print services already stopped.
May  2 10:33:13 phys-schost-1 syslogd: going down on signal 15
The system is down.
syncing file systems... done
Type any key to continue
```

See Also See [“How to Boot a Cluster” on page 71](#) to restart a global cluster or a zone cluster that was shut down.

▼ How to Boot a Cluster

This procedure explains how to start a global cluster or zone cluster whose nodes have been shut down. For global-cluster nodes, the system displays the ok prompt on SPARC systems or the Press any key to continue message on the GRUB based x86 systems.

The phys-schost# prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

Note - To create a zone cluster, follow the instructions in [“Creating and Configuring a Zone Cluster” in Oracle Solaris Cluster Software Installation Guide](#) or use the GUI to create the zone cluster.

1. Boot each node into cluster mode.

Perform all steps in this procedure from a node of the global cluster.

- **On SPARC based systems, run the following command.**

```
ok boot
```

- **On x86 based systems, run the following commands.**

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

For more information about GRUB based booting, see [“Booting a System” in Booting and Shutting Down Oracle Solaris 11.2 Systems](#) .

Note - Nodes must have a working connection to the cluster interconnect to attain cluster membership.

- **If you have a zone cluster, you can boot the entire zone cluster.**

```
phys-schost# clzonecluster boot zoneclustername
```

- **If you have more than one zone cluster, you can boot all zone clusters. Use + instead of the zoneclustername.**

2. Verify that the nodes booted without error and are online.

The `cluster status` command reports the global-cluster nodes' status.

```
phys-schost# cluster status -t node
```

When you run the `clzonecluster status` command from a global-cluster node, the command reports the state of the zone-cluster node.

```
phys-schost# clzonecluster status
```

Note - If a node's `/var` file system fills up, Oracle Solaris Cluster might not be able to restart on that node. If this problem arises, see [“How to Repair a Full /var File System” on page 95](#). For more information, see the `clzonecluster(1CL)` man page.

Example 3-4 SPARC: Booting a Global Cluster

The following example shows the console output when node `phys-schost-1` is booted into the global cluster. Similar messages appear on the consoles of the other nodes in the global cluster. When the `autoboot` property of a zone cluster is set to `true`, the system automatically boots the zone-cluster node after booting the global-cluster node on that machine.

When a global-cluster node reboots, all zone cluster nodes on that machine halt. Any zone-cluster node on that same machine with the `autoboot` property set to `true` boots after the global-cluster node restarts.

```
ok boot
Rebooting with command: boot
...
Hostname: phys-schost-1
Booting as part of a cluster
NOTICE: Node phys-schost-1 with votecount = 1 added.
NOTICE: Node phys-schost-2 with votecount = 1 added.
NOTICE: Node phys-schost-3 with votecount = 1 added.
...
NOTICE: Node phys-schost-1: attempting to join cluster
...
NOTICE: Node phys-schost-2 (incarnation # 937690106) has become reachable.
NOTICE: Node phys-schost-3 (incarnation # 937690290) has become reachable.
NOTICE: cluster has reached quorum.
NOTICE: node phys-schost-1 is up; new incarnation number = 937846227.
NOTICE: node phys-schost-2 is up; new incarnation number = 937690106.
NOTICE: node phys-schost-3 is up; new incarnation number = 937690290.
NOTICE: Cluster members: phys-schost-1 phys-schost-2 phys-schost-3.
...
```

Example 3-5 x86: Booting a Cluster

The following example shows the console output when node `phys-schost-1` is booted into the cluster. Similar messages appear on the consoles of the other nodes in the cluster.


```

ATI RAGE SDRAM BIOS P/N GR-xlint.007-4.330
* BIOS Lan-Console 2.0
Copyright (C) 1999-2001 Intel Corporation
MAC ADDR: 00 02 47 31 38 3C
AMIBIOS (C)1985-2002 American Megatrends Inc.,
Copyright 1996-2002 Intel Corporation
SCB20.86B.1064.P18.0208191106
SCB2 Production BIOS Version 2.08
BIOS Build 1064
2 X Intel(R) Pentium(R) III CPU family      1400MHz
Testing system memory, memory size=2048MB
2048MB Extended Memory Passed
512K L2 Cache SRAM Passed
ATAPI CD-ROM SAMSUNG CD-ROM SN-124

Press <F2> to enter SETUP, <F12> Network

Adaptec AIC-7899 SCSI BIOS v2.57S4
(c) 2000 Adaptec, Inc. All Rights Reserved.
Press <Ctrl><A> for SCSISelect(TM) Utility!

Ch B, SCSI ID: 0 SEAGATE ST336605LC      160
SCSI ID: 1 SEAGATE ST336605LC      160
SCSI ID: 6 ESG-SHV SCA HSBP M18      ASYN
Ch A, SCSI ID: 2 SUN StorEdge 3310      160
SCSI ID: 3 SUN StorEdge 3310      160

AMIBIOS (C)1985-2002 American Megatrends Inc.,
Copyright 1996-2002 Intel Corporation
SCB20.86B.1064.P18.0208191106
SCB2 Production BIOS Version 2.08
BIOS Build 1064

2 X Intel(R) Pentium(R) III CPU family      1400MHz
Testing system memory, memory size=2048MB
2048MB Extended Memory Passed
512K L2 Cache SRAM Passed
ATAPI CD-ROM SAMSUNG CD-ROM SN-124

SunOS - Intel Platform Edition      Primary Boot Subsystem, vsn 2.0

Current Disk Partition Information

Part#  Status  Type      Start      Length
=====
1      Active  X86 BOOT  2428       21852
2              SOLARIS  24280      71662420
3              <unused>
4              <unused>
Please select the partition you wish to boot: *      *

Solaris DCB

loading /solaris/boot.bin

```

```
SunOS Secondary Boot version 3.00

Solaris Intel Platform Edition Booting System

Autobooting from bootpath: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/
pci8086,341a@7,1/sd@0,0:a

If the system hardware has changed, or to boot from a different
device, interrupt the autoboot process by pressing ESC.
Press ESCape to interrupt autoboot in 2 seconds.
Initializing system
Please wait...
Warning: Resource Conflict - both devices are added

NON-ACPI device: ISY0050
Port: 3F0-3F5, 3F7; IRQ: 6; DMA: 2
ACPI device: ISY0050
Port: 3F2-3F3, 3F4-3F5, 3F7; IRQ: 6; DMA: 2

<<< Current Boot Parameters >>>
Boot path: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/pci8086,341a@7,1/
sd@0,0:a
Boot args:

Type   b [file-name] [boot-flags] <ENTER> to boot with options
or     i <ENTER>                       to enter boot interpreter
or     <ENTER>                          to boot with defaults

<<< timeout in 5 seconds >>>

Select (b)oot or (i)nterpreter:
Size: 275683 + 22092 + 150244 Bytes
/platform/i86pc/kernel/unix loaded - 0xac000 bytes used
SunOS Release 5.9 Version Generic_112234-07 32-bit
Copyright 1983-2003 Sun Microsystems, Inc. All rights reserved.
Use is subject to license terms.
configuring IPv4 interfaces: e1000g2.
Hostname: phys-schost-1
Booting as part of a cluster
NOTICE: CMM: Node phys-schost-1 (nodeid = 1) with votecount = 1 added.
NOTICE: CMM: Node phys-schost-2 (nodeid = 2) with votecount = 1 added.
NOTICE: CMM: Quorum device 1 (/dev/did/rdisk/d1s2) added; votecount = 1, bitmask
of nodes with configured paths = 0x3.
NOTICE: clcomm: Adapter e1000g3 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being initiated
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 online
NOTICE: clcomm: Adapter e1000g0 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being constructed
NOTICE: CMM: Node phys-schost-1: attempting to join cluster.
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being initiated
NOTICE: CMM: Quorum device /dev/did/rdisk/d1s2: owner set to node 1.
NOTICE: CMM: Cluster has reached quorum.
```

```

NOTICE: CMM: Node phys-schost-1 (nodeid = 1) is up; new incarnation number = 1068496374.
NOTICE: CMM: Node phys-schost-2 (nodeid = 2) is up; new incarnation number = 1068496374.
NOTICE: CMM: Cluster members: phys-schost-1 phys-schost-2.
NOTICE: CMM: node reconfiguration #1 completed.
NOTICE: CMM: Node phys-schost-1: joined cluster.

```

▼ How to Reboot a Cluster

To shut down a global cluster, run the `cluster shutdown` command and then boot the global cluster with the `boot` command on each node. To shut down a zone cluster, use the `clzonecluster halt` command and then use the `clzonecluster boot` command to boot the zone cluster. You can also use the `clzonecluster reboot` command. For more information, see the [cluster\(1CL\)](#), [boot\(1M\)](#), and [clzonecluster\(1CL\)](#) man pages.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **If your cluster is running Oracle RAC, shut down all instances of the database on the cluster you are shutting down.**
Refer to the Oracle RAC product documentation for shutdown procedures.
2. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on any node in the cluster.**
Perform all steps in this procedure from a node of the global cluster.
3. **Shut down the cluster.**

- **Shut down the global cluster.**

```
phys-schost# cluster shutdown -g0 -y
```

- **If you have a zone cluster, shut down the zone cluster from a global-cluster node.**

```
phys-schost# clzonecluster halt zoneclustername
```

Each node is shut down. You can also use the `cluster shutdown` command within a zone cluster to shut down the zone cluster.

Note - Nodes must have a working connection to the cluster interconnect to attain cluster membership.

4. Boot each node.

The order in which the nodes are booted is irrelevant unless you make configuration changes between shutdowns. If you make configuration changes between shutdowns, start the node with the most current configuration first.

- For a global-cluster node on a SPARC based system, run the following command.

```
ok boot
```

- For a global-cluster node on an x86 based system, run the following commands.
When the GRUB menu is displayed, select the appropriate Oracle Solaris OS entry and press Enter.

Note - Nodes must have a working connection to the cluster interconnect to attain cluster membership.

For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#) .

- For a zone cluster, type the following command on a single node of the global cluster to boot the zone cluster.

```
phys-schost# clzonecluster boot zoneclustername
```

Messages appear on the booted nodes' consoles as cluster components are activated.

5. Verify that the nodes booted without error and are online.

- **The `clnode status` command reports the status of the nodes on the global cluster.**

```
phys-schost# clnode status
```

- **Running the `clzonecluster status` command on a global-cluster node reports the status of the zone-cluster nodes.**

```
phys-schost# clzonecluster status
```

You can also run the `cluster status` command within a zone cluster to see the status of the nodes.

Note - If a node's `/var` file system fills up, Oracle Solaris Cluster might not be able to restart on that node. If this problem arises, see [“How to Repair a Full `/var` File System” on page 95](#).

Example 3-6 Rebooting a Zone Cluster

The following example shows how to halt and boot a zone cluster called *sparse-sczone*. You can also use the `clzonecluster reboot` command.

```
phys-schost# clzonecluster halt sparse-sczone
Waiting for zone halt commands to complete on all the nodes of the zone cluster "sparse-
sczone"...
Sep  5 19:17:46 schost-4 cl_runtime: NOTICE: Membership : Node 4 of cluster 'sparse-sczone'
died.
Sep  5 19:17:46 schost-4 cl_runtime: NOTICE: Membership : Node 2 of cluster 'sparse-sczone'
died.
Sep  5 19:17:46 schost-4 cl_runtime: NOTICE: Membership : Node 1 of cluster 'sparse-sczone'
died.
Sep  5 19:17:46 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster 'sparse-sczone'
died.
phys-schost#
phys-schost# clzonecluster boot sparse-sczone
Waiting for zone boot commands to complete on all the nodes of the zone cluster "sparse-
sczone"...
phys-schost# Sep  5 19:18:23 schost-4 cl_runtime: NOTICE: Membership : Node 1 of cluster
'sparse-sczone' joined.
Sep  5 19:18:23 schost-4 cl_runtime: NOTICE: Membership : Node 2 of cluster 'sparse-sczone'
joined.
Sep  5 19:18:23 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster 'sparse-sczone'
joined.
Sep  5 19:18:23 schost-4 cl_runtime: NOTICE: Membership : Node 4 of cluster 'sparse-sczone'
joined.

phys-schost#
phys-schost# clzonecluster status

=== Zone Clusters ===

--- Zone Cluster Status ---

Name           Node Name   Zone HostName  Status   Zone Status
-----
sparse-sczone  schost-1   sczone-1       Online   Running
                schost-2   sczone-2       Online   Running
                schost-3   sczone-3       Online   Running
                schost-4   sczone-4       Online   Running
phys-schost#
```

Example 3-7 SPARC: Rebooting a Global Cluster

The following example shows the console output when normal global-cluster operation is stopped, all nodes are shut down to the `ok` prompt, and the global cluster is restarted. The `-g 0` option sets the grace period to zero, and the `-y` option provides an automatic yes response to the confirmation question. Shutdown messages also appear on the consoles of other nodes in the global cluster.

```
phys-schost# cluster shutdown -g0 -y
```

```

Wed Mar 10 13:47:32 phys-schost-1 cl_runtime:
WARNING: CMM monitoring disabled.
phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
...
The system is down.
syncing file systems... done
Program terminated
ok boot
Rebooting with command: boot
...
Hostname: phys-schost-1
Booting as part of a cluster
...
NOTICE: Node phys-schost-1: attempting to join cluster
...
NOTICE: Node phys-schost-2 (incarnation # 937690106) has become reachable.
NOTICE: Node phys-schost-3 (incarnation # 937690290) has become reachable.
NOTICE: cluster has reached quorum.
...
NOTICE: Cluster members: phys-schost-1 phys-schost-2 phys-schost-3.
...
NOTICE: Node phys-schost-1: joined cluster
...
The system is coming up. Please wait.
checking ufs filesystems
...
reservation program successfully exiting
Print services started.
volume management starting.
The system is ready.
phys-schost-1 console login:
NOTICE: Node phys-schost-1: joined cluster
...
The system is coming up. Please wait.
checking ufs filesystems
...
reservation program successfully exiting
Print services started.
volume management starting.
The system is ready.
phys-schost-1 console login:

```

Example 3-8 x86: Rebooting a Cluster

The following example shows the console output when normal cluster operation is topped, all nodes are shut down, and the cluster is restarted. The `-g 0` option sets the grace period to zero, and `-y` provides an automatic yes response to the confirmation question. Shutdown messages also appear on the consoles of other nodes in the cluster.

```

# cluster shutdown -g0 -y
May 2 10:32:57 phys-schost-1 cl_runtime:

```

```
WARNING: CMM: Monitoring disabled.
root@phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
System services are now being stopped.
/etc/rc0.d/K05initrgm: Calling clnode evacuate
failfasts already disabled on node 1
Print services already stopped.
May 2 10:33:13 phys-schost-1 syslogd: going down on signal 15
The system is down.
syncing file systems... done
Type any key to continue

ATI RAGE SDRAM BIOS P/N GR-xlint.007-4.330
*                               BIOS Lan-Console 2.0
Copyright (C) 1999-2001 Intel Corporation
MAC ADDR: 00 02 47 31 38 3C
AMIBIOS (C)1985-2002 American Megatrends Inc.,
Copyright 1996-2002 Intel Corporation
SCB20.86B.1064.P18.0208191106
SCB2 Production BIOS Version 2.08
BIOS Build 1064
2 X Intel(R) Pentium(R) III CPU family    1400MHz
Testing system memory, memory size=2048MB
2048MB Extended Memory Passed
512K L2 Cache SRAM Passed
ATAPI CD-ROM SAMSUNG CD-ROM SN-124

Press <F2> to enter SETUP, <F12> Network

Adaptec AIC-7899 SCSI BIOS v2.5754
(c) 2000 Adaptec, Inc. All Rights Reserved.
Press <Ctrl><A> for SCSISelect(TM) Utility!

Ch B,  SCSI ID: 0 SEAGATE ST336605LC      160
SCSI ID: 1 SEAGATE ST336605LC          160
SCSI ID: 6 ESG-SHV SCA HSBP M18        ASYN
Ch A,  SCSI ID: 2 SUN StorEdge 3310     160
SCSI ID: 3 SUN StorEdge 3310          160

AMIBIOS (C)1985-2002 American Megatrends Inc.,
Copyright 1996-2002 Intel Corporation
SCB20.86B.1064.P18.0208191106
SCB2 Production BIOS Version 2.08
BIOS Build 1064

2 X Intel(R) Pentium(R) III CPU family    1400MHz
Testing system memory, memory size=2048MB
2048MB Extended Memory Passed
512K L2 Cache SRAM Passed
ATAPI CD-ROM SAMSUNG CD-ROM SN-124

SunOS - Intel Platform Edition           Primary Boot Subsystem, vsn 2.0
```

Current Disk Partition Information

Part#	Status	Type	Start	Length
1	Active	X86 BOOT	2428	21852
2		SOLARIS	24280	71662420
3		<unused>		
4		<unused>		

Please select the partition you wish to boot: * *

Solaris DCB

loading /solaris/boot.bin

SunOS Secondary Boot version 3.00

Solaris Intel Platform Edition Booting System

Autobooting from bootpath: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/pci8086,341a@7,1/sd@0,0:a

If the system hardware has changed, or to boot from a different device, interrupt the autoboot process by pressing ESC.

Press ESCape to interrupt autoboot in 2 seconds.

Initializing system

Please wait...

Warning: Resource Conflict - both devices are added

NON-ACPI device: ISY0050

Port: 3F0-3F5, 3F7; IRQ: 6; DMA: 2

ACPI device: ISY0050

Port: 3F2-3F3, 3F4-3F5, 3F7; IRQ: 6; DMA: 2

<<< Current Boot Parameters >>>

Boot path: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/pci8086,341a@7,1/sd@0,0:a

Boot args:

Type b [file-name] [boot-flags] <ENTER> to boot with options
 or i <ENTER> to enter boot interpreter
 or <ENTER> to boot with defaults

<<< timeout in 5 seconds >>>

Select (b)oot or (i)nterpreter: **b**

Size: 275683 + 22092 + 150244 Bytes

/platform/i86pc/kernel/unix loaded - 0xac000 bytes used

SunOS Release 5.9 Version Generic_112234-07 32-bit

Copyright 1983-2003 Sun Microsystems, Inc. All rights reserved.

Use is subject to license terms.

configuring IPv4 interfaces: e1000g2.

Hostname: phys-schost-1

Booting as part of a cluster

NOTICE: CMM: Node phys-schost-1 (nodeid = 1) with votecount = 1 added.


```

NOTICE: CMM: Node phys-schost-2 (nodeid = 2) with votecount = 1 added.
NOTICE: CMM: Quorum device 1 (/dev/did/rdisk/dls2) added; votecount = 1, bitmask
of nodes with configured paths = 0x3.
NOTICE: clcomm: Adapter e1000g3 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being initiated
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 online
NOTICE: clcomm: Adapter e1000g0 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being constructed
NOTICE: CMM: Node phys-schost-1: attempting to join cluster.
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being initiated
NOTICE: CMM: Quorum device /dev/did/rdisk/dls2: owner set to node 1.
NOTICE: CMM: Cluster has reached quorum.
NOTICE: CMM: Node phys-schost-1 (nodeid = 1) is up; new incarnation number = 1068496374.
NOTICE: CMM: Node phys-schost-2 (nodeid = 2) is up; new incarnation number = 1068496374.
NOTICE: CMM: Cluster members: phys-schost-1 phys-schost-2.
NOTICE: CMM: node reconfiguration #1 completed.
NOTICE: CMM: Node phys-schost-1: joined cluster.
WARNING: mod_installdr: no major number for rsmrtd
ip: joining multicasts failed (18) on clprivnet0 - will use link layer
broadcasts for multicast
The system is coming up. Please wait.
checking ufs filesystems
/dev/rdisk/clt0d0s5: is clean.
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 online
NIS domain name is dev.eng.mycompany.com
starting rpc services: rpcbind keyserver ypbind done.
Setting netmask of e1000g2 to 192.168.255.0
Setting netmask of e1000g3 to 192.168.255.128
Setting netmask of e1000g0 to 192.168.255.128
Setting netmask of clprivnet0 to 192.168.255.0
Setting default IPv4 interface for multicast: add net 224.0/4: gateway phys-schost-1
syslog service starting.
obtaining access to all attached disks

*****
*
* The X-server can not be started on display :0...
*
*****
volume management starting.
Starting Fault Injection Server...
The system is ready.

phys-schost-1 console login:

```

Shutting Down and Booting a Single Node in a Cluster

You can shut down a global-cluster node or a zone-cluster node. This section provides instructions for shutting down a global-cluster node and a zone-cluster node.

To shut down a global-cluster node, use the `clnode evacuate` command with the Oracle Solaris `shutdown` command. Use the `cluster shutdown` command only when shutting down an entire global cluster.

On a zone-cluster node, use the `clzonecluster halt` command on a global cluster to shut down a single zone-cluster node or an entire zone cluster. You can also use the `clnode evacuate` and `shutdown` commands to shut down a zone-cluster node.

For more information, see the [clnode\(1CL\)](#), [shutdown\(1M\)](#), and [clzonecluster\(1CL\)](#) man pages.

In the procedures in this chapter, `phys-schost#` reflects a global-cluster prompt. The `clzonecluster` interactive shell prompt is `clzc:schost>`.

TABLE 3-2 Task Map: Shutting Down and Booting a Node

Task	Tool	Instructions
Stop a node.	For a global-cluster node, use the <code>clnode evacuate</code> and <code>shutdown</code> commands. For a zone-cluster node, use the <code>clzonecluster halt</code> command.	“How to Shut Down a Node” on page 83
Start a node. The node must have a working connection to the cluster interconnect to attain cluster membership.	For a global-cluster node, use the <code>boot</code> or <code>b</code> command. For a zone-cluster node, use the <code>clzonecluster boot</code> command.	“How to Boot a Node” on page 86
Stop and restart (reboot) a node on a cluster. The node must have a working connection to the cluster interconnect to attain cluster membership.	For a global-cluster node, use the <code>clnode evacuate</code> and <code>shutdown</code> commands, followed by <code>boot</code> or <code>b</code> . For a zone-cluster node, use the <code>clzonecluster reboot</code> command.	“How to Reboot a Node” on page 90
Boot a node so that the node does not participate in cluster membership.	For a global-cluster node, use <code>clnode evacuate</code> and <code>shutdown</code> commands, followed by <code>boot -x</code>	“How to Boot a Node in Noncluster Mode” on page 93

Task	Tool	Instructions
		on SPARC or GRUB menu entry editing on x86.
		If the underlying global cluster is booted in noncluster mode, the zone cluster node is automatically in noncluster mode.

▼ How to Shut Down a Node

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.



Caution - Do not use `send brk` on a cluster console to shut down a node on a global cluster or a zone cluster. The command is not supported within a cluster.

You can also use the Oracle Solaris Cluster Manager GUI to evacuate a global-cluster node and switch all resource groups and device groups to the next-preferred node. You can also shut down a zone-cluster node. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

- 1. If your cluster is running Oracle RAC, shut down all instances of the database on the cluster you are shutting down.**

Refer to the Oracle RAC product documentation for shutdown procedures.

- 2. Assume a role that provides `solaris.cluster.admin` RBAC authorization on the cluster node to be shut down.**

Perform all steps in this procedure from a node of the global cluster.

- 3. If you want to halt a specific zone cluster member, skip Steps 4 - 6 and execute the following command from a global-cluster node:**

```
phys-schost# clzonecluster halt -n physical-name zoneclustername
```

When you specify a particular zone-cluster node, you stop only that node. By default, the `halt` command stops the zone clusters on all nodes.

- 4. Switch all resource groups, resources, and device groups from the node being shut down to other global cluster members.**

On the global-cluster node to shut down, type the following command. The `clnode evacuate` command switches over all resource groups and device groups from the specified node to the next-preferred node. (You can also run `clnode evacuate` within a zone-cluster node.)

```
phys-schost# clnode evacuate node
```

node Specifies the node from which you are switching resource groups and device groups.

5. Shut down the node.

Execute the shutdown command on the global-cluster node you want to shut down.

```
phys-schost# shutdown -g0 -y -i0
```

Verify that the global-cluster node is showing the ok prompt on a SPARC based system or the Press any key to continue message on the GRUB menu on an x86 based system.

6. If necessary, power off the node.

Example 3-9 SPARC: Shutting Down a Global-Cluster Node

The following example shows the console output when node `phys-schost-1` is shut down. The `-g0` option sets the grace period to zero, and the `-y` option provides an automatic yes response to the confirmation question. Shutdown messages for this node appear on the consoles of other nodes in the global cluster.

```
phys-schost# clnode evacuate phys-schost-1
phys-schost# shutdown -g0 -y -i0
Wed Mar 10 13:47:32 phys-schost-1 cl_runtime:
WARNING: CMM monitoring disabled.
phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
Notice: rgmd is being stopped.
Notice: rpc.pmfd is being stopped.
Notice: rpc.fed is being stopped.
umount: /global/.devices/node@1 busy
umount: /global/phys-schost-1 busy
The system is down.
syncing file systems... done
Program terminated
ok
```

Example 3-10 x86: Shutting Down a Global-Cluster Node

The following example shows the console output when node `phys-schost-1` is shut down. The `-g0` option sets the grace period to zero, and the `-y` option provides an automatic yes response to the confirmation question. Shutdown messages for this node appear on the consoles of other nodes in the global cluster.

```

phys-schost# clnode evacuate phys-schost-1
phys-schost# shutdown -g0 -y -i0
Shutdown started.   Wed Mar 10 13:47:32 PST 2004

Changing to init state 0 - please wait
Broadcast Message from root (console) on phys-schost-1 Wed Mar 10 13:47:32...
THE SYSTEM phys-schost-1 IS BEING SHUT DOWN NOW ! ! !
Log off now or risk your files being damaged

phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
System services are now being stopped.
/etc/rc0.d/K05initrgm: Calling clnode evacuate
failfasts disabled on node 1
Print services already stopped.
Mar 10 13:47:44 phys-schost-1 syslogd: going down on signal 15
umount: /global/.devices/node@2 busy
umount: /global/.devices/node@1 busy
The system is down.
syncing file systems... done
WARNING: CMM: Node being shut down.
Type any key to continue

```

Example 3-11 Shutting Down a Zone-Cluster Node

The following example shows how use the `clzonecluster halt` to shut down a node on a zone cluster called *sparse-sczone*. (You can also run the `clnode evacuate` and `shutdown` commands in a zone-cluster node.)

```

phys-schost# clzonecluster status

=== Zone Clusters ===

--- Zone Cluster Status ---

Name           Node Name   Zone HostName  Status   Zone Status
-----
sparse-sczone  schost-1   sczone-1      Online   Running
                schost-2   sczone-2      Online   Running
                schost-3   sczone-3      Online   Running
                schost-4   sczone-4      Online   Running

phys-schost#
phys-schost# clzonecluster halt -n schost-4 sparse-sczone
Waiting for zone halt commands to complete on all the nodes of the zone cluster "sparse-
sczone"...
Sep  5 19:24:00 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster 'sparse-sczone'
died.
phys-host#
phys-host# clzonecluster status

=== Zone Clusters ===

```

```

--- Zone Cluster Status ---

Name           Node Name   Zone HostName  Status   Zone Status
-----
sparse-sczone  schost-1   sczone-1      Online   Running
               schost-2   sczone-2      Online   Running
               schost-3   sczone-3      Offline  Installed
               schost-4   sczone-4      Online   Running

phys-schost#
    
```

See Also See [“How to Boot a Node” on page 86](#) to restart a global-cluster node that was shut down.

▼ How to Boot a Node

If you intend to shut down or reboot other active nodes in the global cluster or zone cluster, wait until the multiuser-server milestone comes online for the node you are booting.

Otherwise, the node will not be available to take over services from other nodes in the cluster that you shut down or reboot.

Note - Starting a node can be affected by the quorum configuration. In a two-node cluster, you must have a quorum device configured so that the total quorum count for the cluster is three. You should have one quorum count for each node and one quorum count for the quorum device. In this situation, if the first node is shut down, the second node continues to have quorum and runs as the sole cluster member. For the first node to come back in the cluster as a cluster node, the second node must be up and running. The required cluster quorum count (two) must be present.

If you are running Oracle Solaris Cluster in a guest domain, rebooting the control or I/O domain can have an impact on the running guest domain, including the domain going down. You should rebalance the workload to other nodes and stop the guest domain running Oracle Solaris Cluster before you reboot the control or I/O domain.

When a control or I/O domain is rebooted, heartbeats are not received or sent by the guest domain. This causes split brain and a cluster reconfiguration to occur. Since the control or I/O domain is rebooting, the guest domain cannot access any shared devices. The other cluster nodes will fence this guest domain from the shared devices. When the control or I/O domain finishes its reboot, I/O resumes on the guest domain and any I/O to shared storage causes the guest domain to panic because it has been fenced off the shared disks as part of the cluster reconfiguration. You can mitigate this issue if a guest is employing two I/O domains for redundancy and you reboot the I/O domains one at a time.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

Note - Nodes must have a working connection to the cluster interconnect to attain cluster membership.

You can also boot a zone cluster node using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

1. To start a global-cluster node or zone-cluster node that has been shut down, boot the node.

Perform all steps in this procedure from a node of the global cluster.

- On SPARC based systems, run the following command.

```
ok boot
```

- On x86 based systems, run the following commands.

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

Messages appear on the booted nodes' consoles as cluster components are activated.

- If you have a zone cluster, you can specify a node to boot.

```
phys-schost# clzonecluster boot -n node zoneclustername
```

2. Verify that the node booted without error, and is online.

- **Running the `cluster status` command reports the status of a global-cluster node.**

```
phys-schost# cluster status -t node
```

- **Running the `clzonecluster status` command from a node on the global cluster reports the status of all zone-cluster nodes.**

```
phys-schost# clzonecluster status
```

A zone-cluster node can only be booted in cluster mode when the node hosting the node is booted in cluster mode.

Note - If a node's /var file system fills up, Oracle Solaris Cluster might not be able to restart on that node. If this problem arises, see [“How to Repair a Full /var File System” on page 95](#).

Example 3-12 SPARC: Booting a Global-Cluster Node

The following example shows the console output when node phys-schost-1 is booted into the global cluster.

```
ok boot
Rebooting with command: boot
...
Hostname: phys-schost-1
Booting as part of a cluster
...
NOTICE: Node phys-schost-1: attempting to join cluster
...
NOTICE: Node phys-schost-1: joined cluster
...
The system is coming up. Please wait.
checking ufs filesystems
...
reservation program successfully exiting
Print services started.
volume management starting.
The system is ready.
phys-schost-1 console login:
```

Example 3-13 x86: Booting a Cluster Node

The following example shows the console output when node phys-schost-1 is booted into the cluster.

```
<<< Current Boot Parameters >>>
Boot path: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/pci8086,341a@7,1/sd@0,0:a
Boot args:

Type    b [file-name] [boot-flags] <ENTER>   to boot with options
or      i <ENTER>                          to enter boot interpreter
or      <ENTER>                             to boot with defaults

<<< timeout in 5 seconds >>>

Select (b)oot or (i)nterpreter: Size: 276915 + 22156 + 150372 Bytes
/platform/i86pc/kernel/unix loaded - 0xac000 bytes used
SunOS Release 5.9 Version on81-feature-patch:08/30/2003 32-bit
Copyright 1983-2003 Sun Microsystems, Inc. All rights reserved.
Use is subject to license terms.
configuring IPv4 interfaces: e1000g2.
Hostname: phys-schost-1
Booting as part of a cluster
```



```

NOTICE: CMM: Node phys-schost-1 (nodeid = 1) with votecount = 1 added.
NOTICE: CMM: Node phys-schost-2 (nodeid = 2) with votecount = 1 added.
NOTICE: CMM: Quorum device 1 (/dev/did/rdisk/dls2) added; votecount = 1, bitmask
of nodes with configured paths = 0x3.
WARNING: CMM: Initialization for quorum device /dev/did/rdisk/dls2 failed with
error EACCES. Will retry later.
NOTICE: clcomm: Adapter e1000g3 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being constructed
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 being initiated
NOTICE: clcomm: Path phys-schost-1:e1000g3 - phys-schost-2:e1000g3 online
NOTICE: clcomm: Adapter e1000g0 constructed
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being constructed
NOTICE: CMM: Node phys-schost-1: attempting to join cluster.
WARNING: CMM: Reading reservation keys from quorum device /dev/did/rdisk/dls2
failed with error 2.
NOTICE: CMM: Cluster has reached quorum.
NOTICE: CMM: Node phys-schost-1 (nodeid = 1) is up; new incarnation number =
1068503958.
NOTICE: CMM: Node phys-schost-2 (nodeid = 2) is up; new incarnation number =
1068496374.
NOTICE: CMM: Cluster members: phys-schost-1 phys-schost-2.
NOTICE: CMM: node reconfiguration #3 completed.
NOTICE: CMM: Node phys-schost-1: joined cluster.
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 being initiated
NOTICE: clcomm: Path phys-schost-1:e1000g0 - phys-schost-2:e1000g0 online
NOTICE: CMM: Retry of initialization for quorum device /dev/did/rdisk/dls2 was
successful.
WARNING: mod_installdr: no major number for rsmrtd
ip: joining multicasts failed (18) on clprivnet0 - will use link layer
broadcasts for multicast
The system is coming up. Please wait.
checking ufs filesystems
/dev/rdisk/clt0d0s5: is clean.
NIS domain name is dev.eng.mycompany.com
starting rpc services: rpcbind keyserp ybind done.
Setting netmask of e1000g2 to 192.168.255.0
Setting netmask of e1000g3 to 192.168.255.128
Setting netmask of e1000g0 to 192.168.255.128
Setting netmask of clprivnet0 to 192.168.255.0
Setting default IPv4 interface for multicast: add net 224.0/4: gateway phys-schost-1
syslog service starting.
obtaining access to all attached disks

*****
*
* The X-server can not be started on display :0...
*
*****
volume management starting.
Starting Fault Injection Server...
The system is ready.

phys-schost-1 console login:

```

▼ How to Reboot a Node

To shut down or reboot other active nodes in the global cluster or zone cluster, wait until the multiuser-server milestone comes online for the node that you are rebooting.

Otherwise, the node will not be available to take over services from other nodes in the cluster that you shut down or reboot.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.



Caution - If a method for any resource times out and cannot be killed, the node will be rebooted only if the resource's `Failover_mode` property is set to `HARD`. If the `Failover_mode` property is set to any other value, the node will not be rebooted.

You can also reboot a zone-cluster node using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **If the global-cluster or zone-cluster node is running Oracle RAC, shut down all instances of the database on the node that you are shutting down.**

Refer to the Oracle RAC product documentation for shutdown procedures.

2. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on the node to shut down.**

Perform all steps in this procedure from a node of the global cluster.

3. **Shut down the global-cluster node by using the `clnode evacuate` and `shutdown` commands.**

Shut down the zone cluster with the `clzonecluster halt` command executed on a node of the global cluster. (The `clnode evacuate` and `shutdown` commands also work in a zone cluster.)

For a global cluster, type the following commands on the node to shut down. The `clnode evacuate` command switches over all device groups from the specified node to the next-preferred node. The command also switches all resource groups from global zones on the specified node to the next-preferred global zone on other nodes.

Note - To shut down a single node, use the `shutdown -g0 -y -i6` command. To shut down multiple nodes at the same time, use the `shutdown -g0 -y -i0` command to halt the nodes. After all the nodes have halted, use the `boot` command on all nodes to boot them back in to the cluster.

- On a SPARC based system, run the following commands to reboot a single node.

```
phys-schost# clnode evacuate node
```

```
phys-schost# shutdown -g0 -y -i6
```

- On an x86 based system, run the following commands to reboot a single node.

```
phys-schost# clnode evacuate node
```

```
phys-schost# shutdown -g0 -y -i6
```

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

- Specify the zone-cluster node to shut down and reboot.

```
phys-schost# clzonecluster reboot - node zoneclustername
```

Note - Nodes must have a working connection to the cluster interconnect to attain cluster membership.

4. Verify that the node booted without error and is online.

- **Verify that the global-cluster node is online.**

```
phys-schost# cluster status -t node
```

- **Verify that the zone-cluster node is online.**

```
phys-schost# clzonecluster status
```

Example 3-14 SPARC: Rebooting a Global-Cluster Node

The following example shows the console output when node `phys-schost-1` is rebooted. Messages for this node, such as shutdown and startup notification, appear on the consoles of other nodes in the global cluster.

```
phys-schost# clnode evacuate phys-schost-1
phys-schost# shutdown -g0 -y -i6
Shutdown started.   Wed Mar 10 13:47:32 phys-schost-1 cl_runtime:
```

```
WARNING: CMM monitoring disabled.
```

```
phys-schost-1#
```

```
INIT: New run level: 6
```

```
The system is coming down. Please wait.
```

```
System services are now being stopped.
```

```
Notice: rgmd is being stopped.
```

```
Notice: rpc.pmfd is being stopped.
```

```
Notice: rpc.fed is being stopped.
```

```

umount: /global/.devices/node@1 busy
umount: /global/phys-schost-1 busy
The system is down.
syncing file systems... done
rebooting...
Resetting ...
'''
Sun Ultra 1 SBus (UltraSPARC 143MHz), No Keyboard
OpenBoot 3.11, 128 MB memory installed, Serial #5932401.
Ethernet address 8:8:20:99:ab:77, Host ID: 8899ab77.
...
Rebooting with command: boot
...
Hostname: phys-schost-1
Booting as part of a cluster
...
NOTICE: Node phys-schost-1: attempting to join cluster
...
NOTICE: Node phys-schost-1: joined cluster
...
The system is coming up. Please wait.
The system is ready.
phys-schost-1 console login:

```

Example 3-15 Rebooting a Zone-Cluster Node

The following example shows how to reboot a node on a zone cluster.

```

phys-schost# clzonecluster reboot -n schost-4 sparse-sczone
Waiting for zone reboot commands to complete on all the nodes of the zone cluster
"sparse-sczone"...
Sep  5 19:40:59 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster
'sparse-sczone' died.
phys-schost# Sep  5 19:41:27 schost-4 cl_runtime: NOTICE: Membership : Node 3 of cluster
'sparse-sczone' joined.

phys-schost#
phys-schost# clzonecluster status

=== Zone Clusters ===

--- Zone Cluster Status ---
Name           Node Name   Zone HostName  Status  Zone Status
-----
sparse-sczone  schost-1   sczone-1       Online  Running
                schost-2   sczone-2       Online  Running
                schost-3   sczone-3       Online  Running
                schost-4   sczone-4       Online  Running

phys-schost#

```

▼ How to Boot a Node in Noncluster Mode

You can boot a global-cluster node in noncluster mode, where the node does not participate in the cluster membership. Noncluster mode is useful when installing the cluster software or performing certain administrative procedures, such as updating a node. A zone-cluster node cannot be in a boot state that is different from the state of the underlying global-cluster node. If the global-cluster node is booted in noncluster mode, the zone-cluster node is automatically in noncluster mode.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on the cluster to be started in noncluster mode.**

Perform all steps in this procedure from a node of the global cluster.

2. **Shut down the zone-cluster node or the global-cluster node.**

The `clnode evacuate` command switches over all device groups from the specified node to the next-preferred node. The command also switches all resource groups from global zones on the specified node to the next-preferred global zones on other nodes.

- **Shut down a specific global cluster node.**

```
phys-schost# clnode evacuate node
```

```
phys-schost# shutdown -g0 -y
```

- **Shut down a specific zone-cluster node from a global-cluster node.**

```
phys-schost# clzonecluster halt -n node zoneclustername
```

You can also use the `clnode evacuate` and `shutdown` commands within a zone cluster.

3. **Verify that the global-cluster node is showing the `ok` prompt on an Oracle Solaris-based system or the `Press any key to continue` message on a GRUB menu on an x86 based system.**

4. **Boot the global-cluster node in noncluster mode.**

- On SPARC based systems, run the following command.

```
ok boot -xs
```

- On x86 based systems, run the following commands.

- a. **In the GRUB menu, use the arrow keys to select the appropriate Oracle Solaris entry and type `e` to edit its commands.**

The GRUB menu appears.

For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#) .

- b. **In the boot parameters screen, use the arrow keys to select the kernel entry and type `e` to edit the entry.**

The GRUB boot parameters screen appears.

- c. **Add `-x` to the command to specify system boot in noncluster mode.**

[Minimal BASH-like line editing is supported. For the first word, TAB lists possible command completions. Anywhere else TAB lists the possible completions of a device/filename. ESC at any time exits.]

```
grub edit> kernel$ /platform/i86pc/kernel/$ISADIR/unix -B $ZFS-BOOTFS -x
```

- d. **Press the Enter key to accept the change and return to the boot parameters screen.**

The screen displays the edited command.

- e. **Type `b` to boot the node into noncluster mode.**

Note - This change to the kernel boot parameter command does not persist over the system boot. The next time you reboot the node, it will boot into cluster mode. To boot into noncluster mode instead, perform these steps again to add the `-x` option to the kernel boot parameter command.

Example 3-16 SPARC: Booting a Global-Cluster Node in Noncluster Mode

The following example shows the console output when node `phys-schost-1` is shut down and restarted in noncluster mode. The `-g0` option sets the grace period to zero, the `-y` option provides an automatic yes response to the confirmation question, and the `-i0` option invokes run level 0 (zero). Shutdown messages for this node appear on the consoles of other nodes in the global cluster.

```
phys-schost# clnode evacuate phys-schost-1
phys-schost# cluster shutdown -g0 -y
Shutdown started.   Wed Mar 10 13:47:32 phys-schost-1 cl_runtime:

WARNING: CMM monitoring disabled.
phys-schost-1#
...
```

```
rg_name = schost-sa-1 ...
offline node = phys-schost-2 ...
num of node = 0 ...
phys-schost-1#
INIT: New run level: 0
The system is coming down. Please wait.
System services are now being stopped.
Print services stopped.
syslogd: going down on signal 15
...
The system is down.
syncing file systems... done
WARNING: node phys-schost-1 is being shut down.
Program terminated

ok boot -x
...
Not booting as part of cluster
...
The system is ready.
phys-schost-1 console login:
```

Repairing a Full /var File System

Both Oracle Solaris software and Oracle Solaris Cluster software write error messages to the `/var/adm/messages` file, which over time can fill the `/var` file system. If a cluster node's `/var` file system fills up, Oracle Solaris Cluster might not be able to start on that node at the next boot up. Additionally, you might not be able to log in to the node.

▼ How to Repair a Full /var File System

If a node reports a full `/var` file system and continues to run Oracle Solaris Cluster services, use this procedure to clear the full file system. Refer to [“Viewing System Messages” in *Troubleshooting System Administration Issues in Oracle Solaris 11.2*](#) for more information.

1. **Assume the root role on the cluster node with the full /var file system.**
2. **Clear the full file system.**

For example, delete nonessential files that are contained in the file system.

Data Replication Approaches

This chapter describes data replication technologies you can use with Oracle Solaris Cluster software. *Data replication* is defined as copying data from a primary storage device to a backup or secondary device. If the primary device fails, your data is available from the secondary device. Data replication helps assure high availability and disaster tolerance for your cluster.

Oracle Solaris Cluster software supports the following types of data replication:

- Between clusters – Use Oracle Solaris Cluster Geographic Edition for disaster recovery
- Within a cluster – Use as a replacement for host-based mirroring within a campus cluster

To perform data replication, you must have a device group that has the same name as the object you are replicating. A device can belong to only one device group at a time, so if you already have an Oracle Solaris Cluster device group that contains the device, you must delete the group before you add that device to a new device group. For instructions on creating and managing Solaris Volume Manager, ZFS, or raw-disk device groups, see [“Administering Device Groups” on page 118](#).

You must understand both host-based and storage-based data replication before you can select the replication approach that best serves your cluster. For more information about using Oracle Solaris Cluster Geographic Edition to manage your data replication for disaster recovery, see the [Oracle Solaris Cluster Geographic Edition Overview](#).

This chapter contains the following section:

- [“Understanding Data Replication” on page 97](#)
- [“Using Storage-Based Data Replication Within a Cluster” on page 99](#)

Understanding Data Replication

Oracle Solaris Cluster 4.2 supports host-based and storage-based data replication.

- *Host-based data replication* uses software to replicate disk volumes between geographically dispersed clusters in real time. Remote mirror replication enables data from the master volume of the primary cluster to be replicated to the master volume of the geographically

dispersed secondary cluster. A remote mirror bitmap tracks differences between the master volume on the primary disk and the master volume on the secondary disk. An example of host-based replication software used for replication between clusters (and between a cluster and a host that is not in a cluster) is the Availability Suite feature of Oracle Solaris.

Host-based data replication is a less expensive data replication solution because it uses host resources, rather than special storage arrays. Databases, applications, or file systems that are configured to allow multiple hosts running the Oracle Solaris OS to write data to a shared volume are not supported (for example, Oracle RAC). For more information about using host-based data replication between two clusters, see [Oracle Solaris Cluster Geographic Edition Data Replication Guide for Oracle Solaris Availability Suite](#) . To see an example of host-based replication that does not use Oracle Solaris Cluster Geographic Edition, see Appendix A, “[Configuring Host-Based Data Replication With Sun StorageTek Availability Suite Software](#)” on page 295.

- *Storage-based data replication* uses software on the storage controller to move the work of data replication off the cluster nodes and onto the storage device. This software frees some node processing power to serve cluster requests. An example of storage-based software that can replicate data inside a cluster or between clusters is EMC SRDF. Storage-based data replication can be especially important in campus cluster configurations and can simplify the infrastructure required. For more information about using storage-based data replication in a campus cluster environment, see “[Using Storage-Based Data Replication Within a Cluster](#)” on page 99.

For more information about using storage-based replication between two or more clusters and the Oracle Solaris Cluster Geographic Edition product that automates the process, see [Oracle Solaris Cluster Geographic Edition Data Replication Guide for EMC Symmetrix Remote Data Facility](#) . See also Appendix A, “[Configuring Host-Based Data Replication With Sun StorageTek Availability Suite Software](#)” on page 295 for an example of storage-based replication between clusters.

Supported Data Replication Methods

Oracle Solaris Cluster software supports the following methods of data replication between clusters or within a cluster:

1. Replication Between Clusters – For disaster recovery, you can use host-based or storage-based replication to perform data replication between clusters. Generally, you would choose either host-based replication or storage-based replication, rather than a combination of the two. You can manage both types of replication with Oracle Solaris Cluster Geographic Edition software.
 - Host-Based Replication
 - Availability Suite feature of Oracle Solaris.

If you want to use host-based replication without Oracle Solaris Cluster Geographic Edition software, see the instructions in [Appendix A, “Example”](#),

[“Configuring Host-Based Data Replication With Sun StorageTek Availability Suite Software” on page 295.](#)

- Storage-Based Replication
 - EMC Symmetrix Remote Data Facility (SRDF), through the Oracle Solaris Cluster Geographic Edition.
 - Oracle ZFS Storage Appliance. For more information, see [“Data Replication” in Oracle Solaris Cluster Geographic Edition Overview](#) .

If you want to use storage-based replication without Oracle Solaris Cluster Geographic Edition software, see the documentation for your replication software.

2. Replication Within a Cluster – This method is used as a replacement for host-based mirroring.
 - Storage-Based Replication
 - EMC Symmetrix Remote Data Facility (SRDF)
3. Application-Based Replication – Oracle Data Guard is an example of application-based replication software. This type of software is used only for disaster recovery to replicate a single-instance or RAC database. For more information, see the [Oracle Solaris Cluster Geographic Edition Data Replication Guide for Oracle Data Guard](#) .

Using Storage-Based Data Replication Within a Cluster

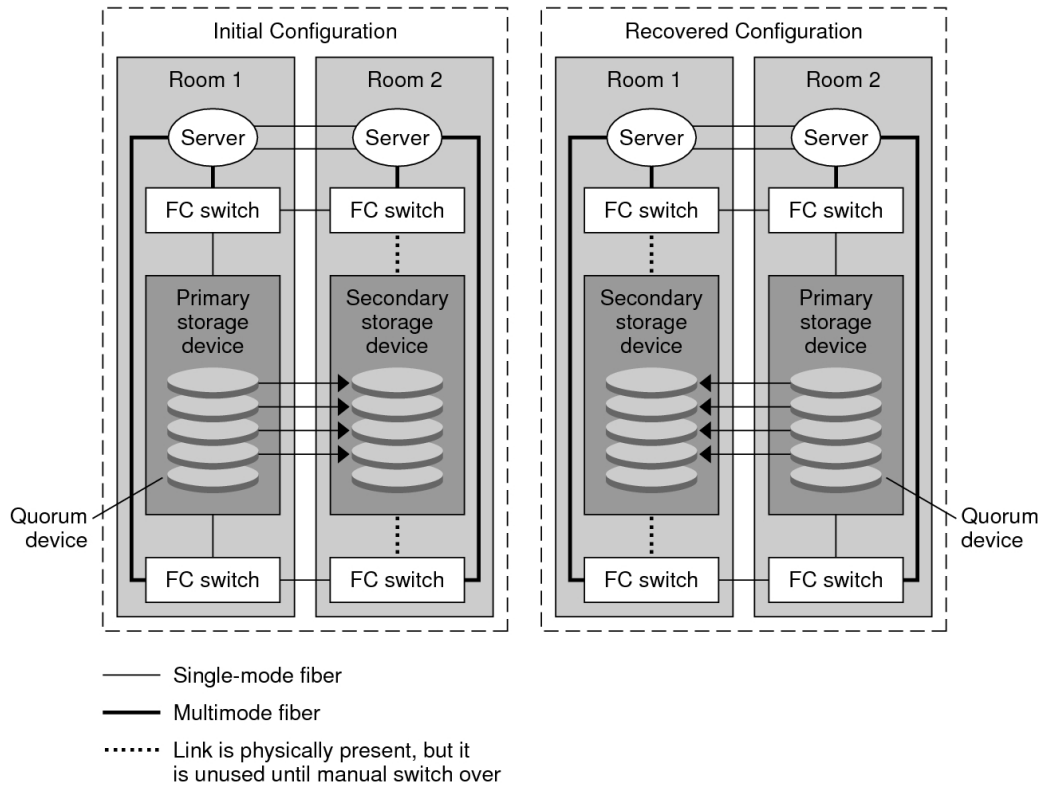
Storage-based data replication uses software installed on the storage device to manage the replication within a cluster or a campus cluster. Such software is specific to your particular storage device, and is not used for disaster recovery. Refer to the documentation that shipped with your storage device when configuring storage-based data replication.

Depending on the software you use, you can use either automatic or manual failover with storage-based data replication. Oracle Solaris Cluster supports both manual and automatic failover of the replicants with EMC SRDF software.

This section describes storage-based data replication as used in a campus cluster. [Figure 4-1](#) shows a sample two-room configuration where data is replicated between two storage arrays. In this configuration, the primary storage array is contained in the first room, where it provides data to the nodes in both rooms. The primary storage array also provides the secondary storage array with data to replicate.

Note - [Figure 4-1](#) illustrates that the quorum device is on an unreplicated volume. A replicated volume cannot be used as a quorum device.

FIGURE 4-1 Two-Room Configuration With Storage-Based Data Replication



Storage-based synchronous replication with EMC SRDF is supported with Oracle Solaris Cluster. Asynchronous replication is not supported for EMC SRDF.

Do not use EMC SRDF's Domino mode or Adaptive Copy mode. Domino mode makes the local and target SRDF volumes unavailable to the host when the target is unavailable. Adaptive Copy mode is generally used for data migrations and data center moves and it not recommended for disaster recovery.

If contact with the remote storage device is lost, ensure that an application that is running on the primary cluster is not blocked by specifying a Fence_level of never or async. If you specify a Fence_level of data or status, the primary storage device refuses updates if the updates cannot be copied to the remote storage device.

Requirements and Restrictions When Using Storage-Based Data Replication Within a Cluster

To ensure data integrity, use multipathing and the proper RAID package. The following list includes considerations for implementing a cluster configuration that uses storage-based data replication.

- If configuring the cluster for automatic failover, use synchronous replication.
For instructions on configuring the cluster for automatic failover of replicated volumes, see [“Administering Storage-Based Replicated Devices” on page 105](#). For details on the requirements to design a campus cluster, see [“Shared Data Storage” in Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).
- Particular application-specific data might not be suitable for asynchronous data replication. Use your understanding of your application's behavior to determine how best to replicate application-specific data across the storage devices.
- Node-to-node distance is limited by the Oracle Solaris Cluster Fibre Channel and interconnect infrastructure. Contact your Oracle service provider for more information about current limitations and supported technologies.
- Do not configure a replicated volume as a quorum device. Locate any quorum devices on a shared, unreplicated volume or use the quorum server.
- Ensure that only the primary copy of the data is visible to cluster nodes. Otherwise, the volume manager might try to simultaneously access both primary and secondary copies of the data. Refer to the documentation that was shipped with your storage array for information about controlling the visibility of your data copies.
- EMC SRDF allows the user to define groups of replicated devices. Each replication device group requires an Oracle Solaris Cluster device group with the same name.
- For a three-site or three-data-center configuration using EMC SRDF with concurrent or cascaded RDF devices, you must add the following entry in the Solutions Enabler SYMCLI options file on all participating cluster nodes:

```
SYMAPI_2SITE_CLUSTER_DG=device-group:rdf-group-number
```

This entry enables the cluster software to automate the movement of the application between the two SRDF synchronous sites. The *rdf-group-number* in the entry represents the RDF group that connects the host's local symmetrix to the second site's symmetrix.

For more information about three-data-center configurations, see [“Three-Data-Center \(3DC\) Topologies” in Oracle Solaris Cluster Geographic Edition Overview](#).

- Oracle Real Application Clusters (Oracle RAC) is not supported with SRDF when replicating within a cluster. Nodes connected to replicas that are not currently the primary replica will not have write access. Any scalable application that requires direct write access from all nodes of the cluster cannot be supported with replicated devices.
- The multi-owner Solaris Volume Manager for Oracle Solaris Cluster software are not supported.

- Do not use the Domino mode or Adaptive Copy mode in EMC SRDF. See [“Using Storage-Based Data Replication Within a Cluster” on page 99](#) for more information.

Manual Recovery Concerns When Using Storage-Based Data Replication Within a Cluster

As with all campus clusters, those clusters that use storage-based data replication generally do not need intervention when they experience a single failure. However, if you are using manual failover and you lose the room that holds your primary storage device (as shown in [Figure 4-1](#)), problems arise in a two-node cluster. The remaining node cannot reserve the quorum device and cannot boot as a cluster member. In this situation, your cluster requires the following manual intervention:

1. Your Oracle service provider must reconfigure the remaining node to boot as a cluster member.
2. You or your Oracle service provider must configure an unreplicated volume of your secondary storage device as a quorum device.
3. You or your Oracle service provider must configure the remaining node to use the secondary storage device as primary storage. This reconfiguration might involve rebuilding volume manager volumes, restoring data, or changing application associations with storage volumes.

Best Practices When Using Storage-Based Data Replication

When using EMC SRDF software for storage-based data replication, use dynamic devices instead of static devices. Static devices require several minutes to change the replication primary and can impact failover time.

Administering Global Devices, Disk-Path Monitoring, and Cluster File Systems

This chapter provides information about and procedures for administering global devices, disk-path monitoring, and cluster file systems.

- “Overview of Administering Global Devices and the Global Namespace” on page 103
- “Administering Storage-Based Replicated Devices” on page 105
- “Overview of Administering Cluster File Systems” on page 118
- “Administering Device Groups” on page 118
- “Administering the SCSI Protocol Settings for Storage Devices” on page 143
- “Administering Cluster File Systems” on page 148
- “Administering Disk-Path Monitoring” on page 153

For a high-level description of the related procedures in this chapter, see [Table 5-3](#).

For conceptual information related to global devices, the global namespace, device groups, disk-path monitoring, and the cluster file system, see [Oracle Solaris Cluster Concepts Guide](#) .

Overview of Administering Global Devices and the Global Namespace

Administration of Oracle Solaris Cluster device groups depends on the volume manager that is installed on the cluster. Solaris Volume Manager is “cluster-aware,” so you add, register, and remove device groups by using the Solaris Volume Manager `metaset` command. For more information, see the [metaset\(1M\)](#) man page.

Oracle Solaris Cluster software automatically creates a raw-disk device group for each disk and tape device in the cluster. However, cluster device groups remain in an offline state until you access the groups as global devices. When administering device groups, or volume manager disk groups, you need to be on the cluster node that is the primary node for the group.

Normally, you do not need to administer the global device namespace. The global namespace is automatically set up during installation and automatically updated during Oracle Solaris OS reboots. However, if the global namespace needs to be updated, you can run the `cldevice populate` command from any cluster node. This command causes the global namespace to be updated on all other cluster node members, as well as on nodes that might join the cluster in the future.

Global Device Permissions for Solaris Volume Manager

Changes made to global device permissions are not automatically propagated to all the nodes in the cluster for Solaris Volume Manager and disk devices. If you want to change permissions on global devices, you must manually change the permissions on all the nodes in the cluster. For example, if you want to change permissions on global device `/dev/global/dsk/d3s0` to 644, you must issue the following command on all nodes in the cluster:

```
# chmod 644 /dev/global/dsk/d3s0
```

Dynamic Reconfiguration With Global Devices

You must consider the following issues when completing dynamic reconfiguration operations on disk and tape devices in a cluster.

- All of the requirements, procedures, and restrictions that are documented for the Oracle Solaris dynamic reconfiguration feature also apply to Oracle Solaris Cluster dynamic reconfiguration support. The only exception is for the operating system quiescence operation. Therefore, review the documentation for the Oracle Solaris dynamic reconfiguration feature *before* using the dynamic reconfiguration feature with Oracle Solaris Cluster software. You should review in particular the issues that affect non-network IO devices during a dynamic reconfiguration detach operation.
- Oracle Solaris Cluster rejects dynamic reconfiguration remove-board operations on active devices in the primary node. Dynamic reconfiguration operations can be performed on inactive devices in the primary node and on any devices in the secondary nodes.
- After the dynamic reconfiguration operation, cluster data access continues as before.
- Oracle Solaris Cluster rejects dynamic reconfiguration operations that impact the availability of quorum devices. See [“Dynamic Reconfiguration With Quorum Devices” on page 163](#) for more information.



Caution - If the current primary node fails while you are performing the dynamic reconfiguration operation on a secondary node, cluster availability is impacted. The primary node will have no place to fail over until a new secondary node is provided.

To perform dynamic reconfiguration operations on global devices, complete the following steps in the order indicated.

TABLE 5-1 Task Map: Dynamic Reconfiguration With Disk and Tape Devices

Task	For Instructions
1. If a dynamic reconfiguration operation that affects an active device group must be performed on the current primary node, switch the primary and secondary nodes before performing the dynamic reconfiguration remove operation on the device	“How to Switch the Primary for a Device Group” on page 140
2. Perform the dynamic reconfiguration removal operation on the device being removed	Check the documentation that came with your system.

Administering Storage-Based Replicated Devices

You can configure an Oracle Solaris Cluster device group to contain devices that are replicated by using storage-based replication. Oracle Solaris Cluster software supports EMC Symmetrix Remote Data Facility software for storage-based replication.

Before you can replicate data with EMC Symmetrix Remote Data Facility software, you must be familiar with the storage-based replication documentation and have the storage-based replication product and the latest updates installed on your system. For information about installing the storage-based replication software, see the product documentation.

The storage-based replication software configures a pair of devices as replicas with one device as the primary replica and the other device as the secondary replica. At any given time, the device attached to one set of nodes will be the primary replicas. The device attached to the other set of nodes will be the secondary replica.

In an Oracle Solaris Cluster configuration, the primary replica is automatically moved whenever the Oracle Solaris Cluster device group to which the replica belongs is moved. Therefore, the replica primary should never be moved in an Oracle Solaris Cluster configuration directly. Rather, the takeover should be accomplished by moving the associated Oracle Solaris Cluster device group.



Caution - The name of the Oracle Solaris Cluster device group that you create (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

This section contains the following procedures:

- [“Administering EMC Symmetrix Remote Data Facility Replicated Devices” on page 106](#)

Administering EMC Symmetrix Remote Data Facility Replicated Devices

The following table lists the tasks you must perform to set up and manage an EMC Symmetrix Remote Data Facility (SRDF) storage-based replicated device.

TABLE 5-2 Task Map: Administering an EMC SRDF Storage-Based Replicated Device

Task	Instructions
Install the SRDF software on your storage device and nodes	The documentation that shipped with your EMC storage device.
Configure the EMC replication group	“How to Configure an EMC SRDF Replication Group” on page 106
Configure the DID device	“How to Configure DID Devices for Replication Using EMC SRDF” on page 108
Register the replicated group	“How to Add and Register a Device Group (Solaris Volume Manager)” on page 125
Verify the configuration	“How to Verify EMC SRDF Replicated Global Device Group Configuration” on page 110
Manually recover data after a campus cluster's primary room completely fails	“How to Recover EMC SRDF Data after a Primary Room's Complete Failure” on page 116

▼ How to Configure an EMC SRDF Replication Group

- Before You Begin**
- EMC Solutions Enabler software must be installed on all cluster nodes before you configure an EMC Symmetrix Remote Data Facility (SRDF) replication group. First, configure the EMC SRDF device groups on shared disks in the cluster. For more information about how to configure the EMC SRDF device groups, see your EMC SRDF product documentation.
 - When using EMC SRDF, use dynamic devices instead of static devices. Static devices require several minutes to change the replication primary and can impact failover time.



Caution - The name of the Oracle Solaris Cluster device group that you create (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on all nodes connected to the storage array.**
2. **For a three-site or three-data-center implementation using concurrent SRDF or cascaded devices, set the `SYMAPI_2SITE_CLUSTER_DG` parameter.**

Add the following entry to the Solutions Enabler options file on all participating cluster nodes:

```
SYMAPI_2SITE_CLUSTER_DG=:rdf-group-number
```

<i>device-group</i>	Specifies the name of the device group.
<i>rdf-group-number</i>	Specifies the RDF group that connects the host's local symmetrix to the second site's symmetrix.

This entry enables the cluster software to automate the movement of the application between the two SRDF synchronous sites.

For more information about three-data-center configurations, see [“Three-Data-Center \(3DC\) Topologies” in Oracle Solaris Cluster Geographic Edition Overview](#).

3. On each node configured with the replicated data, discover the symmetrix device configuration.

This might take a few minutes.

```
# /usr/symcli/bin/symcfg discover
```

4. If you have not already created the replica pairs, create them now.

Use the `symrdf` command to create your replica pairs. For instructions on creating the replica pairs, refer to your SRDF documentation.

Note - If using concurrent RDF devices for a three-site or three-data-center implementation, add the following parameter to all `symrdf` commands:

```
-rdfg rdf-group-number
```

Specifying the RDF group number to the `symrdf` command ensures that the `symrdf` operation is directed to the correct RDF group.

5. On each node configured with replicated devices, verify that data replication is set up correctly.

```
# /usr/symcli/bin/symsg show group-name
```

6. Perform a swap of the device group.

a. Verify that the primary and secondary replicas are synchronized.

```
# /usr/symcli/bin/symrdf -g group-name verify -synchronized
```

b. Determine which node contains the primary replica and which node contains the secondary replica by using the `symsg show` command.

```
# /usr/symcli/bin/symsg show group-name
```

The node with the RDF1 device contains the primary replica and the node with the RDF2 device state contains the secondary replica.

c. Enable the secondary replica.

```
# /usr/symcli/bin/symrdf -g group-name failover
```

d. Swap the RDF1 and RDF2 devices.

```
# /usr/symcli/bin/symrdf -g group-name swap -refresh R1
```

e. Enable the replica pair.

```
# /usr/symcli/bin/symrdf -g group-name establish
```

f. Verify that the primary node and secondary replicas are synchronized.

```
# /usr/symcli/bin/symrdf -g group-name verify -synchronized
```

7. Repeat all of step 5 on the node which originally had the primary replica.

Next Steps After you have configured a device group for your EMC SRDF replicated device, you must configure the device identifier (DID) driver that the replicated device uses.

▼ How to Configure DID Devices for Replication Using EMC SRDF

This procedure configures the device identifier (DID) driver that the replicated device uses. Ensure that the specified DID device instances are replicas of each other and that they belong to the specified replication group.

Before You Begin The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- 1. Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
- 2. Determine which DID devices correspond to the configured RDF1 and RDF2 devices.**

```
# /usr/symcli/bin/symdg show group-name
```

Note - If your system does not display the entire Oracle Solaris device patch, set the environment variable `SYMCLI_FULL_PDEVNAME` to 1 and retype the `symsg -show` command.

3. Determine which DID devices correspond to the Oracle Solaris devices.

```
# cldevice list -v
```

4. For each pair of matched DID devices, combine the instances into a single replicated DID device. Run the following command from the RDF2/secondary side.

```
# cldevice combine -t srdf -g replication-device-group \  
-d destination-instance source-instance
```

Note - The `-T` option is not supported for SRDF data replication devices.

<code>-t replication-type</code>	Specifies the replication type. For EMC SRDF, type SRDF .
<code>-g replication-device-group</code>	Specifies the name of the device group as shown in the <code>symsg show</code> command.
<code>-d destination-instance</code>	Specifies the DID instance that corresponds to the RDF1 device.
<code>source-instance</code>	Specifies the DID instance that corresponds to the RDF2 device.

Note - If you combine the wrong DID device, use the `-b` option for the `scdidadm` command to undo the combining of two DID devices.

```
# scdidadm -b device
```

<code>-b device</code>	The DID instance that corresponded to the <code>destination_device</code> when the instances were combined.
------------------------	---

5. If the name of a replication device group changes, additional steps are required for SRDF. After you complete steps 1 through 4, perform the appropriate additional step.

Item	Description
SRDF	If the name of the replication device group (and the corresponding global device group) changes, you must update the replicated device information by first using the <code>scdidadm -b</code> command to remove the existing information. The last step is to use the <code>cldevice combine</code> command to create a new, updated device.

6. Verify that the DID instances have been combined.

```
# cldevice list -v device
```

7. Verify that the SRDF replication is set.

```
# cldevice show device
```

8. On all nodes, verify that the DID devices for all combined DID instances are accessible.

```
# cldevice list -v
```

Next Steps After you have configured the device identifier (DID) driver that the replicated device uses, you must verify the EMC SRDF replicated global device group configuration.

▼ How to Verify EMC SRDF Replicated Global Device Group Configuration

Before You Begin Before you verify the global device group, you must first create it. You can use device groups from Solaris Volume Manager ZFS, or raw-disk. For more information, consult the following:

- [“How to Add and Register a Device Group \(Solaris Volume Manager\)” on page 125](#)
- [“How to Add and Register a Device Group \(Raw-Disk\)” on page 127](#)
- [“How to Add and Register a Replicated Device Group \(ZFS\)” on page 128](#)



Caution - The name of the Oracle Solaris Cluster device group that you created (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. Verify that the primary device group corresponds to the same node as the node that contains the primary replica.

```
# symdg -show group-name  
# cldevicegroup status -n nodename group-name
```

2. Perform a trial switchover to ensure that the device groups are configured correctly and the replicas can move between nodes.

If the device group is offline, bring it online.

```
# cldevicegroup switch -n nodename group-name
```

-n *nodename* The node to which the device group is switched. This node becomes the new primary.

3. Verify that the switchover was successful by comparing the output of the following commands.

```
# symdg -show group-name
# cldevicegroup status -n nodename group-name
```

Example: Configuring an SRDF Replication Group for Oracle Solaris Cluster

This example completes the Oracle Solaris Cluster specific steps necessary to set up SRDF replication in your cluster. The example assumes that you have already performed the following tasks:

- Completed pairing LUNS for replication between arrays.
- Installed the SRDF software on your storage device and cluster nodes.

This example involves a four-node cluster where two nodes are connected to one symmetrix and the other two nodes are connected to the second symmetrix. The SRDF device group is called dg1.

EXAMPLE 5-1 Creating Replica Pairs

Run the following command on all nodes.

```
# symcfg discover
! This operation might take up to a few minutes.
# symdev list pd
```

Symmetrix ID: 000187990182

Device Name		Directors			Device		
Sym	Physical	SA	:P DA	:IT Config	Attribute	Sts	Cap (MB)
0067	c5t600604800001879901*	16D:0	02A:C1	RDF2+Mir	N/Grp'd	RW	4315
0068	c5t600604800001879901*	16D:0	16B:C0	RDF1+Mir	N/Grp'd	RW	4315
0069	c5t600604800001879901*	16D:0	01A:C0	RDF1+Mir	N/Grp'd	RW	4315
...							

On all nodes on the RDF1 side, type:

```
# symdg -type RDF1 create dg1
# symld -g dg1 add dev 0067
```

On all nodes on the RDF2 side, type:

```
# symdg -type RDF2 create dg1
# symld -g dg1 add dev 0067
```

EXAMPLE 5-2 Verifying Data Replication Setup

From one node in the cluster, type:

```
# symdg show dg1
```

Group Name: dg1

```
Group Type                : RDF1      (RDFA)
Device Group in GNS       : No
Valid                     : Yes
Symmetrix ID              : 000187900023
Group Creation Time       : Thu Sep 13 13:21:15 2007
Vendor ID                 : EMC Corp
Application ID            : SYMCLI
```

```
Number of STD Devices in Group      : 1
Number of Associated GK's           : 0
Number of Locally-associated BCV's  : 0
Number of Locally-associated VDEV's : 0
Number of Remotely-associated BCV's (STD RDF): 0
Number of Remotely-associated BCV's (BCV RDF): 0
Number of Remotely-assoc'd RBCV's (RBCV RDF) : 0
```

Standard (STD) Devices (1):

```
{
-----
LdevName          PdevName          Sym          Cap
Dev Att. Sts      (MB)
-----
DEV001            /dev/rdisk/c5t6006048000018790002353594D303637d0s2 0067      RW
4315
}
```

Device Group RDF Information

```
...
# symrdf -g dg1 establish
```

Execute an RDF 'Incremental Establish' operation for device group 'dg1' (y/[n]) ? y

An RDF 'Incremental Establish' operation execution is in progress for device group 'dg1'. Please wait...

```
Write Disable device(s) on RA at target (R2).....Done.
Suspend RDF link(s).....Done.
Mark target (R2) devices to refresh from source (R1).....Started.
Device: 0067 ..... Marked.
Mark target (R2) devices to refresh from source (R1).....Done.
```



```
Merge device track tables between source and target.....Started.
Device: 0067 ..... Merged.
Merge device track tables between source and target.....Done.
Resume RDF link(s).....Started.
Resume RDF link(s).....Done.
```

The RDF 'Incremental Establish' operation successfully initiated for device group 'dg1'.

```
#
# symrdf -g dg1 query
```

```
Device Group (DG) Name      : dg1
DG's Type                   : RDF2
DG's Symmetrix ID          : 000187990182
```

Target (R2) View				Source (R1) View				MODES		
ST				LI	ST					
Standard	A			N	A					
Logical	T	R1 Inv	R2 Inv	K	T	R1 Inv	R2 Inv	RDF Pair		
Device	Dev	E	Tracks	Tracks	S Dev	E	Tracks	Tracks	MDA	STATE
DEV001	0067	WD	0	0	RW	0067	RW	0	0	S.. Synchronized
Total		-----		-----		-----		-----		
MB(s)		0.0		0.0		0.0		0.0		

Legend for MODES:

```
M(ode of Operation): A = Async, S = Sync, E = Semi-sync, C = Adaptive Copy
D(omino)           : X = Enabled, . = Disabled
A(daptive Copy)    : D = Disk Mode, W = WP Mode, . = ACp off
```

```
#
```

EXAMPLE 5-3 Displaying DIDs Corresponding to the Disks Used

The same procedure applies to the RDF1 and RDF2 sides.

You can look under the PdevName field of output of the `dymdg show dg` command.

On the RDF1 side, type:

```
# symdg show dg1
```

```
Group Name: dg1
```

```
Group Type : RDF1 (RDFA)
```

```
...
```

```
Standard (STD) Devices (1):
{
-----
LdevName          PdevName          Sym          Cap
Dev  Att.  Sts          (MB)
-----
DEV001            /dev/rdisk/c5t6006048000018790002353594D303637d0s2 0067  RW
4315
}
```

Device Group RDF Information

...

To obtain the corresponding DID, type:

```
# scdidadm -L | grep c5t6006048000018790002353594D303637d0
217    pmoney1:/dev/rdsk/c5t6006048000018790002353594D303637d0 /dev/did/rdsk/d217
217    pmoney2:/dev/rdsk/c5t6006048000018790002353594D303637d0 /dev/did/rdsk/d217
#
```

To list the corresponding DID, type:

```
# cldevice show d217

=== DID Device Instances ===

DID Device Name:          /dev/did/rdsk/d217
Full Device Path:        pmoney2:/dev/rdsk/
c5t6006048000018790002353594D303637d0
Full Device Path:        pmoney1:/dev/rdsk/
c5t6006048000018790002353594D303637d0
Replication:             none
default_fencing:        global

#
```

On the RDF2 side, type:

You can look under the PdevName field of output of `dymdg show dg` command.

```
# symdg show dg1

Group Name: dg1

Group Type                : RDF2      (RDFA)
...
Standard (STD) Devices (1):
{
-----
LdevName          PdevName          Sym          Cap
Dev  Att.  Sts          (MB)
-----
DEV001            /dev/rdsk/c5t6006048000018799018253594D303637d0s2 0067  WD
4315
}
```

```
Device Group RDF Information
...
```

To obtain the corresponding DID, type:

```
# scdidadm -L | grep c5t6006048000018799018253594D303637d0
108    pmoney4:/dev/rdisk/c5t6006048000018799018253594D303637d0 /dev/did/rdsk/d108
108    pmoney3:/dev/rdisk/c5t6006048000018799018253594D303637d0 /dev/did/rdsk/d108
#
```

To list the corresponding DID, type:

```
# cldevice show d108

=== DID Device Instances ===

DID Device Name:          /dev/did/rdsk/d108
Full Device Path:        pmoney3:/dev/rdsk/c5t6006048000018799018253594D303637d0
Full Device Path:        pmoney4:/dev/rdsk/c5t6006048000018799018253594D303637d0
Replication:             none
default_fencing:         global

#
```

EXAMPLE 5-4 Combining DID instances

From the RDF2 side, type:

```
# cldevice combine -t srdf -g dg1 -d d217 d108
#
```

EXAMPLE 5-5 Displaying the Combined DIDs

From any node in the cluster, type:

```
# cldevice show d217 d108
cldevice: (C727402) Could not locate instance "108".

=== DID Device Instances ===

DID Device Name:          /dev/did/rdsk/d217
Full Device Path:        pmoney1:/dev/rdsk/
c5t6006048000018799002353594D303637d0
Full Device Path:        pmoney2:/dev/rdsk/
c5t6006048000018799002353594D303637d0
Full Device Path:        pmoney4:/dev/rdsk/
c5t6006048000018799018253594D303637d0
Full Device Path:        pmoney3:/dev/rdsk/
c5t6006048000018799018253594D303637d0
Replication:             srdf
default_fencing:         global
```

#

▼ How to Recover EMC SRDF Data after a Primary Room's Complete Failure

This procedure performs data recovery when a campus cluster's primary room fails completely, the primary room fails over to a secondary room, and then the primary room comes back online. The campus cluster's primary room is the primary node and storage site. The complete failure of a room includes the failure of both the host and the storage in that room. If the primary room fails, Oracle Solaris Cluster automatically fails over to the secondary room, makes the secondary room's storage device readable and writable, and enables the failover of the corresponding device groups and resource groups.

When the primary room returns online, you can manually recover the data from the SRDF device group that was written to the secondary room and resynchronize the data. This procedure recovers the SRDF device group by synchronizing the data from the original secondary room (this procedure uses *phys-campus-2* for the secondary room) to the original primary room (*phys-campus-1*). The procedure also changes the SRDF device group type to RDF1 on *phys-campus-2* and to RDF2 on *phys-campus-1*.

Before You Begin You must configure the EMC replication group and DID devices, as well as register the EMC replication group before you can perform a manual failover. For information about creating a Solaris Volume Manager device group, see [“How to Add and Register a Device Group \(Solaris Volume Manager\)”](#) on page 125.

Note - These instructions demonstrate one method you can use to manually recover SRDF data after the primary room fails over completely and then comes back online. Check the EMC documentation for additional methods.

Log into the campus cluster's primary room to perform these steps. In the procedure below, *dg1* is the SRDF device group name. At the time of the failure, the primary room in this procedure is *phys-campus-1* and the secondary room is *phys-campus-2*.

1. **Log into the campus cluster's primary room and assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **From the primary room, use the `symrdf` command to query the replication status of the RDF devices and view information about those devices.**

```
phys-campus-1# symrdf -g dg1 query
```

Tip - A device group that is in the `split` state is not synchronized.

3. **If the RDF pair state is `split` and the device group type is RDF1, then force a failover of the SRDF device group.**

```
phys-campus-1# symrdf -g dg1 -force failover
```

4. View the status of the RDF devices.

```
phys-campus-1# symrdf -g dg1 query
```

5. After the failover, you can swap the data on the RDF devices that failed over.

```
phys-campus-1# symrdf -g dg1 swap
```

6. Verify the status and other information about the RDF devices.

```
phys-campus-1# symrdf -g dg1 query
```

7. Establish the SRDF device group in the primary room.

```
phys-campus-1# symrdf -g dg1 establish
```

8. Confirm that the device group is in a synchronized state and that the device group type is RDF2.

```
phys-campus-1# symrdf -g dg1 query
```

Example 5-6 Manually Recovering EMC SRDF Data after a Primary Site Failover

This example provides the Oracle Solaris Cluster-specific steps necessary to manually recover EMC SRDF data after a campus cluster's primary room fails over, a secondary room takes over and records data, and then the primary room comes back online. In the example, the SRDF device group is called *dg1* and the standard logical device is DEV001. The primary room is *phys-campus-1* at the time of the failure, and the secondary room is *phys-campus-2*. Perform the steps from the campus cluster's primary room, *phys-campus-1*.

```
phys-campus-1# symrdf -g dg1 query | grep DEV
DEV001 0012RW 0 0NR 0012RW 2031 0 S.. Split
```

```
phys-campus-1# symdg list | grep RDF
dg1 RDF1 Yes 00187990182 1 0 0 0 0
```

```
phys-campus-1# symrdf -g dg1 -force failover
...
```

```
phys-campus-1# symrdf -g dg1 query | grep DEV
DEV001 0012 WD 0 0 NR 0012 RW 2031 0 S.. Failed Over
```

```
phys-campus-1# symdg list | grep RDF
dg1 RDF1 Yes 00187990182 1 0 0 0 0
```

```
phys-campus-1# symrdf -g dg1 swap
...
```

```
phys-campus-1# symrdf -g dg1 query | grep DEV
```

```
DEV001 0012 WD 0 0 NR 0012 RW 0 2031 S.. Suspended

phys-campus-1# syndg list | grep RDF
dg1 RDF2 Yes 000187990182 1 0 0 0 0

phys-campus-1# symrdf -g dg1 establish
...

phys-campus-1# symrdf -g dg1 query | grep DEV
DEV001 0012 WD 0 0 RW 0012 RW 0 0 S.. Synchronized

phys-campus-1# syndg list | grep RDF
dg1 RDF2 Yes 000187990182 1 0 0 0 0
```

Overview of Administering Cluster File Systems

No special Oracle Solaris Cluster commands are necessary for cluster file system administration. Administer a cluster file system as you would any other Oracle Solaris file system, using standard Oracle Solaris file system commands, such as `mount` and `newfs`. Mount cluster file systems by specifying the `-g` option to the `mount` command. Cluster file systems use UFS and can also be automatically mounted at boot. Cluster file systems are only visible from a node in a global cluster.

Note - When the cluster file system reads files, the file system does not update the access time on those files.

Cluster File System Restrictions

The following restrictions apply to the cluster file system administration:

- The `unlink` command is not supported on directories that are not empty. For more information, see the [unlink\(1M\)](#) man page.
- The `lockfs -d` command is not supported. Use `lockfs -n` as a workaround.
- You cannot remount a cluster file system with the `directio` mount option added at remount time.

Administering Device Groups

As your cluster requirements change, you might need to add, remove, or modify the device groups on your cluster. Oracle Solaris Cluster provides an interactive interface called `clsetup`

that you can use to make these changes. `clsetup` generates `cluster` commands. Generated commands are shown in the examples at the end of some procedures. The following table lists tasks for administering device groups and provides links to the appropriate procedures in this section.



Caution - Do not run `metaset -s setname -f -t` on a cluster node that is booted outside the cluster if other nodes are active cluster members and at least one of them owns the disk set.

Note - Oracle Solaris Cluster software automatically creates a raw-disk device group for each disk and tape device in the cluster. However, cluster device groups remain in an offline state until you access the groups as global devices.

You can also bring a device group online and take it offline using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

TABLE 5-3 Task Map: Administering Device Groups

Task	Instructions
Update the global-devices namespace without a reconfiguration reboot by using the <code>cldevice populate</code> command	“How to Update the Global-Devices Namespace” on page 120
Change the size of a <code>lofi</code> device that is used for the global-devices namespace	“How to Change the Size of a <code>lofi</code> Device That Is Used for the Global-Devices Namespace” on page 121
Move an existing global-devices namespace	“How to Migrate the Global-Devices Namespace From a Dedicated Partition to a <code>lofi</code> Device” on page 122
	“How to Migrate the Global-Devices Namespace From a <code>lofi</code> Device to a Dedicated Partition” on page 124
Add Solaris Volume Manager disksets and register them as device groups by using the <code>metaset</code> command	“How to Add and Register a Device Group (Solaris Volume Manager)” on page 125
Add and register a raw-disk device group by using the <code>cldevicegroup</code> command	“How to Add and Register a Device Group (Raw-Disk)” on page 127
Add a named device group for ZFS using the <code>cldevicegroup</code> command	“How to Add and Register a Replicated Device Group (ZFS)” on page 128
Remove Solaris Volume Manager device groups from the configuration by using the <code>metaset</code> and <code>metaclear</code> commands	“How to Remove and Unregister a Device Group (Solaris Volume Manager)” on page 130
Remove a node from all device groups by using the <code>cldevicegroup</code> , <code>metaset</code> , and <code>clsetup</code> commands	“How to Remove a Node From All Device Groups” on page 130
Remove a node from a Solaris Volume Manager device group by using the <code>metaset</code> command	“How to Remove a Node From a Device Group (Solaris Volume Manager)” on page 131
Remove a node from a raw-disk device group by using the <code>cldevicegroup</code> command	“How to Remove a Node From a Raw-Disk Device Group” on page 133

Task	Instructions
Change device group properties by using <code>clsetup</code> to generate <code>cldevicegroup</code>	“How to Change Device Group Properties” on page 135
Display device groups and properties by using the <code>cldevicegroup show</code> command	“How to List a Device Group Configuration” on page 139
Change the desired number of secondaries for a device group by using <code>clsetup</code> to generate <code>cldevicegroup</code>	“How to Set the Desired Number of Secondaries for a Device Group” on page 136
Switch the primary for a device group by using the <code>cldevicegroup switch</code> command	“How to Switch the Primary for a Device Group” on page 140
Put a device group in maintenance state by using the <code>metaset</code> command	“How to Put a Device Group in Maintenance State” on page 141

▼ How to Update the Global-Devices Namespace

When adding a new global device, manually update the global-devices namespace by running the `cldevice populate` command.

Note - The `cldevice populate` command does not have any effect if the node that is running the command is not currently a cluster member. The command also has no effect if the `/global/.devices/node@nodeID` file system is not mounted.

- 1. Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
- 2. On each node in the cluster, run the `devfsadm` command.**
You can run this command on all nodes in the cluster at the same time. For more information, see the [`devfsadm\(1M\)`](#) man page.
- 3. Reconfigure the namespace.**

```
# cldevice populate
```
- 4. On each node, verify that the “`cldevice populate`” command has been completed before you attempt to create any disksets.**

The `cldevice` command calls itself remotely on all nodes, even when the command is run from just one node. To determine whether the `cldevice populate` command has completed processing, run the following command on each node of the cluster.

```
# ps -ef | grep cldevice populate
```


Example 5-7 Updating the Global-Devices Namespace

The following example shows the output generated by successfully running the `cldevice populate` command.

```
# devfsadm
cldevice populate
Configuring the /dev/global directory (global devices)...
obtaining access to all attached disks
reservation program successfully exiting
# ps -ef | grep cldevice populate
```

▼ How to Change the Size of a lofi Device That Is Used for the Global-Devices Namespace

If you use a lofi device for the global-devices namespace on one or more nodes of the global cluster, perform this procedure to change the size of the device.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on a node whose lofi device for the global-devices namespace you want to resize.**
2. **Evacuate services off the node and reboot the node into noncluster mode.**
Do this to ensure that global devices are not served from this node while you perform this procedure. For instructions, see [“How to Boot a Node in Noncluster Mode” on page 93](#).
3. **Unmount the global-device file system and detach its lofi device.**
The global-devices file system mounts locally.

```
phys-schost# umount /global/.devices/node@\`clinfo -n` > /dev/null 2>&1
```

Ensure that the lofi device is detached

```
phys-schost# lofiadm -d /.globaldevices
```

The command returns no output if the device is detached

Note - If the file system is mounted by using the `-m` option, no entry is added to the `mnttab` file. The `umount` command might report a warning similar to the following:

```
umount: warning: /global/.devices/node@2 not in mnttab  =====>>>
not mounted
```

This warning is safe to ignore.

4. **Delete and recreate the `/.globaldevices` file with the required size.**
The following example shows the creation of a new `/.globaldevices` file that is 200 Mbytes in size.

```
phys-schost# rm /.globaldevices
phys-schost# mkfile 200M /.globaldevices
```

5. **Create a new file system for the global-devices namespace.**

```
phys-schost# lofiadm -a /.globaldevices
phys-schost# newfs `lofiadm /.globaldevices` < /dev/null
```

6. **Boot the node into cluster mode.**

The global devices are now populated on the new file system.

```
phys-schost# reboot
```

7. **Migrate to the node any services that you want to run on that node.**

Migrating the Global-Devices Namespace

You can create a namespace on a loopback file interface (`lofi`) device, rather than creating a global-devices namespace on a dedicated partition.

Note - ZFS for root file systems is supported, with one significant exception. If you use a dedicated partition of the boot disk for the global-devices file system, you must use only UFS as its file system. The global-devices namespace requires the proxy file system (PxFS) running on a UFS file system. However, a UFS file system for the global-devices namespace can coexist with a ZFS file system for the root (`/`) file system and other root file systems, for example, `/var` or `/home`. Alternatively, if you instead use a `lofi` device to host the global-devices namespace, there is no limitation on the use of ZFS for root file systems.

The following procedures describe how to move an existing global-devices namespace from a dedicated partition to a `lofi` device or the opposite:

- [“How to Migrate the Global-Devices Namespace From a Dedicated Partition to a `lofi` Device” on page 122](#)
- [“How to Migrate the Global-Devices Namespace From a `lofi` Device to a Dedicated Partition” on page 124](#)

▼ How to Migrate the Global-Devices Namespace From a Dedicated Partition to a `lofi` Device

1. **Assume the `rootrole` on the global-cluster node whose namespace location you want to change.**

2. Evacuate services off the node and reboot the node into noncluster mode.

Do this to ensure that global devices are not served from this node while you perform this procedure. For instructions, see [“How to Boot a Node in Noncluster Mode” on page 93](#).

3. Ensure that a file named `/.globaldevices` does not exist on the node.

If the file does exist, delete it.

4. Create the `lofi` device.

```
# mkfile 100m /.globaldevices# lofiadm -a /.globaldevices
# LOFI_DEV=`lofiadm /.globaldevices`
# newfs `echo ${LOFI_DEV} | sed -e 's/lofi/rlofi/g'` < /dev/null# lofiadm -d /.
globaldevices
```

5. In the `/etc/vfstab` file, comment out the global-devices namespace entry.

This entry has a mount path that begins with `/global/.devices/node@nodeID`.

6. Unmount the global-devices partition `/global/.devices/node@nodeID`.

7. Disable and re-enable the `globaldevices` and `scmountdev` SMF services.

```
# svcadm disable globaldevices
# svcadm disable scmountdev
# svcadm enable scmountdev
# svcadm enable globaldevices
```

A `lofi` device is now created on `/.globaldevices` and mounted as the global-devices file system.

8. Repeat these steps on other nodes whose global-devices namespace you want to migrate from a partition to a `lofi` device.

9. From one node, populate the global-device namespaces.

```
# /usr/cluster/bin/cldevice populate
```

On each node, verify that the command has completed processing before you perform any further actions on the cluster.

```
# ps -ef | grep cldevice populate
```

The global-devices namespace now resides on a `lofi` device.

10. Migrate to the node any services that you want to run on that node.

▼ How to Migrate the Global-Devices Namespace From a `lofi` Device to a Dedicated Partition

1. Assume the `root` role on the global-cluster node whose namespace location you want to change.
2. Evacuate services off the node and reboot the node into noncluster mode. Do this to ensure that global devices are not served from this node while you perform this procedure. For instructions, see [“How to Boot a Node in Noncluster Mode”](#) on page 93.
3. On a local disk of the node, create a new partition that meets the following requirements:

- Is at least 512 MByte in size
- Uses the UFS file system

4. Add an entry to the `/etc/vfstab` file for the new partition to be mounted as the global-devices file system.

- Determine the current node's node ID.

```
# /usr/sbin/clinfo -n node-ID
```

- Create the new entry in the `/etc/vfstab` file, using the following format:

```
blockdevice rawdevice /global/.devices/node@nodeID ufs 2 no global
```

For example, if the partition that you choose to use is `/dev/did/rdisk/d5s3`, the new entry to add to the `/etc/vfstab` file would then be as follows: `/dev/did/dsk/d5s3 /dev/did/rdisk/d5s3 /global/.devices/node@3 ufs 2 no global`

5. Unmount the global devices partition `/global/.devices/node@nodeID`.
6. Remove the `lofi` device that is associated with the `/.globaldevices` file.

```
# lofiadm -d /.globaldevices
```

7. Delete the `/.globaldevices` file.

```
# rm /.globaldevices
```

8. Disable and re-enable the `globaldevices` and `scmountdev` SMF services.

```
# svcadm disable globaldevices# svcadm disable scmountdev
# svcadm enable scmountdev
# svcadm enable globaldevices
```

The partition is now mounted as the global-devices namespace file system.

9. Repeat these steps on other nodes whose global-devices namespace you might want to migrate from a `lofi` device to a partition.
10. Boot into cluster mode and populate the global-devices namespace.
 - a. From one node in the cluster, populate the global-devices namespace.


```
# /usr/cluster/bin/cldevice populate
```
 - b. Ensure that the process completes on all nodes of the cluster before you perform any further action on any of the nodes.


```
# ps -ef | grep cldevice populate
```

The global-devices namespace now resides on the dedicated partition.
11. Migrate to the node any services that you want to run on that node.

Adding and Registering Device Groups

You can add and register device groups for Solaris Volume Manager, ZFS, or raw-disk.

▼ How to Add and Register a Device Group (Solaris Volume Manager)

Use the `metaset` command to create a Solaris Volume Manager disk set and register the disk set as an Oracle Solaris Cluster device group. When you register the disk set, the name that you assigned to the disk set is automatically assigned to the device group.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.



Caution - The name of the Oracle Solaris Cluster device group that you create (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

1. Assume a role that provides `solaris.cluster.modify` RBAC authorization on one of the nodes connected to the disks where you are creating the disk set.

2. Add the Solaris Volume Manager disk set and register it as a device group with Oracle Solaris Cluster.

To create a multi-owner disk group, use the `-M` option.

```
# metaset -s diskset -a -M -h nodelist
```

`-s diskset` Specifies the disk set to be created.

`-a -h nodelist` Adds the list of nodes that can master the disk set.

`-M` Designates the disk group as multi-owner.

Note - Running the `metaset` command to set up a Solaris Volume Manager device group on a cluster results in one secondary by default, regardless of the number of nodes that are included in that device group. You can change the desired number of secondary nodes by using the `clsetup` utility after the device group has been created. Refer to [“How to Set the Desired Number of Secondaries for a Device Group” on page 136](#) for more information about disk failover.

3. If you are configuring a replicated device group, set the replication property for the device group.

```
# cldevicegroup sync devicegroup
```

4. Verify that the device group has been added.

The device group name matches the disk set name that is specified with `metaset`.

```
# cldevicegroup list
```

5. List the DID mappings.

```
# cldevice show | grep Device
```

- Choose drives that are shared by the cluster nodes that will master or potentially master the disk set.
- Use the full DID device name, which has the form `/dev/did/rdisk/dN`, when you add a drive to a disk set.

In the following example, the entries for DID device `/dev/did/rdisk/d3` indicate that the drive is shared by `phys-schost-1` and `phys-schost-2`.

```
=== DID Device Instances ===
DID Device Name: /dev/did/rdisk/d1
Full Device Path: phys-schost-1:/dev/rdisk/c0t0d0
DID Device Name: /dev/did/rdisk/d2
Full Device Path: phys-schost-1:/dev/rdisk/c0t6d0
DID Device Name: /dev/did/rdisk/d3
Full Device Path: phys-schost-1:/dev/rdisk/clt1d0
```

```
Full Device Path:          phys-schost-2:/dev/rdisk/c1t1d0
...
```

6. Add the drives to the disk set.

Use the full DID path name.

```
# metaset -s setname -a /dev/did/rdsk/dN
```

-s *setname* Specifies the disk set name, which is the same as the device group name.

-a Adds the drive to the disk set.

Note - Do *not* use the lower-level device name (*cNtXdY*) when you add a drive to a disk set. Because the lower-level device name is a local name and not unique throughout the cluster, using this name might prevent the metaset from being able to switch over.

7. Verify the status of the disk set and drives.

```
# metaset -s setname
```

Example 5-8 Adding a Solaris Volume Manager Device Group

The following example shows the creation of the disk set and device group with the disk drives `/dev/did/rdsk/d1` and `/dev/did/rdsk/d2` and verifies that the device group has been created.

```
# metaset -s dg-schost-1 -a -h phys-schost-1
```

```
# cldevicegroup list
dg-schost-1
```

```
# metaset -s dg-schost-1 -a /dev/did/rdsk/d1 /dev/did/rdsk/d2
```

▼ How to Add and Register a Device Group (Raw-Disk)

Oracle Solaris Cluster software supports the use of raw-disk device groups in addition to other volume managers. When you initially configure Oracle Solaris Cluster, device groups are automatically configured for each raw device in the cluster. Use this procedure to reconfigure these automatically created device groups for use with Oracle Solaris Cluster software.

Create a new device group of the raw-disk type for the following reasons:

- You want to add more than one DID to the device group
- You need to change the name of the device group

- You want to create a list of device groups without using the `-v` option of the `cldevicegroup` command



Caution - If you are creating a device group on replicated devices, the name of the device group that you create (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

1. Identify the devices that you want to use and unconfigure any predefined device groups.

The following commands remove the predefined device groups for `d7` and `d8`.

```
paris-1# cldevicegroup disable dsk/d7 dsk/d8
paris-1# cldevicegroup offline dsk/d7 dsk/d8
paris-1# cldevicegroup delete dsk/d7 dsk/d8
```

2. Create the new raw-disk device group, including the desired devices.

The following command creates a global device group, `rawdg`, which contains `d7` and `d8`.

```
paris-1# cldevicegroup create -n phys-paris-1,phys-paris-2 -t rawdisk
        -d d7,d8 rawdg
paris-1# /usr/cluster/lib/dcs/clcg show rawdg -d d7 rawdg
paris-1# /usr/cluster/lib/dcs/clcg show rawdg -d d8 rawdg
```

▼ How to Add and Register a Replicated Device Group (ZFS)

To replicate ZFS, you must create a named device group and list the disks that belong to the `zpool`. A device can belong to only one device group at a time, so if you already have an Oracle Solaris Cluster device group that contains the device, you must delete the group before you add that device to a new ZFS device group.

The name of the Oracle Solaris Cluster device group that you create (Solaris Volume Manager or raw-disk) must be the same as the name of the replicated device group.

1. Delete the default device groups that correspond to the devices in the `zpool`.

For example, if you have a `zpool` called `mypool` that contains two devices `/dev/did/dsk/d2` and `/dev/did/dsk/d13`, you must delete the two default device groups called `d2` and `d13`.

```
# cldevicegroup offline dsk/d2 dsk/d13
# cldevicegroup delete dsk/d2 dsk/d13
```

2. Create a named device group with DIDs that correspond to those in the device group you removed in [Step 1](#).


```
# cldevicegroup create -n pnode1,pnode2 -d d2,d13 -t rawdisk mypool
```

This action creates a device group called mypool (with the same name as the zpool), which manages the raw devices /dev/did/dsk/d2 and /dev/did/dsk/d13.

3. Create a zpool that contains those devices.

```
# zpool create mypool mirror /dev/did/dsk/d2 /dev/did/dsk/d13
```

4. Create a resource group to manage migration of the replicated devices (in the device group) with only global zones in its nodelist.

```
# clrg create -n pnode1,pnode2 migrate_srdfdg-rg
```

5. Create a hasp-rs resource in the resource group you created in [Step 4](#), setting the globaldevicepaths property to a device group of type raw-disk.

You created this device in [Step 2](#).

```
# clrs create -t HASStoragePlus -x globaldevicepaths=mypool -g \
migrate_srdfdg-rg hasp2migrate_mypool
```

6. Set the +++ value in the rg_affinities property from this resource group to the resource group you created in [Step 4](#).

```
# clrg create -n pnode1,pnode2 -p \
RG_affinities=+++migrate_srdfdg-rg oracle-rg
```

7. Create an HASStoragePlus resource (hasp-rs) for the zpool you created in [Step 3](#) in the resource group that you created in either [Step 4](#) or [Step 6](#).

Set the resource_dependencies property to the hasp-rs resource that you created in [Step 5](#).

```
# clrs create -g oracle-rg -t HASStoragePlus -p zpools=mypool \
-p resource_dependencies=hasp2migrate_mypool \
-p ZpoolsSearchDir=/dev/did/dsk hasp2import_mypool
```

8. Use the new resource group name where a device group name is required.

Maintaining Device Groups

You can perform a variety of administrative tasks for your device groups. Some of these tasks can also be performed in the Oracle Solaris Cluster GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

How to Remove and Unregister a Device Group (Solaris Volume Manager)

Device groups are Solaris Volume Manager disksets that have been registered with Oracle Solaris Cluster. To remove a Solaris Volume Manager device group, use the `metaclear` and `metaset` commands. These commands remove the device group with the same name and unregister the disk group as an Oracle Solaris Cluster device group.

Refer to the Solaris Volume Manager documentation for the steps to remove a disk set.

▼ How to Remove a Node From All Device Groups

Use this procedure to remove a cluster node from all device groups that list the node in their lists of potential primaries.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on the node that you are removing as a potential primary of all device groups.**
2. **Determine the device group or groups of which the node to be removed is a member.**

Look for the node name in the `Device group node list` for each device group.

```
# cldevicegroup list -v
```

3. **If any of the device groups identified in [Step 2](#) are of the device group type `SVM`, perform the steps in [“How to Remove a Node From a Device Group \(Solaris Volume Manager\)”](#) on page 131 for each device group of that type.**
 4. **Determine the raw-device disk groups of which the node to be removed is a member.**
- ```
cldevicegroup list -v
```
5. **If any of the device groups listed in [Step 4](#) are of the device group types `Disk` or `Local_Disk`, perform the steps in [“How to Remove a Node From a Raw-Disk Device Group”](#) on page 133 for each of these device groups.**

**6. Verify that the node has been removed from the potential primaries list of all device groups.**

The command returns nothing if the node is no longer listed as a potential primary of any device group.

```
cldevicegroup list -v nodename
```

## ▼ How to Remove a Node From a Device Group (Solaris Volume Manager)

Use this procedure to remove a cluster node from the list of potential primaries of a Solaris Volume Manager device group. Repeat the `metaset` command for each device group from which you want to remove the node.



**Caution** - Do not run `metaset -s setname -f -t` on a cluster node that is booted outside the cluster if other nodes are active cluster members and at least one of them owns the disk set.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

**1. Verify that the node is still a member of the device group and that the device group is a Solaris Volume Manager device group.**

Device group type SDS/SVM indicates a Solaris Volume Manager device group.

```
phys-schost-1% cldevicegroup show devicegroup
```

**2. Determine which node is the current primary for the device group.**

```
cldevicegroup status devicegroup
```

**3. Assume the root role on the node that currently owns the device group that you want to modify.**

**4. Delete the node's hostname from the device group.**

```
metaset -s setname -d -h nodelist
```

`-s setname` Specifies the device group name.

`-d` Deletes from the device group the nodes identified with `-h`.

`-h nodelist` Specifies the node name of the node or nodes that will be removed.

---

**Note** - The update can take several minutes to complete.

---

If the command fails, add the `-f` (force) option to the command.

```
metaset -s setname -d -f -h nodelist
```

5. Repeat [Step 4](#) for each device group from which the node is being removed as a potential primary.
6. Verify that the node has been removed from the device group.

The device group name matches the disk set name that is specified with `metaset`.

```
phys-schost-1% cldevicegroup list -v devicegroup
```

**Example 5-9** Removing a Node From a Device Group (Solaris Volume Manager)

The following example shows the removal of the hostname `phys-schost-2` from a device group configuration. This example eliminates `phys-schost-2` as a potential primary for the designated device group. Verify removal of the node by running the `cldevicegroup show` command. Check that the removed node is no longer displayed in the screen text.

```
[Determine the Solaris Volume Manager
 device group for the node:]
cldevicegroup show dg-schost-1
=== Device Groups ===

Device Group Name: dg-schost-1
Type: SVM
failback: no
Node List: phys-schost-1, phys-schost-2
preferenced: yes
numsecondaries: 1
diskset name: dg-schost-1
[Determine which node is the current primary for the device group:]
cldevicegroup status dg-schost-1
=== Cluster Device Groups ===

--- Device Group Status ---

Device Group Name Primary Secondary Status

dg-schost-1 phys-schost-1 phys-schost-2 Online
[Assume the root role on the node that currently owns the device group.]
[Remove the host name from the device group:]
metaset -s dg-schost-1 -d -h phys-schost-2
[Verify removal of the node:]
phys-schost-1% cldevicegroup list -v dg-schost-1
```

```

=== Cluster Device Groups ===

--- Device Group Status ---

Device Group Name Primary Secondary Status

dg-schost-1 phys-schost-1 - Online

```

## ▼ How to Remove a Node From a Raw-Disk Device Group

Use this procedure to remove a cluster node from the list of potential primaries of a raw-disk device group.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.read` and `solaris.cluster.modify` RBAC authorization on a node in the cluster** *other than the node to remove*.
2. **Identify the device groups that are connected to the node being removed, and determine which are raw-disk device groups.**

```
cldevicegroup show -n nodename -t rawdisk +
```

3. **Disable the `localonly` property of each `Local_Disk` raw-disk device group.**

```
cldevicegroup set -p localonly=false devicegroup
```

See the [cldevicegroup\(1CL\)](#) man page for more information about the `localonly` property.

4. **Verify that you have disabled the `localonly` property of all raw-disk device groups that are connected to the node being removed.**

The `Disk` device group type indicates that the `localonly` property is disabled for that raw-disk device group.

```
cldevicegroup show -n nodename -t rawdisk -v +
```

5. **Remove the node from all raw-disk device groups that are identified in [Step 2](#).**

You must complete this step for each raw-disk device group that is connected to the node being removed.

```
cldevicegroup remove-node -n nodename devicegroup
```

**Example 5-10** Removing a Node From a Raw Device Group

This example shows how to remove a node (phys-schost-2) from a raw-disk device group. All commands are run from another node of the cluster (phys-schost-1).

[Identify the device groups connected to the node being removed, and determine which are raw-disk

```
device groups:]
phys-schost-1# cldevicegroup show -n phys-schost-2 -t rawdisk -v +
Device Group Name: dsk/d4
Type: Disk
failback: false
Node List: phys-schost-2
preferenced: false
localonly: false
autogen true
numsecondaries: 1
device names: phys-schost-2
```

```
Device Group Name: dsk/d1
Type: SVM
failback: false
Node List: pbrave1, pbrave2
preferenced: true
localonly: false
autogen true
numsecondaries: 1
diskset name: ms1
```

```
(dsk/d4) Device group node list: phys-schost-2
(dsk/d2) Device group node list: phys-schost-1, phys-schost-2
(dsk/d1) Device group node list: phys-schost-1, phys-schost-2
```

[Disable the localonly flag for each local disk on the node:]

```
phys-schost-1# cldevicegroup set -p localonly=false dsk/d4
```

[Verify that the localonly flag is disabled:]

```
phys-schost-1# cldevicegroup show -n phys-schost-2 -t rawdisk +
(dsk/d4) Device group type: Disk
(dsk/d8) Device group type: Local_Disk
```

[Remove the node from all raw-disk device groups:]

```
phys-schost-1# cldevicegroup remove-node -n phys-schost-2 dsk/d4
phys-schost-1# cldevicegroup remove-node -n phys-schost-2 dsk/d2
phys-schost-1# cldevicegroup remove-node -n phys-schost-2 dsk/d1
```

## ▼ How to Change Device Group Properties

The method for establishing the primary ownership of a device group is based on the setting of an ownership preference attribute called `preferenced`. If the attribute is not set, the primary owner of an otherwise unowned device group is the first node that attempts to access a disk in that group. However, if this attribute is set, you must specify the preferred order in which nodes attempt to establish ownership.

If you disable the `preferenced` attribute, then the `fallback` attribute is also automatically disabled. However, if you attempt to enable or re-enable the `preferenced` attribute, you have the choice of enabling or disabling the `fallback` attribute.

If the `preferenced` attribute is either enabled or re-enabled, you are required to reestablish the order of nodes in the primary ownership preference list.

This procedure uses 5 to set or unset the `preferenced` attribute and the `fallback` attribute for Solaris Volume Manager device groups.

**Before You Begin** To perform this procedure, you need the name of the device group for which you are changing attribute values.

The `phys - schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.read` and `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
2. **Start the `clsetup` utility.**  

```
clsetup
```

The Main Menu is displayed.
3. **To work with device groups, type the number for the option for device groups and volumes.**  

The Device Groups Menu is displayed.
4. **To change key properties of a device group, type the number for the option for changing key properties of a Solaris Volume Manager device group.**  

The Change Key Properties Menu is displayed.
5. **To change a device group property, type the number for option for changing the preferences or fallback properties.**

Follow the instructions to set the preferred and failback options for a device group.

## 6. Verify that the device group attributes have been changed.

Look for the device group information displayed by the following command.

```
cldevicegroup show -v devicegroup
```

### Example 5-11 Changing Device Group Properties

The following example shows the `cldevicegroup` command generated by `clsetup` when it sets the attribute values for a device group (`dg-schost-1`).

```
cldevicegroup set -p preferred=true -p failback=true -p numsecondaries=1 \
-p nodelist=phys-schost-1,phys-schost-2 dg-schost-1
cldevicegroup show dg-schost-1
```

```
=== Device Groups ===
```

|                    |                              |
|--------------------|------------------------------|
| Device Group Name: | dg-schost-1                  |
| Type:              | SVM                          |
| failback:          | yes                          |
| Node List:         | phys-schost-1, phys-schost-2 |
| preferred:         | yes                          |
| numsecondaries:    | 1                            |
| diskset names:     | dg-schost-1                  |

## ▼ How to Set the Desired Number of Secondaries for a Device Group

The `numsecondaries` property specifies the number of nodes within a device group that can master the group if the primary node fails. The default number of secondaries for device services is one. You can set the value to any integer between one and the number of operational nonprimary provider nodes in the device group.

This setting is an important factor in balancing cluster performance and availability. For example, increasing the desired number of secondaries increases the device group's opportunity to survive multiple failures that occur simultaneously within a cluster. Increasing the number of secondaries also decreases performance regularly during normal operation. A smaller number of secondaries typically results in better performance, but reduces availability. However, a larger number of secondaries does not always result in greater availability of the file system or device group in question. Refer to [Chapter 3, “Key Concepts for System Administrators and Application Developers,”](#) in *Oracle Solaris Cluster Concepts Guide* for more information.



If you change the `numsecondaries` property, secondary nodes are added or removed from the device group if the change causes a mismatch between the actual number of secondaries and the desired number.

This procedure uses the `clsetup` utility to set the `numsecondaries` property for all types of device groups. Refer to [cldevicegroup\(1CL\)](#) for information about device group options when configuring any device group.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.read` and `solaris.cluster.modify` RBAC authorization on any node of the cluster.**

2. **Start the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

3. **To work with device groups, select the Device Groups and Volumes menu item.**

The Device Groups Menu is displayed.

4. **To change key properties of a device group, select the Change Key Properties of a Device Group menu item.**

The Change Key Properties Menu is displayed.

5. **To change the desired number of secondaries, type the number for the option for changing the `numsecondaries` property.**

Follow the instructions and type the desired number of secondaries to be configured for the device group. The corresponding `cldevicegroup` command is then executed, a log is printed, and the utility returns to the previous menu.

6. **Validate the device group configuration.**

```
cldevicegroup show dg-schost-1
```

```
=== Device Groups ===
```

```
Device Group Name: dg-schost-1
Type: Local_Disk
```

```
failback: yes
Node List: phys-schost-1, phys-schost-2 phys-schost-3
preferenced: yes
numsecondaries: 1
diskgroup names: dg-schost-1
```

---

**Note** - Device group configuration changes include adding or removing volumes, as well as changing the group, owner, or permissions of existing volumes. Reregistration after configuration changes ensures that the global namespace is in the correct state. See [“How to Update the Global-Devices Namespace” on page 120](#).

---

## 7. Verify that the device group attribute has been changed.

Look for the device group information that is displayed by the following command.

```
cldevicegroup show -v devicegroup
```

### Example 5-12 Changing the Desired Number of Secondaries (Solaris Volume Manager)

The following example shows the `cldevicegroup` command that is generated by `clsetup` when it configures the desired number of secondaries for a device group (`dg-schost-1`). This example assumes that the disk group and volume were created previously.

```
cldevicegroup set -p numsecondaries=1 dg-schost-1
cldevicegroup show -v dg-schost-1

=== Device Groups ===

Device Group Name: dg-schost-1
Type: SVM
failback: yes
Node List: phys-schost-1, phys-schost-2
preferenced: yes
numsecondaries: 1
diskset names: dg-schost-1
```

### Example 5-13 Setting the Desired Number of Secondaries to the Default Value

The following example shows use of a null string value to configure the default number of secondaries. The device group will be configured to use the default value, even if the default value changes.

```
cldevicegroup set -p numsecondaries= dg-schost-1
cldevicegroup show -v dg-schost-1

=== Device Groups ===

Device Group Name: dg-schost-1
Type: SVM
```

```

failback: yes
Node List: phys-schost-1, phys-schost-2 phys-schost-3
preferenced: yes
numsecondaries: 1
diskset names: dg-schost-1

```

## ▼ How to List a Device Group Configuration

You do not need to be the root role to list the configuration. However, you do need `solaris.cluster.read` authorization.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- **Use one method from the following list.**

|                                                      |                                                                                                            |
|------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| Oracle Solaris Cluster Manager GUI                   | See <a href="#">Chapter 13, “Using the Oracle Solaris Cluster GUI”</a> for more information.               |
| <code>cldevicegroup show</code>                      | Use <code>cldevicegroup show</code> to list the configuration for all device groups in the cluster.        |
| <code>cldevicegroup show <i>devicegroup</i></code>   | Use <code>cldevicegroup show <i>devicegroup</i></code> to list the configuration of a single device group. |
| <code>cldevicegroup status <i>devicegroup</i></code> | Use <code>cldevicegroup status <i>devicegroup</i></code> to determine the status of a single device group. |
| <code>cldevicegroup status +</code>                  | Use <code>cldevicegroup status +</code> to determine the status of all device groups in the cluster.       |

Use the `-v` option with any of these commands to obtain more detailed information.

**Example 5-14** Listing the Status of All Device Groups

```

cldevicegroup status +
=== Cluster Device Groups ===
--- Device Group Status ---

```

| Device Group Name | Primary       | Secondary     | Status  |
|-------------------|---------------|---------------|---------|
| dg-schost-1       | phys-schost-2 | phys-schost-1 | Online  |
| dg-schost-2       | phys-schost-1 | --            | Offline |
| dg-schost-3       | phys-schost-3 | phy-shost-2   | Online  |

**Example 5-15** Listing the Configuration of a Particular Device Group

```
cldevicegroup show dg-schost-1

=== Device Groups ===

Device Group Name: dg-schost-1
Type: SVM
failback: yes
Node List: phys-schost-2, phys-schost-3
preferenced: yes
numsecondaries: 1
diskset names: dg-schost-1
```

## ▼ How to Switch the Primary for a Device Group

This procedure can also be used to start (bring online) an inactive device group.

You can also bring an inactive device group online using the Oracle Solaris Cluster Manager GUI. See the Oracle Solaris Cluster Manager online help for more information. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- 1. Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
- 2. Use `cldevicegroup switch` to switch the device group primary.**

```
cldevicegroup switch -n nodename devicegroup
```

`-n nodename`            Specifies the name of the node to switch to. This node become the new primary.

`devicegroup`            Specifies the device group to switch.

### 3. Verify that the device group has been switched to the new primary.

If the device group is properly registered, information for the new device group is displayed when you use the following command.

```
cldevice status devicegroup
```

#### Example 5-16 Switching the Primary for a Device Group

The following example shows how to switch the primary for a device group and verify the change.

```
cldevicegroup switch -n phys-schost-1 dg-schost-1

cldevicegroup status dg-schost-1

=== Cluster Device Groups ===

--- Device Group Status ---

Device Group Name Primary Secondary Status

dg-schost-1 phys-schost-1 phys-schost-2 Online
```

## ▼ How to Put a Device Group in Maintenance State

Putting a device group in maintenance state prevents that device group from automatically being brought online whenever one of its devices is accessed. You should put a device group in maintenance state when completing repair procedures that require that all I/O activity be quiesced until completion of the repair. Putting a device group in maintenance state also helps prevent data loss by ensuring that a device group is not brought online on one node while the disk set or disk group is being repaired on another node.

For instructions on how to restore a corrupted diskset, see [“Restoring a Corrupted Diskset” on page 267](#).

---

**Note** - Before a device group can be placed in maintenance state, all access to its devices must be stopped, and all dependent file systems must be unmounted.

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also take an active device group offline using the Oracle Solaris Cluster Manager GUI. See the Oracle Solaris Cluster Manager online help for more information. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

**1. Place the device group in maintenance state.**

**a. If the device group is enabled, disable the device group.**

```
cldevicegroup disable devicegroup
```

**b. Take the device group offline.**

```
cldevicegroup offline devicegroup
```

**2. If the repair procedure being performed requires ownership of a disk set or disk group, manually import that disk set or disk group.**

For Solaris Volume Manager:

```
metaset -C take -f -s diskset
```



---

**Caution** - If you are taking ownership of a Solaris Volume Manager disk set, you *must* use the `metaset -C take` command when the device group is in maintenance state. Using `metaset -t` brings the device group online as part of taking ownership.

---

**3. Complete the repair procedure that you need to perform.**

**4. Release ownership of the disk set or disk group.**



---

**Caution** - Before taking the device group out of maintenance state, you must release ownership of the disk set or disk group. Failure to release ownership can result in data loss.

---

```
metaset -C release -s diskset
```

**5. Bring the device group online.**

```
cldevicegroup online devicegroup
cldevicegroup enable devicegroup
```

**Example 5-17** Putting a Device Group in Maintenance State

This example shows how to put device group `dg-schost-1` in maintenance state, and remove the device group from maintenance state.

```
[Place the device group in maintenance state.]
cldevicegroup disable dg-schost-1
```

```
cldevicegroup offline dg-schost-1
 [If needed, manually import the disk set or disk group.]
metaset -C take -f -s dg-schost-1
 [Complete all necessary repair procedures.]
 [Release ownership.]
metaset -C release -s dg-schost-1
 [Bring the device group online.]
cldevicegroup online dg-schost-1
cldevicegroup enable dg-schost-1
```

## Administering the SCSI Protocol Settings for Storage Devices

Oracle Solaris Cluster software installation automatically assigns SCSI reservations to all storage devices. Use the following procedures to check the settings of devices and, if necessary, to override the setting for a device:

- [“How to Display the Default Global SCSI Protocol Settings for All Storage Devices” on page 143](#)
- [“How to Display the SCSI Protocol of a Single Storage Device” on page 144](#)
- [“How to Change the Default Global Fencing Protocol Settings for All Storage Devices” on page 145](#)
- [“How to Change the Fencing Protocol for a Single Storage Device” on page 146](#)

### ▼ How to Display the Default Global SCSI Protocol Settings for All Storage Devices

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.read` RBAC authorization.**
2. **From any node, display the current global default SCSI protocol setting.**

```
cluster show -t global
```

For more information, see the [cluster\(1CL\)](#) man page.

**Example 5-18** Displaying the Default Global SCSI Protocol Settings for All Storage Devices

The following example displays the SCSI protocol settings for all storage devices on the cluster.

```
cluster show -t global

=== Cluster ===

Cluster Name: racerxx
clusterid: 0x4FES2C888
installmode: disabled
heartbeat_timeout: 10000
heartbeat_quantum: 1000
private_netaddr: 172.16.0.0
private_netmask: 255.255.111.0
max_nodes: 64
max_privatenets: 10
udp_session_timeout: 480
concentrate_load: False
global_fencing: prefer3
Node List: phys-racerxx-1, phys-racerxx-2
```

## ▼ How to Display the SCSI Protocol of a Single Storage Device

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.read` RBAC authorization.**
2. **From any node, display the SCSI protocol setting of the storage device.**

```
cldevice show device
```

*device*                    The name of the device path or a device name.

For more information, see the [cldevice\(1CL\)](#) man page.

**Example 5-19** Displaying the SCSI Protocol of a Single Device

The following example displays the SCSI protocol for the device `/dev/rdisk/c4t8d0`.

```
cldevice show /dev/rdisk/c4t8d0
```



=== DID Device Instances ===

|                   |                          |
|-------------------|--------------------------|
| DID Device Name:  | /dev/did/rdisk/d3        |
| Full Device Path: | phappy1:/dev/rdsk/c4t8d0 |
| Full Device Path: | phappy2:/dev/rdsk/c4t8d0 |
| Replication:      | none                     |
| default_fencing:  | global                   |

## ▼ How to Change the Default Global Fencing Protocol Settings for All Storage Devices

You can turn fencing on or off globally for all storage devices connected to a cluster. The default fencing setting of a single storage device overrides the global setting when the device's default fencing is set to `pathcount`, `prefer3`, or `nofencing`. If the default fencing setting of a storage device is set to `global`, the storage device will use the global setting. For example, if a storage device has the default setting `pathcount`, the setting will not change if you use this procedure to change the global SCSI protocol settings to `prefer3`. You must use the [“How to Change the Fencing Protocol for a Single Storage Device” on page 146](#) procedure to change the default setting of a single device.



**Caution** - If fencing is turned off under the wrong circumstances, your data can be vulnerable to corruption during application failover. Examine this data corruption possibility carefully when you are considering turning fencing off. Fencing can be turned off if the shared storage device does not support the SCSI protocol or if you want to allow access to the cluster's storage from hosts outside the cluster.

To change the default fencing setting for a quorum device, you must unconfigure the device, change the fencing setting, and reconfigure the quorum device. If you plan to turn fencing off and back on regularly for devices that include quorum devices, consider configuring quorum through a quorum server service to eliminate interruptions in quorum operation.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Set the fencing protocol for all storage devices that are not quorum devices.**

```
cluster set -p global_fencing={pathcount | prefer3 | nofencing | nofencing-noscrub}
```

|                                |                                                                                                                                                                                                                                                                                                    |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>-p global_fencing</code> | Sets the current global default fencing algorithm for all shared devices.                                                                                                                                                                                                                          |
| <code>prefer3</code>           | Uses the SCSI-3 protocol for devices with more than two paths.                                                                                                                                                                                                                                     |
| <code>pathcount</code>         | Determines the fencing protocol by the number of DID paths that are attached to the shared device. The pathcount setting is used for quorum devices.                                                                                                                                               |
| <code>nofencing</code>         | Turns fencing off by setting the fencing status for all storage devices.                                                                                                                                                                                                                           |
| <code>nofencing-noscrub</code> | Scrubbing the device ensures that the device is cleared of all persistent SCSI reservation information and allows access to the storage from systems outside the cluster. Use the <code>nofencing-noscrub</code> option only for storage devices that have severe problems with SCSI reservations. |

**Example 5-20** Setting the Default Global Fencing Protocol Settings for All Storage Devices

The following example sets the fencing protocol for all storage devices on the cluster to the SCSI-3 protocol.

```
cluster set -p global_fencing=prefer3
```

## ▼ How to Change the Fencing Protocol for a Single Storage Device

You can also set the fencing protocol for a single storage device.

---

**Note** - To change the default fencing setting for a quorum device, you must unconfigure the device, change the fencing setting, and reconfigure the quorum device. If you plan to turn fencing off and back on regularly for devices that include quorum devices, consider configuring quorum through a quorum server service to eliminate interruptions in quorum operation.

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.



**Caution** - If fencing is turned off under the wrong circumstances, your data can be vulnerable to corruption during application failover. Examine this data corruption possibility carefully when you are considering turning fencing off. Fencing can be turned off if the shared storage device does not support the SCSI protocol or if you want to allow access to the cluster's storage from hosts outside the cluster.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Set the fencing protocol of the storage device.**

```
cldevice set -p default_fencing ={pathcount | \
scsi3 | global | nofencing | nofencing-noscrub} device
```

|                                                 |                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>-p</code><br><code>default_fencing</code> | Modifies the <code>default_fencing</code> property of the device.                                                                                                                                                                                                                                                                                                                                |
| <code>pathcount</code>                          | Determines the fencing protocol by the number of DID paths that are attached to the shared device.                                                                                                                                                                                                                                                                                               |
| <code>scsi3</code>                              | Uses the SCSI-3 protocol.                                                                                                                                                                                                                                                                                                                                                                        |
| <code>global</code>                             | Uses the global default fencing setting. The global setting is used for non-quorum devices.                                                                                                                                                                                                                                                                                                      |
| <code>nofencing-</code><br><code>noscrub</code> | Turns fencing off by setting the fencing status for the specified DID instance.<br><br>Scrubbing the device ensures that the device is cleared of all persistent SCSI reservation information and allows access to the storage device from systems outside the cluster. Use the <code>nofencing-noscrub</code> option only for storage devices that have severe problems with SCSI reservations. |
| <code>device</code>                             | Specifies the name of the device path or device name.                                                                                                                                                                                                                                                                                                                                            |

For more information, see the [cluster\(1CL\)](#) man page.

**Example 5-21** Setting the Fencing Protocol of a Single Device

The following example sets the device `d5`, specified by device number, to the SCSI-3 protocol.

```
cldevice set -p default_fencing=prefer3 d5
```

The following example turns default fencing off for the `d11` device.

```
#cldevice set -p default_fencing=nofencing d11
```

## Administering Cluster File Systems

The cluster file system is a globally available file system that can be read and accessed from any node of the cluster.

**TABLE 5-4** Task Map: Administering Cluster File Systems

| Task                                                                           | Instructions                                                          |
|--------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Add cluster file systems after the initial Oracle Solaris Cluster installation | <a href="#">“How to Add a Cluster File System” on page 148</a>        |
| Remove a cluster file system                                                   | <a href="#">“How to Remove a Cluster File System” on page 151</a>     |
| Check global mount points in a cluster for consistency across nodes            | <a href="#">“How to Check Global Mounts in a Cluster” on page 153</a> |

### ▼ How to Add a Cluster File System

Perform this task for each cluster file system you create after your initial Oracle Solaris Cluster installation.



---

**Caution** - Be sure you specify the correct disk device name. Creating a cluster file system destroys any data on the disks. If you specify the wrong device name, you will erase data that you might not intend to delete.

---

Ensure the following prerequisites have been completed prior to adding an additional cluster file system:

- The root role privilege is established on a node in the cluster.
- Volume manager software be installed and configured on the cluster.
- A device group (such as a Solaris Volume Manager device group) or block disk slice exists on which to create the cluster file system.

You can also use the Oracle Solaris Cluster Manager GUI to add a cluster file system to a zone cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

If you used Oracle Solaris Cluster Manager to install data services, one or more cluster file systems already exist if shared disks on which to create the cluster file systems were sufficient.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

### 1. Assume the root role on any node in the cluster.

---

**Tip** - For faster file system creation, become the root role on the current primary of the global device for which you create a file system.

---

### 2. Create a UFS file system by using the `newfs` command.




---

**Caution** - Any data on the disks is destroyed when you create a file system. Be sure that you specify the correct disk device name. If you specify the wrong device name, you might erase data that you did not intend to delete.

---

```
phys-schost# newfs raw-disk-device
```

The following table shows examples of names for the *raw-disk-device* argument. Note that naming conventions differ for each volume manager.

| Volume Manager         | Sample Disk Device Name             | Description                                |
|------------------------|-------------------------------------|--------------------------------------------|
| Solaris Volume Manager | <code>/dev/md/nfs/rdisk/d1</code>   | Raw disk device d1 within the nfs disk set |
| None                   | <code>/dev/global/rdisk/d1s3</code> | Raw disk device d1s3                       |

### 3. On each node in the cluster, create a mount-point directory for the cluster file system.

A mount point is required *on each node*, even if the cluster file system is not accessed on that node.

---

**Tip** - For ease of administration, create the mount point in the `/global/device-group/` directory. This location enables you to easily distinguish cluster file systems, which are globally available, from local file systems.

---

```
phys-schost# mkdir -p /global/device-group/mount-point/
```

*device-group*

Name of the directory that corresponds to the name of the device group that contains the device.

*mount-point*

Name of the directory on which to mount the cluster file system.

**4. On each node in the cluster, add an entry to the `/etc/vfstab` file for the mount point.**

See the `vfstab(4)` man page for details.

- a. **In each entry, specify the required mount options for the type of file system that you use.**
- b. **To automatically mount the cluster file system, set the `mount at boot` field to `yes`.**
- c. **For each cluster file system, ensure that the information in its `/etc/vfstab` entry is identical on each node.**
- d. **Ensure that the entries in each node's `/etc/vfstab` file list devices in the same order.**
- e. **Check the boot order dependencies of the file systems.**

For example, consider the scenario where `phys-schost-1` mounts disk device `d0` on `/global/oracle/` and `phys-schost-2` mounts disk device `d1` on `/global/oracle/logs/`. With this configuration, `phys-schost-2` can boot and mount `/global/oracle/logs/` only after `phys-schost-1` boots and mounts `/global/oracle/`.

**5. On any node in the cluster, run the configuration check utility.**

```
phys-schost# cluster check -k vfstab
```

The configuration check utility verifies that the mount points exist. The utility also verifies that `/etc/vfstab` file entries are correct on all nodes of the cluster. If no errors occur, no output is returned.

For more information, see the `cluster(1CL)` man page.

**6. Mount the cluster file system from any node in the cluster.**

```
phys-schost# mount /global/device-group/mountpoint/
```

**7. On each node of the cluster, verify that the cluster file system is mounted.**

You can use either the `df` command or `mount` command to list mounted file systems. For more information, see the `df(1M)` man page or `mount(1M)` man page.

## ▼ How to Remove a Cluster File System

You *remove* a cluster file system by merely unmounting it. To also remove or delete the data, remove the underlying disk device (or metadvice or volume) from the system.

---

**Note** - Cluster file systems are automatically unmounted as part of the system shutdown that occurs when you run `cluster shutdown` to stop the entire cluster. A cluster file system is not unmounted when you run `shutdown` to stop a single node. However, if the node being shut down is the only node with a connection to the disk, any attempt to access the cluster file system on that disk results in an error.

---

Ensure that the following prerequisites have been completed prior to unmounting cluster file systems:

- The root role privilege is established on a node in the cluster.
- The file system is not busy. A file system is considered busy if a user is working in a directory in the file system, or if a program has a file open in that file system. The user or program could be running on any node in the cluster.

You can also remove a zone-cluster file system using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume the root role on any node in the cluster.**
2. **Determine which cluster file systems are mounted.**

```
mount -v
```

3. **On each node, list all processes that are using the cluster file system, so that you know which processes you are going to stop.**

```
fuser -c [-u] mountpoint
```

-c                      Reports on files that are mount points for file systems and any files within those mounted file systems.

-u                      (Optional) Displays the user login name for each process ID.

*mountpoint*                Specifies the name of the cluster file system for which you want to stop processes.

4. **On each node, stop all processes for the cluster file system.**

Use your preferred method for stopping processes. If necessary, use the following command to force termination of processes associated with the cluster file system.

```
fuser -c -k mountpoint
```

A SIGKILL is sent to each process that uses the cluster file system.

5. **On each node, verify that no processes are using the file system.**

```
fuser -c mountpoint
```

6. **From just one node, unmount the file system.**

```
umount mountpoint
```

*mountpoint* Specifies the name of the cluster file system you want to unmount. This can be either the directory name where the cluster file system is mounted, or the device name path of the file system.

7. **(Optional) Edit the `/etc/vfstab` file to delete the entry for the cluster file system being removed.**

Perform this step on each cluster node that has an entry for this cluster file system in its `/etc/vfstab` file.

8. **(Optional) Remove the disk device group/metadevice/volume/plex.**

See your volume manager documentation for more information.

#### Example 5-22 Removing a Cluster File System

The following example removes a UFS cluster file system that is mounted on the Solaris Volume Manager metadevice or volume/`dev/md/oracle/rdisk/d1`.

```
mount -v
...
/global/oracle/d1 on /dev/md/oracle/dsk/d1 read/write/setuid/global/logging/largefiles
fuser -c /global/oracle/d1
/global/oracle/d1: 4006c
fuser -c -k /global/oracle/d1
/global/oracle/d1: 4006c
fuser -c /global/oracle/d1
/global/oracle/d1:
umount /global/oracle/d1

(On each node, remove the highlighted entry:)
pfedit /etc/vfstab
#device device mount FS fsck mount mount
#to mount to fsck point type pass at boot options
#
/global/oracle/d1 /dev/md/oracle/rdisk/d1 /global/oracle/d1 ufs 2 yes global,logging

[Save and exit.]
```



To remove the data on the cluster file system, remove the underlying device. See your volume manager documentation for more information.

## ▼ How to Check Global Mounts in a Cluster

The `cluster(1CL)` utility verifies the syntax of the entries for cluster file systems in the `/etc/vfstab` file. If there are no errors, nothing is returned.

---

**Note** - Run the `cluster check` command after making cluster configuration changes, such as removing a cluster file system, that have affected devices or volume management components.

---

1. **Assume the root role on any node in the cluster.**
2. **Check the cluster global mounts.**

```
cluster check -k vfstab
```

## Administering Disk-Path Monitoring

Disk path monitoring (DPM) administration commands enable you to receive notification of secondary disk-path failure. Use the procedures in this section to perform administrative tasks that are associated with monitoring disk paths. Refer to [Chapter 3, “Key Concepts for System Administrators and Application Developers,” in \*Oracle Solaris Cluster Concepts Guide\*](#) for conceptual information about the disk-path monitoring daemon. Refer to the `cldevice(1CL)` man page for a description of the command options and related commands. For more information about tuning the `scdpmd` daemon, see the `scdpmd.conf(4)` man page. Also see the `syslogd(1M)` man page for logged errors that the daemon reports.

---

**Note** - Disk paths are automatically added to the monitoring list monitored when I/O devices are added to a node by using the `cldevice` command. Disk paths are also automatically unmonitored when devices are removed from a node by using Oracle Solaris Cluster commands.

---

**TABLE 5-5** Task Map: Administering Disk-Path Monitoring

| Task                   | Instructions                                               |
|------------------------|------------------------------------------------------------|
| Monitor a disk path.   | <a href="#">“How to Monitor a Disk Path” on page 154</a>   |
| Unmonitor a disk path. | <a href="#">“How to Unmonitor a Disk Path” on page 156</a> |

| Task                                                                                                                                                                                                    | Instructions                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Print the status of faulted disk paths for a node.                                                                                                                                                      | <a href="#">“How to Print Failed Disk Paths” on page 156</a>                                                                                                                                                                                        |
| Monitor disk paths from a file.                                                                                                                                                                         | <a href="#">“How to Monitor Disk Paths From a File” on page 158</a>                                                                                                                                                                                 |
| Enable or disable the automatic rebooting of a node when all monitored shared-disk paths fail.                                                                                                          | <a href="#">“How to Enable the Automatic Rebooting of a Node When All Monitored Shared-Disk Paths Fail” on page 159</a><br><a href="#">“How to Disable the Automatic Rebooting of a Node When All Monitored Shared-Disk Paths Fail” on page 160</a> |
| Resolve an incorrect disk-path status. An incorrect disk-path status can be reported when the monitored DID device is unavailable at boot time, and the DID instance is not uploaded to the DID driver. | <a href="#">“How to Resolve a Disk-Path Status Error” on page 157</a>                                                                                                                                                                               |

The procedures in the following section that issue the `cldevice` command include the `disk-path` argument. The `disk-path` argument consists of a node name and a disk name. The node name is not required and defaults to `all` if you do not specify it.

## ▼ How to Monitor a Disk Path

Perform this task to monitor disk paths in your cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also enable monitoring of a disk path using the Oracle Solaris Cluster Manager GUI. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.**

2. **Monitor a disk path.**

```
cldevice monitor -n node disk
```

3. **Verify that the disk path is monitored.**

```
cldevice status device
```

**Example 5-23** Monitoring a Disk Path on a Single Node

The following example monitors the `schost-1:/dev/did/rdisk/d1` disk path from a single node. Only the DPM daemon on the node `schost-1` monitors the path to the disk `/dev/did/dsk/d1`.

```
cldevice monitor -n schost-1 /dev/did/dsk/d1
cldevice status d1
```

| Device Instance   | Node          | Status |
|-------------------|---------------|--------|
| -----             |               |        |
| /dev/did/rdisk/d1 | phys-schost-1 | Ok     |

**Example 5-24** Monitoring a Disk Path on All Nodes

The following example monitors the `schost-1:/dev/did/dsk/d1` disk path from all nodes. DPM starts on all nodes for which `/dev/did/dsk/d1` is a valid path.

```
cldevice monitor /dev/did/dsk/d1
cldevice status /dev/did/dsk/d1
```

| Device Instance   | Node          | Status |
|-------------------|---------------|--------|
| -----             |               |        |
| /dev/did/rdisk/d1 | phys-schost-1 | Ok     |

**Example 5-25** Rereading the Disk Configuration From the CCR

The following example forces the daemon to reread the disk configuration from the CCR and prints the monitored disk paths with status.

```
cldevice monitor +
cldevice status
```

| Device Instance   | Node     | Status |
|-------------------|----------|--------|
| -----             |          |        |
| /dev/did/rdisk/d1 | schost-1 | Ok     |
| /dev/did/rdisk/d2 | schost-1 | Ok     |
| /dev/did/rdisk/d3 | schost-1 | Ok     |
|                   | schost-2 | Ok     |
| /dev/did/rdisk/d4 | schost-1 | Ok     |
|                   | schost-2 | Ok     |
| /dev/did/rdisk/d5 | schost-1 | Ok     |
|                   | schost-2 | Ok     |
| /dev/did/rdisk/d6 | schost-1 | Ok     |
|                   | schost-2 | Ok     |
| /dev/did/rdisk/d7 | schost-2 | Ok     |
| /dev/did/rdisk/d8 | schost-2 | Ok     |

## ▼ How to Unmonitor a Disk Path

Use this procedure to unmonitor a disk path.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also disable monitoring of a disk path using the Oracle Solaris Cluster Manager GUI. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.**
2. **Determine the state of the disk path to unmonitor.**

```
cldevice status device
```

3. **On each node, unmonitor the appropriate disk paths.**

```
cldevice unmonitor -n node disk
```

### Example 5-26 Unmonitoring a Disk Path

The following example unmonitors the `schost-2:/dev/did/rdisk/d1` disk path and prints disk paths with status for the entire cluster.

```
cldevice unmonitor -n schost2 /dev/did/rdisk/d1
cldevice status -n schost2 /dev/did/rdisk/d1
```

| Device Instance   | Node     | Status      |
|-------------------|----------|-------------|
| -----             | ----     | -----       |
| /dev/did/rdisk/d1 | schost-2 | Unmonitored |

## ▼ How to Print Failed Disk Paths

Use the following procedure to print the faulted disk paths for a cluster.

1. **Assume the `root` role on any node in the cluster.**
2. **Print the faulted disk paths throughout the cluster.**

```
cldevice status -s fail
```

**Example 5-27** Printing Faulted Disk Paths

The following example prints faulted disk paths for the entire cluster.

```
cldevice status -s fail
```

| Device Instance | Node          | Status |
|-----------------|---------------|--------|
| -----           | ----          | -----  |
| dev/did/dsk/d4  | phys-schost-1 | fail   |

## ▼ How to Resolve a Disk-Path Status Error

If the following events occur, DPM might not update the status of a failed path when it comes back online:

- A monitored-path failure causes a node reboot.
- The device under the monitored DID path does not come back online until after the rebooted node is back online.

The incorrect disk-path status is reported because the monitored DID device is unavailable at boot time, and therefore the DID instance is not uploaded to the DID driver. When this situation occurs, manually update the DID information.

**1. From one node, update the global-devices namespace.**

```
cldevice populate
```

**2. On each node, verify that command processing has completed before you proceed to the next step.**

The command executes remotely on all nodes, even though the command is run from just one node. To determine whether the command has completed processing, run the following command on each node of the cluster.

```
ps -ef | grep cldevice populate
```

**3. Verify that, within the DPM polling time frame, the status of the faulted disk path is now Ok.**

```
cldevice status disk-device
```

| Device Instance | Node          | Status |
|-----------------|---------------|--------|
| -----           | ----          | -----  |
| dev/did/dsk/dN  | phys-schost-1 | Ok     |

## ▼ How to Monitor Disk Paths From a File

Use the following procedure to monitor or unmonitor disk paths from a file.

To change your cluster configuration by using a file, you must first export the current configuration. This export operation creates an XML file that you can then modify to set the configuration items you are changing. The instructions in this procedure describe this entire process.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.**

2. **Export your device configuration to an XML file.**

```
cldevice export -o configurationfile
```

`-o configurationfile` Specify the file name for your XML file.

3. **Modify the configuration file so that device paths are monitored.**

Find the device paths that you want to monitor, and set the `monitored` attribute to `true`.

4. **Monitor the device paths.**

```
cldevice monitor -i configurationfile
```

`-i configurationfile` Specify the file name of the modified XML file.

5. **Verify that device path is now monitored.**

```
cldevice status
```

### Example 5-28 Monitor Disk Paths From a File

In the following example, the device path between the node `phys-schost-2` and device `d3` is monitored by using an XML file.

The first step is to export the current cluster configuration.

```
cldevice export -o deviceconfig
```

The deviceconfig XML file shows that the path between phys-schost-2 and d3 is not currently monitored.

```
<?xml version="1.0"?>
<!DOCTYPE cluster SYSTEM "/usr/cluster/lib/xml/cluster.dtd">
<cluster name="brave_clus">
.
.
.
 <deviceList readonly="true">
 <device name="d3" ctd="c1t8d0">
 <devicePath nodeRef="phys-schost-1" monitored="true"/>
 <devicePath nodeRef="phys-schost-2" monitored="false"/>
 </device>
 </deviceList>
</cluster>
```

To monitor that path, set the monitored attribute to true, as follows.

```
<?xml version="1.0"?>
<!DOCTYPE cluster SYSTEM "/usr/cluster/lib/xml/cluster.dtd">
<cluster name="brave_clus">
.
.
.
 <deviceList readonly="true">
 <device name="d3" ctd="c1t8d0">
 <devicePath nodeRef="phys-schost-1" monitored="true"/>
 <devicePath nodeRef="phys-schost-2" monitored="true"/>
 </device>
 </deviceList>
</cluster>
```

Use the `cldevice` command to read the file and turn on monitoring.

```
cldevice monitor -i deviceconfig
```

Use the `cldevice` command to verify that the device is now monitored.

```
cldevice status
```

**See Also** For more detail about exporting cluster configuration and using the resulting XML file to set cluster configuration, see the [cluster\(1CL\)](#) and the [clconfiguration\(5CL\)](#) man pages.

## ▼ How to Enable the Automatic Rebooting of a Node When All Monitored Shared-Disk Paths Fail

When you enable this feature, a node automatically reboots, provided that the following conditions are met:

- All monitored shared-disk paths on the node fail.
- At least one of the disks is accessible from a different node in the cluster.

Rebooting the node restarts all resource groups and device groups that are mastered on that node on another node.

If all monitored shared-disk paths on a node remain inaccessible after the node automatically reboots, the node does not automatically reboot again. However, if any disk paths become available after the node reboots but then fail, the node automatically reboots again.

When you enable the `reboot_on_path_failure` property, the states of local-disk paths are not considered when determining if a node reboot is necessary. Only monitored shared disks are affected.

You can also edit the `reboot_on_path_failure` node property using the Oracle Solaris Cluster Manager GUI. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **On any node in the cluster, assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **For *all* nodes in the cluster, enable the automatic rebooting of a node when all monitored shared-disk paths to it fail.**

```
clnode set -p reboot_on_path_failure=enabled +
```

## ▼ How to Disable the Automatic Rebooting of a Node When All Monitored Shared-Disk Paths Fail

When you disable this feature and all monitored shared-disk paths on a node fail, the node does *not* automatically reboot.

1. **On any node in the cluster, assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **For *all* nodes in the cluster, disable the automatic rebooting of a node when monitored all monitored shared-disk paths to it fail.**

```
clnode set -p reboot_on_path_failure=disabled +
```



## Administering Quorum

---

This chapter provides the procedures for administering quorum devices within Oracle Solaris Cluster and Oracle Solaris Cluster quorum servers. For information about quorum concepts, see “Quorum and Quorum Devices” in *Oracle Solaris Cluster Concepts Guide*.

- “Administering Quorum Devices” on page 161
- “Administering Oracle Solaris Cluster Quorum Servers” on page 183

### Administering Quorum Devices

A quorum device is a shared storage device or quorum server that is shared by two or more nodes and that contributes votes that are used to establish a quorum. This section provides the procedures for administering quorum devices.

You can use the `clquorum` command to perform all quorum device administrative procedures. In addition, you can accomplish some procedures by using the `clsetup` interactive utility or the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [How to Access Oracle Solaris Cluster Manager](#). Whenever possible, quorum procedures are described in this section by using the `clsetup` utility. The Oracle Solaris Cluster Manager online help describes how to perform quorum procedures by using the GUI. For more information, see the `clquorum(1CL)` and `clsetup(1CL)` man pages.

When you work with quorum devices, keep in mind the following guidelines:

- All quorum commands must be run from a global-cluster node.
- If the `clquorum` command is interrupted or fails, the quorum configuration information can become inconsistent in the cluster configuration database. If this inconsistency occurs, either rerun the command or run the `clquorum reset` command to reset the quorum configuration.
- For highest availability of the cluster, ensure that the total number of votes that are contributed by quorum devices is less than the total number of votes that are contributed by nodes. Otherwise, the nodes cannot form a cluster if all quorum devices are unavailable, even if all nodes are functioning.

- Do not add a disk that is currently configured as a quorum device to an Oracle Solaris ZFS storage pool. If a configured quorum device is added to a ZFS storage pool, the disk is relabeled as an EFI disk and quorum configuration information is lost and the disk no longer provides a quorum vote to the cluster. Once a disk is in a storage pool, that disk can then be configured as a quorum device. Or, you can unconfigure the disk, add it to the storage pool, then reconfigure the disk as a quorum device.

---

**Note** - The `clsetup` command is an interactive interface to the other Oracle Solaris Cluster commands. When `clsetup` runs, the command generates the appropriate specific commands, in this case `clquorum` commands. These generated commands are shown in the examples at the end of the procedures.

---

To view the quorum configuration, use `clquorum show`. The `clquorum list` command displays the names of quorum devices in the cluster. The `clquorum status` command provides status and vote count information.

Most examples shown in this section are from a three-node cluster.

**TABLE 6-1** Task List: Administering Quorum

Task	For Instructions
Add a quorum device to a cluster by using the <code>clsetup</code> utility	<a href="#">“Adding a Quorum Device” on page 163</a>
Remove a quorum device from a cluster by using the <code>clsetup</code> utility (to generate <code>clquorum</code> )	<a href="#">“How to Remove a Quorum Device” on page 171</a>
Remove the last quorum device from a cluster by using the <code>clsetup</code> utility (to generate <code>clquorum</code> )	<a href="#">“How to Remove the Last Quorum Device From a Cluster” on page 173</a>
Replace a quorum device in a cluster by using the add and remove procedures	<a href="#">“How to Replace a Quorum Device” on page 174</a>
Modify a quorum device list by using the add and remove procedures	<a href="#">“How to Modify a Quorum Device Node List” on page 175</a>
Put a quorum device into maintenance state by using the <code>clsetup</code> utility (to generate <code>clquorum</code> )	<a href="#">“How to Put a Quorum Device Into Maintenance State” on page 178</a>
(While in maintenance state, the quorum device does not participate in voting to establish the quorum.)	
Reset the quorum configuration to its default state by using the <code>clsetup</code> utility (to generate <code>clquorum</code> )	<a href="#">“How to Bring a Quorum Device Out of Maintenance State” on page 179</a>
List the quorum devices and vote counts by using the <code>clquorum</code> command	<a href="#">“How to List the Quorum Configuration” on page 181</a>

## Dynamic Reconfiguration With Quorum Devices

You must consider a few issues when completing dynamic reconfiguration operations on quorum devices in a cluster.

- All of the requirements, procedures, and restrictions that are documented for the Oracle Solaris dynamic reconfiguration feature also apply to Oracle Solaris Cluster dynamic reconfiguration support, except for the operating system quiescence operation. Therefore, review the documentation for the Oracle Solaris dynamic reconfiguration feature *before* using the dynamic reconfiguration feature with Oracle Solaris Cluster software. You should review in particular the issues that affect non-network IO devices during a dynamic reconfiguration detach operation.
- Oracle Solaris Cluster rejects dynamic reconfiguration remove-board operations that are performed when an interface is present that is configured for a quorum device.
- If the dynamic reconfiguration operation would pertain to an active device, Oracle Solaris Cluster rejects the operation and identifies the devices that would be affected by the operation.

To remove a quorum device, you must complete the following steps, in the order indicated.

**TABLE 6-2** Task Map: Dynamic Reconfiguration With Quorum Devices

Task	For Instructions
1. Enable a new quorum device to replace the one being removed.	<a href="#">“Adding a Quorum Device” on page 163</a>
2. Disable the quorum device to be removed.	<a href="#">“How to Remove a Quorum Device” on page 171</a>
3. Perform the dynamic reconfiguration remove-operation on the device being removed.	

## Adding a Quorum Device

This section provides procedures to add a quorum device. Ensure that all nodes in the cluster are online before adding a new quorum device. For information about determining the number of quorum vote counts necessary for your cluster, recommended quorum configurations, and failure fencing, see [“Quorum and Quorum Devices” in Oracle Solaris Cluster Concepts Guide](#).



**Caution** - Do not add a disk that is currently configured as a quorum device to a Solaris ZFS storage pool. When a configured quorum device is added to a Solaris ZFS storage pool, the disk is relabeled as an EFI disk and quorum configuration information is lost and the disk no longer provides a quorum vote to the cluster. Once a disk is in a storage pool, that disk can then be configured as a quorum device. You can also unconfigure the disk, add it to the storage pool, and then reconfigure the disk as a quorum device.

The Oracle Solaris Cluster software supports the following types of quorum devices:

- Shared LUNs from the following:
  - Shared SCSI disk
  - Serial Attached Technology Attachment (SATA) storage
  - Oracle ZFS Storage Appliance
- Oracle Solaris Cluster Quorum Server

Procedures for adding these devices are provided in the following sections:

- [“How to Add a Shared Disk Quorum Device” on page 165](#)
- [“How to Add a Quorum Server Quorum Device” on page 167](#)

---

**Note** - You cannot configure replicated disks as quorum devices. If you try to add a replicated disk as a quorum device, you receive the following error message and the command exits with an error code.

*Disk-name* is a replicated device. Replicated devices cannot be configured as quorum devices.

---

A shared-disk quorum device is any attached storage device that is supported by Oracle Solaris Cluster software. The shared disk is connected to two or more nodes of your cluster. If you turn fencing on, a dual-ported disk can be configured as a quorum device that uses SCSI-2 or SCSI-3 (the default is SCSI-2). If fencing is turned on and your shared device is connected to more than two nodes, you can configure your shared disk as a quorum device that uses the SCSI-3 protocol (the default protocol for more than two nodes). You can use the SCSI override flag to make the Oracle Solaris Clustersoftware use the SCSI-3 protocol for dual-ported shared disks.

If you turn fencing off for a shared disk, you can then configure the disk as a quorum device that uses the software quorum protocol. This would be true regardless of whether the disk supports SCSI-2 or SCSI-3 protocols. Software quorum is a protocol from Oracle that emulates a form of SCSI Persistent Group Reservations (PGR).



---

**Caution** - If you are using disks that do not support SCSI (such as SATA), you should turn SCSI fencing off.

---

For quorum devices, you can use a disk that contains user data or is a member of a device group. View the protocol that is used by the quorum subsystem with a shared disk by looking at the `access-mode` value for the shared disk in the output from the `cluster show` command.

You can also create a quorum server device or a shared disk quorum device using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

See the `clsetup(1CL)` and `clquorum(1CL)` man pages for information about the commands that are used in the following procedures.

## ▼ How to Add a Shared Disk Quorum Device

Oracle Solaris Cluster software supports shared-disk (both SCSI and SATA) devices as quorum devices. A SATA device does not support a SCSI reservation, and you must disable the SCSI reservation fencing flag and use the software quorum protocol to configure these disks as quorum devices.

To complete this procedure, identify a disk drive by its device ID (DID), which is shared by the nodes. Use the `cldevice show` command to see the list of DID names. Refer to the [cldevice\(1CL\)](#) man page for additional information. Ensure that all nodes in the cluster are online before adding a new quorum device.

Use this procedure to configure SCSI or SATA devices.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
2. **Start the `clsetup` utility.**

```
clsetup
```

The `clsetup` Main Menu is displayed.

3. **Type the number for the option for Quorum.**  
The Quorum Menu is displayed.
4. **Type the number for the option for adding a quorum device, then type `yes` when the `clsetup` utility asks you to confirm the quorum device that you are adding.**  
The `clsetup` utility asks what type of quorum device you want to add.
5. **Type the number for the option for a shared-disk quorum device.**  
The `clsetup` utility asks which global device you want to use.
6. **Type the global device you are using.**  
The `clsetup` utility asks you to confirm that the new quorum device should be added to the global device you specified.
7. **Type `yes` to continue adding the new quorum device.**

If the new quorum device is added successfully, the `clsetup` utility displays a message to that effect.

## 8. Verify that the quorum device has been added.

```
clquorum list -v
```

### Example 6-1 Adding a Shared Disk Quorum Device

The following example shows the `clquorum` command generated by `clsetup` when it adds a shared-disk quorum device and a verification step.

Assume the root role that provides `solaris.cluster.modify` RBAC authorization on any cluster node.

```
[Start the clsetup utility:]
clsetup
[Select Quorum>Add a quorum device]
[Answer the questions when prompted.]
[You will need the following information.]
[Information: Example:]
[Directly attached shared disk shared_disk]
[Global device d20]

[Verify that the clquorum command was completed successfully:]
clquorum add d20

 Command completed successfully.
[Quit the clsetup Quorum Menu and Main Menu.]
[Verify that the quorum device is added:]
clquorum list -v

Quorum Type
----- -
d20 shared_disk
scphyshost-1 node
scphyshost-2 node
```

## ▼ How to Add an Oracle ZFS Storage Appliance NAS Quorum Device

Ensure that all nodes in the cluster are online before adding a new quorum device.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to add an Oracle ZFS Storage Appliance NAS device. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Consult the installation documentation that shipped with the Oracle ZFS Storage Appliance or the appliance's online Help for instructions on setting up an iSCSI device.**
2. **On each of the cluster nodes, discover the iSCSI LUN and set the iSCSI access list to static configuration.**

```
iscsiadm modify discovery -s enable

iscsiadm list discovery
Discovery:
Static: enabled
Send Targets: disabled
iSNS: disabled

iscsiadm add static-config iqn.LUNName,IPAddress_of_NASDevice
devfsadm -i iscsi
cldevice refresh
```

3. **From one cluster node, configure the DIDs for the iSCSI LUN.**

```
/usr/cluster/bin/cldevice populate
```

4. **Identify the DID device that represents the NAS device LUN that has just been configured into the cluster using iSCSI.**

Use the `cldevice show` command to see the list of DID names. Refer to the [cldevice\(1CL\)](#) man page for additional information.

5. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
6. **Use the `clquorum` command to add the NAS device as a quorum device using the DID device identified in [Step 4](#).**

```
clquorum add d20
```

The cluster has default rules for deciding whether to use scsi-2, scsi-3, or software quorum protocols. See the [clquorum\(1CL\)](#) man page for more information.

## ▼ How to Add a Quorum Server Quorum Device

**Before You Begin** Before you can add an Oracle Solaris Cluster quorum server as a quorum device, the Oracle Solaris Cluster quorum server software must be installed on the host machine and the quorum

server must be started and running. For information about installing the quorum server, see the [“How to Install and Configure Oracle Solaris Cluster Quorum Server Software”](#) in *Oracle Solaris Cluster Software Installation Guide*.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also create a quorum server device using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
2. **Ensure that all Oracle Solaris Cluster nodes are online and can communicate with the Oracle Solaris Cluster quorum server.**
  - a. **Ensure that network switches that are directly connected to cluster nodes meet one of the following criteria:**
    - The switch supports Rapid Spanning Tree Protocol (RSTP).
    - Fast port mode is enabled on the switch.

One of these features is required to ensure immediate communication between cluster nodes and the quorum server. If this communication is significantly delayed by the switch, the cluster interprets this prevention of communication as loss of the quorum device.

- b. **If the public network uses variable-length subnetting, also called Classless Inter-Domain Routing (CIDR), modify the following files on each node.**

If you use classful subnets, as defined in RFC 791, you do not need to perform these steps.

- i. **Add to the `/etc/inet/netmasks` file an entry for each public subnet that the cluster uses.**

The following is an example entry which contains a public-network IP address and netmask:

```
10.11.30.0 255.255.255.0
```

- ii. **Append `netmask + broadcast +` to the `hostname` entry in each `/etc/hostname.adapter` file.**

```
nodename netmask + broadcast +
```



- c. On each node in the cluster, add the quorum server hostname to the `/etc/inet/hosts` file or the `/etc/inet/ipnodes` file.**

Add a hostname-to-address mapping to the file, such as the following.

```
ipaddress qshost1
```

*ipaddress*                    The IP address of the computer where the quorum server is running.

*qshost1*                    The hostname of the computer where the quorum server is running.

- d. If you use a naming service, add the quorum server host's name-to-address mapping to the name-service database.**

- 3. Start the `clsetup` utility.**

```
clsetup
```

The `clsetup` Main Menu is displayed.

- 4. Type the number for the option for Quorum.**

The Quorum Menu is displayed.

- 5. Type the number for the option for adding a quorum device.**

Then type **yes** to confirm that you are adding a quorum device.

The `clsetup` utility asks what type of quorum device you want to add.

- 6. Type the number for the option for a quorum-server quorum device and then type **yes** to confirm that you are adding a quorum-server quorum device.**

The `clsetup` utility asks you to provide the name of the new quorum device.

- 7. Type the name of the quorum device you are adding.**

The quorum device name can be any name you choose. The name is only used to process future administrative commands.

The `clsetup` utility asks you to provide the name of the host of the quorum server.

- 8. Type the name of the host of the quorum server.**

This name specifies the IP address of the machine where the quorum server runs or the hostname of the machine on the network.

Depending on the IPv4 or IPv6 configuration of the host, the IP address of the machine must be specified in the `/etc/hosts` file, the `/etc/inet/ipnodes` file, or both.

---

**Note** - The machine you specify must be reachable by all cluster nodes and must run the quorum server.

---

The `clsetup` utility asks you to provide the port number of the quorum server.

**9. Type the port number that is used by the quorum server to communicate with the cluster nodes.**

The `clsetup` utility asks you to confirm that the new quorum device should be added.

**10. Type `yes` to continue adding the new quorum device.**

If the new quorum device is added successfully, the `clsetup` utility displays a message to that effect.

**11. Verify that the quorum device has been added.**

```
clquorum list -v
```

**Example 6-2** Adding a Quorum Server Quorum Device

The following example shows the `clquorum` command that is generated by `clsetup` when it adds a quorum server quorum device. The example also shows a verification step.

Assume the root role that provides `solaris.cluster.modify` RBAC authorization on any cluster node.

[Start the `clsetup` utility:]

```
clsetup
```

```
[Select Quorum > Add a quorum device]
```

```
[Answer the questions when prompted.]
```

```
[You will need the following information.]
```

```
[Information: Example:]
```

```
[Quorum Device quorum_server quorum device]
```

```
[Name: qd1]
```

```
[Host Machine Name: 10.11.124.84]
```

```
[Port Number: 9001]
```

[Verify that the `clquorum` command was completed successfully:]

```
clquorum add -t quorum_server -p qshost=10.11.124.84 -p port=9001 qd1
```

Command completed successfully.

[Quit the `clsetup` Quorum Menu and Main Menu.]

[Verify that the quorum device is added:]

```
clquorum list -v
```

```
Quorum Type
----- ----
qd1 quorum_server
scphyshost-1 node
```

```

scphyshost-2 node

clquorum status

=== Cluster Quorum ===
-- Quorum Votes Summary --

Needed Present Possible
----- -
3 5 5

-- Quorum Votes by Node --

Node Name Present Possible Status

phys-schost-1 1 1 Online
phys-schost-2 1 1 Online

-- Quorum Votes by Device --

Device Name Present Possible Status

qd1 1 1 Online
d3s2 1 1 Online
d4s2 1 1 Online

```

## Removing or Replacing a Quorum Device

This section provides the following procedures for removing or replacing a quorum device:

- [“How to Remove a Quorum Device” on page 171](#)
- [“How to Remove the Last Quorum Device From a Cluster” on page 173](#)
- [“How to Replace a Quorum Device” on page 174](#)

### ▼ How to Remove a Quorum Device

When a quorum device is removed, it no longer participates in the voting to establish quorum. Note that all two-node clusters require that at least one quorum device be configured. If this is the last quorum device on a cluster, `clquorum(1CL)` will fail to remove the device from the configuration. If you are removing a node, remove all quorum devices connected to the node.

---

**Note** - If the device you intend to remove is the last quorum device in the cluster, see the procedure [“How to Remove the Last Quorum Device From a Cluster” on page 173](#).

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to remove a quorum device. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.**

2. **Determine the quorum device to be removed.**

```
clquorum list -v
```

3. **Execute the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

4. **Type the number for the option for Quorum.**

5. **Type the number for the option to remove a quorum device.**

Answer the questions displayed during the removal process.

6. **Quit `clsetup`.**

7. **Verify that the quorum device is removed.**

```
clquorum list -v
```

#### **Example 6-3** Removing a Quorum Device

This example shows how to remove a quorum device from a cluster with two or more quorum devices configured.

Assume the root role that provides `solaris.cluster.modify` RBAC authorization on any cluster node.

```
[Determine the quorum device to be removed:]
clquorum list -v
[Start the clsetup utility:]
clsetup
[Select Quorum>Remove a quorum device]
[Answer the questions when prompted.]
Quit the clsetup Quorum Menu and Main Menu.]
[Verify that the quorum device is removed:]
clquorum list -v
```

```
Quorum Type
```

```

scphyshost-1 node
scphyshost-2 node
scphyshost-3 node

```

**Troubleshooting** If you lose communications between the cluster and the quorum server host while removing a quorum server quorum device, you must clean up stale configuration information about the quorum server host. For instructions on performing this cleanup, see [“Cleaning Up Stale Quorum Server Cluster Information” on page 187](#).

## ▼ How to Remove the Last Quorum Device From a Cluster

This procedure removes the last quorum device from a two-node cluster by using the `clquorum` force option, `-F`. Generally, you should first remove the failed device and then add the replacement quorum device. If this is not the last quorum device in a two-node cluster, follow the steps in [“How to Remove a Quorum Device” on page 171](#).

Adding a quorum device involves a node reconfiguration, which touches the failed quorum device and panics the machine. The Force option lets you remove the failed quorum device without panicking the machine. The `clquorum` command enables you to remove the device from the configuration. For more information, see the `clquorum(1CL)` man page. After you remove the failed quorum device, you can add a new device with the `clquorum add` command. See [“Adding a Quorum Device” on page 163](#).

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.**
2. **Remove the quorum device by using the `clquorum` command.**

If the quorum device failed, use the `-F` Force option to remove the failed device.

```
clquorum remove -F qd1
```

---

**Note** - You can also place the node to be removed in maintenance state and then remove the quorum device with the `clquorum remove quorum` command. The `clsetup` cluster administration menu options are not available while the cluster is in install mode. See [“How to Put a Node Into Maintenance State” on page 238](#) and the `clsetup(1CL)` man page for more information.

---

3. **Verify that the quorum device has been removed.**

```
clquorum list -v
```

4. Depending on why you are removing the last quorum device, proceed with one of the following steps:
  - If you are replacing the quorum device that has been removed, complete the following substeps:
    - a. Add the new quorum device.  
See [“Adding a Quorum Device” on page 163](#) for instructions on adding the new quorum device.
    - b. Remove the cluster from install mode.  

```
cluster set -p installmode=disabled
```
  - If you are reducing your cluster to a single-node cluster, remove the cluster from install mode.  

```
cluster set -p installmode=disabled
```

#### Example 6-4 Removing the Last Quorum Device

This example shows how to put the cluster in maintenance mode and remove the last remaining quorum device in a cluster configuration.

```
[Assume the root role that provides solaris.cluster.modify RBAC authorization on any
cluster node.]
[Place the cluster in install mode:]
cluster set -p installmode=enabled
[Remove the quorum device:]
clquorum remove d3
[Verify that the quorum device has been removed:]
clquorum list -v
Quorum Type

scphyshost-1 node
scphyshost-2 node
scphyshost-3 node
```

## ▼ How to Replace a Quorum Device

Use this procedure to replace an existing quorum device with another quorum device. You can replace a quorum device with a similar device type, such as replacing a NAS device with another NAS device, or you can replace the device with a dissimilar device, such as replacing a NAS device with a shared disk.

The `phys - schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

**1. Configure a new quorum device.**

You need to first add a new quorum device to the configuration to take the place of the old device. See [“Adding a Quorum Device” on page 163](#) to add a new quorum device to the cluster.

**2. Remove the device that you are replacing as a quorum device.**

See [“How to Remove a Quorum Device” on page 171](#) to remove the old quorum device from the configuration.

**3. If the quorum device is a failed disk, replace the disk.**

Refer to the hardware procedures in your hardware manual for your disk enclosure. See also the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).

## Maintaining Quorum Devices

This section provides the following procedures for maintaining quorum devices:

- [“How to Modify a Quorum Device Node List” on page 175](#)
- [“How to Put a Quorum Device Into Maintenance State” on page 178](#)
- [“How to Bring a Quorum Device Out of Maintenance State” on page 179](#)
- [“How to List the Quorum Configuration” on page 181](#)
- [“How to Repair a Quorum Device” on page 182](#)
- [“Changing the Quorum's Default Time-out” on page 183](#)

### ▼ How to Modify a Quorum Device Node List

You can use the `clsetup` utility to add a node to or remove a node from the node list of an existing quorum device. To modify a quorum device's node list, you must remove the quorum device, modify the physical connections of nodes to the quorum device you removed, then add the quorum device to the cluster configuration again. When a quorum device is added, the `clquorum` command automatically configures the node-to-disk paths for all nodes attached to the disk. For more information, see the `clquorum(1CL)` man page.

The `phys - schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**

2. **Determine the name of the quorum device you are modifying.**

```
clquorum list -v
```

3. **Start the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

4. **Type the number for the Quorum option.**

The Quorum Menu is displayed.

5. **Type the number for the option to remove a quorum device.**

Follow the instructions. You will be asked the name of the disk to be removed.

6. **Add or delete the node connections to the quorum device.**

7. **Type the number for the option to add a quorum device.**

Follow the instructions. You will be asked the name of the disk to be used as the quorum device.

8. **Verify that the quorum device has been added.**

```
clquorum list -v
```

**Example 6-5** Modifying a Quorum Device Node List

The following example shows how to use the `clsetup` utility to add nodes to or delete nodes from a quorum device node list. In this example, the quorum device name is `d2`, and the final result of the procedures adds another node to the quorum device node list.

[Assume the root role that provides `solaris.cluster.modify` RBAC authorization on any node in the cluster.]

```
[Determine the quorum device name:]
```

```
clquorum list -v
```

```
Quorum Type
----- -
d2 shared_disk
sc-phys-schost-1 node
sc-phys-schost-2 node
```



```

sc-phys-schost-3 node

[Start the clsetup utility:]
clsetup

[Type the number that corresponds with the quorum option.]
.
[Type the number that corresponds with the option to remove a quorum device.]
.
[Answer the questions when prompted.]
[You will need the following information:]

Information: Example:
Quorum Device Name: d2

[Verify that the clquorum command completed successfully:]
clquorum remove d2
Command completed successfully.

[Verify that the quorum device was removed.]
clquorum list -v
Quorum Type

sc-phys-schost-1 node
sc-phys-schost-2 node
sc-phys-schost-3 node

[Type the number that corresponds with the Quorum option.]
.
[Type the number that corresponds with the option to add a quorum device.]
.
[Answer the questions when prompted.]
[You will need the following information:]

Information Example:
quorum device name d2

[Verify that the clquorum command was completed successfully:]
clquorum add d2
Command completed successfully.

Quit the clsetup utility.

[Verify that the correct nodes have paths to the quorum device.
In this example, note that phys-schost-3 has been added to the
enabled hosts list.]
clquorum show d2 | grep Hosts
=== Quorum Devices ===

Quorum Device Name: d2
Hosts (enabled): phys-schost-1, phys-schost-2, phys-schost-3

[Verify that the modified quorum device is online.]

```

```
clquorum status d2
=== Cluster Quorum ===

--- Quorum Votes by Device ---
Device Name Present Possible Status

d2 1 1 Online
```

## ▼ How to Put a Quorum Device Into Maintenance State

Use the `clquorum` command to put a quorum device into a maintenance state. For more information, see the `clquorum(1CL)` man page. The `clsetup` utility does not currently have this capability.

Put a quorum device into a maintenance state when taking the quorum device out of service for an extended period of time. This way, the quorum device's quorum vote count is set to zero and does not contribute to the quorum count while the device is being serviced. While in maintenance state, the quorum device's configuration information is preserved.

---

**Note** - All two-node clusters require at least one configured quorum device. If this is the last quorum device on a two-node cluster, `clquorum` will fail to put the device into maintenance state.

---

To put a cluster node into maintenance state, see [“How to Put a Node Into Maintenance State” on page 238](#).

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to disable a quorum device to put it into a maintenance state. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#). If your cluster is in installation mode, click Reset Quorum Devices to exit installation mode.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
2. **Put the quorum device into the maintenance state.**

```
clquorum disable device
```

*device*                      Specifies the DID name of the disk device to change, for example, d4.

**3. Verify that the quorum device is now in maintenance state.**

The output for the device you placed in maintenance state should read zero for the Quorum Device Votes.

```
clquorum status device
```

**Example 6-6** Putting a Quorum Device Into Maintenance State

The following example shows how to put a quorum device into maintenance state and how to verify the results.

```
clquorum disable d20
clquorum status d20

=== Cluster Quorum ===

--- Quorum Votes by Device ---

Device Name Present Possible Status

d20 1 1 Offline
```

**See Also** To re-enable the quorum device, see [“How to Bring a Quorum Device Out of Maintenance State” on page 179](#).

To put a node into maintenance state, see [“How to Put a Node Into Maintenance State” on page 238](#).

## ▼ How to Bring a Quorum Device Out of Maintenance State

Run this procedure each time a quorum device is in a maintenance state and you want to bring the quorum device out of maintenance state and reset the quorum vote count to the default.




---

**Caution** - If you do not specify either the `globaldev` or `node` options, the quorum count is reset for the entire cluster.

---

When you configure a quorum device, Oracle Solaris Cluster software assigns the quorum device a vote count of  $N-1$  where  $N$  is the number of connected votes to the quorum device. For example, a quorum device that is connected to two nodes with nonzero vote counts has a quorum count of one (two minus one).

- To bring a cluster node as well as its associated quorum devices out of maintenance state, see [“How to Bring a Node Out of Maintenance State” on page 239](#).
- To learn more about quorum vote counts, see [“About Quorum Vote Counts” in Oracle Solaris Cluster Concepts Guide](#).

You can also use the Oracle Solaris Cluster Manager GUI to enable a quorum device to bring it out of a maintenance state. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the cluster.**
2. **Reset the quorum count.**

```
clquorum enable device
```

*device* Specifies the DID name of the quorum device to reset, for example, `d4`.

3. **If you are resetting the quorum count because a node was in maintenance state, reboot the node.**
4. **Verify the quorum vote count.**

```
clquorum show +
```

**Example 6-7** Resetting the Quorum Vote Count (Quorum Device)

The following example resets the quorum count for a quorum device back to the default and verifies the result.

```
clquorum enable d20
clquorum show +

=== Cluster Nodes ===

Node Name: phys-schost-2
Node ID: 1
Quorum Vote Count: 1
Reservation Key: 0x43BAC41300000001

Node Name: phys-schost-3
Node ID: 2
Quorum Vote Count: 1
Reservation Key: 0x43BAC41300000002
```

```

=== Quorum Devices ===

Quorum Device Name: d3
Enabled: yes
Votes: 1
Global Name: /dev/did/rdisk/d20s2
Type: shared_disk
Access Mode: scsi3
Hosts (enabled): phys-schost-2, phys-schost-3

```

## ▼ How to List the Quorum Configuration

You do not need to be in the root role to list the quorum configuration. You can assume any role that provides `solaris.cluster.read` RBAC authorization.

---

**Note** - When you increase or decrease the number of node attachments to a quorum device, the quorum vote count is not automatically recalculated. You can reestablish the correct quorum vote if you remove all quorum devices and then add them back into the configuration. For a two-node cluster, temporarily add a new quorum device before you remove and add back the original quorum device. Then remove the temporary quorum device.

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to view the quorum configuration. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

- **Use the `clquorum` command to list the quorum configuration.**

```
% clquorum show +
```

### Example 6-8 Listing the Quorum Configuration

```

% clquorum show +

=== Cluster Nodes ===

Node Name: phys-schost-2
Node ID: 1
Quorum Vote Count: 1
Reservation Key: 0x43BAC41300000001

Node Name: phys-schost-3

```

```
Node ID: 2
Quorum Vote Count: 1
Reservation Key: 0x43BAC41300000002

=== Quorum Devices ===

Quorum Device Name: d3
Enabled: yes
Votes: 1
Global Name: /dev/did/rdisk/d20s2
Type: shared_disk
Access Mode: scsi3
Hosts (enabled): phys-schost-2, phys-schost-3
```

## ▼ How to Repair a Quorum Device

Use this procedure to replace a malfunctioning quorum device.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

### 1. Remove the disk device that you are replacing as a quorum device.

---

**Note** - If the device you intend to remove is the last quorum device, you might want to first add another disk as a new quorum device. This step assures a valid quorum device if a failure occurs during the replacement procedure. See [“Adding a Quorum Device” on page 163](#) to add a new quorum device.

---

See [“How to Remove a Quorum Device” on page 171](#) to remove a disk device as a quorum device.

### 2. Replace the disk device.

To replace the disk device, see the procedures for the disk enclosure in the hardware guide. See also the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).

### 3. Add the replaced disk as a new quorum device.

See [“Adding a Quorum Device” on page 163](#) to add a disk as a new quorum device.

---

**Note** - If you added an additional quorum device in [Step 1](#), it is now safe to remove it. See [“How to Remove a Quorum Device” on page 171](#) to remove the quorum device.

---

## Changing the Quorum's Default Time-out

A default 25-second time-out exists for the completion of quorum operations during a cluster reconfiguration. You can increase the quorum time-out to a higher value by following the instructions in [“How to Configure Quorum Devices” in Oracle Solaris Cluster Software Installation Guide](#) . Rather than increasing the time-out value, you can also switch to a different quorum device.

Additional troubleshooting information is available in [“How to Configure Quorum Devices” in Oracle Solaris Cluster Software Installation Guide](#) .

---

**Note** - For Oracle Real Application Clusters (Oracle RAC), do not change the default quorum time-out of 25 seconds. In certain split-brain scenarios, a longer time-out period might lead to the failure of Oracle RAC VIP failover, due to the VIP resource timing out. If the quorum device being used is not conforming with the default 25-second time-out, use a different quorum device.

---

## Administering Oracle Solaris Cluster Quorum Servers

Oracle Solaris Cluster Quorum Server provides a quorum device that is not a shared storage device. This section provides procedure for administering Oracle Solaris Cluster quorum servers, including:

- [“Starting and Stopping the Quorum Server Software” on page 183](#)
- [“How to Start a Quorum Server” on page 184](#)
- [“How to Stop a Quorum Server” on page 184](#)
- [“Displaying Information About the Quorum Server” on page 185](#)
- [“Cleaning Up Stale Quorum Server Cluster Information” on page 187](#)

For information about installing and configuring Oracle Solaris Cluster quorum servers, see [“How to Install and Configure Oracle Solaris Cluster Quorum Server Software” in Oracle Solaris Cluster Software Installation Guide](#) .

## Starting and Stopping the Quorum Server Software

These procedures describe how to start and stop the Oracle Solaris Cluster software.

By default, these procedures start and stop a single default quorum server unless you have customized the content of the quorum server configuration file, `/etc/scqsd/scqsd.conf`. The

default quorum server is bound on port 9000 and uses the `/var/scqsd` directory for quorum information.

For information about installing the Quorum Server software, see [“How to Install and Configure Oracle Solaris Cluster Quorum Server Software”](#) in *Oracle Solaris Cluster Software Installation Guide*. For information on changing the value of the quorum time-out, see [“Changing the Quorum's Default Time-out”](#) on page 183.

## ▼ How to Start a Quorum Server

1. Assume the `root` role on the host where you want to start the Oracle Solaris Cluster software.
2. Use the `clquorumserver start` command to start the software.

```
/usr/cluster/bin/clquorumserver start quorumserver
```

`quorumserver` Identifies the quorum server. You can use the port number on which the quorum server listens. If you provided an instance name in the configuration file, you can use the name instead.

To start a single quorum server, provide either the instance name or port number. To start all quorum servers, when you have multiple quorum servers configured, use the `+` operand.

### Example 6-9 Starting All Configured Quorum Servers

The following example starts all the configured quorum servers.

```
/usr/cluster/bin/clquorumserver start +
```

### Example 6-10 Starting a Specific Quorum Server

The following example starts the quorum server that listens on port number 2000.

```
/usr/cluster/bin/clquorumserver start 2000
```

## ▼ How to Stop a Quorum Server

1. Assume the `root` role on the host where you want to start the Oracle Solaris Cluster software.
2. Use the `clquorumserver stop` command to stop the software.



```
/usr/cluster/bin/clquorumserver stop [-d] quorumserver
```

**-d** Controls if the quorum server starts the next time you boot the machine. If you specify the **-d** option, the quorum server will not start the next time the machine boots.

**quorumserver** Identifies the quorum server. You can use the port number on which the quorum server listens. If you provided an instance name in the configuration file, you can use that name instead.

To stop a single quorum server, provide either the instance name or port number. To stop all quorum servers, when you have multiple quorum servers configured, use the **+** operand.

**Example 6-11** Stopping All Configured Quorum Servers

The following example stops all the configured quorum servers.

```
/usr/cluster/bin/clquorumserver stop +
```

**Example 6-12** Stopping a Specific Quorum Server

The following example stops the quorum server that listens on port number 2000.

```
/usr/cluster/bin/clquorumserver stop 2000
```

## Displaying Information About the Quorum Server

You can display configuration information about the quorum server. For every cluster that configured the quorum server as a quorum device, this command shows the corresponding cluster name, cluster ID, list of reservation keys, and list of registration keys.

### ▼ How to Display Information About the Quorum Server

- 1. Assume the `root` role on the host where you want to display the quorum server information.**  
Users other than the `root` role require `solaris.cluster.read` role-based access control (RBAC) authorization. For more information about RBAC rights profiles, see the [rbac\(5\)](#) man page.
- 2. Display the configuration information of the quorum server by using the `clquorumserver` command.**

```
/usr/cluster/bin/clquorumserver show quorumserver
```

*quorumserver* Identifies one or more quorum servers. You can specify the quorum server by instance name, or by port number. To display configuration information for all quorum servers, use the + operand.

**Example 6-13** Displaying the Configuration of One Quorum Server

The following example displays the configuration information for the quorum server that uses port 9000. The command displays information for every cluster that has the quorum server configured as a quorum device. This information includes the cluster name and ID, and the list of reservation and registration keys on the device.

In the following example, nodes with IDs 1, 2, 3, and 4 of cluster *bastille* have registered their keys on the quorum server. Also, because Node 4 owns the quorum device reservation, its key is displayed in the reservation list.

```
/usr/cluster/bin/clquorumserver show 9000

=== Quorum Server on port 9000 ===

--- Cluster bastille (id 0x439A2EFB) Reservation ---

Node ID: 4
Reservation key: 0x439a2efb00000004

--- Cluster bastille (id 0x439A2EFB) Registrations ---

Node ID: 1
Registration key: 0x439a2efb00000001

Node ID: 2
Registration key: 0x439a2efb00000002

Node ID: 3
Registration key: 0x439a2efb00000003

Node ID: 4
Registration key: 0x439a2efb00000004
```

**Example 6-14** Displaying the Configuration of Several Quorum Servers

The following example displays the configuration information for three quorum servers, *qs1*, *qs2*, and *qs3*.

```
/usr/cluster/bin/clquorumserver show qs1 qs2 qs3
```

**Example 6-15** Displaying the Configuration of All Running Quorum Servers

The following example displays the configuration information for all running quorum servers:

```
/usr/cluster/bin/clquorumserver show +
```

## Cleaning Up Stale Quorum Server Cluster Information

To remove a quorum device of type `quorumserver`, use the `clquorum remove` command as described in [“How to Remove a Quorum Device” on page 171](#). Under normal operation, this command also removes the quorum server information about the quorum server host. However, if the cluster loses communications with the quorum server host, removing the quorum device does not clean up this information.

The quorum server cluster information becomes invalid in the following circumstances:

- When a cluster is decommissioned without first removing the cluster quorum device by using the `clquorum remove` command
- When a `quorum_server` type quorum device is removed from a cluster while the quorum server host is down




---

**Caution** - If a quorum device of type `quorumserver` is not yet removed from the cluster, using this procedure to clean up a valid quorum server could compromise the cluster quorum.

---

## ▼ How to Clean Up the Quorum Server Configuration Information

**Before You Begin** Remove the quorum server quorum device from the cluster, as described in [“How to Remove a Quorum Device” on page 171](#).




---

**Caution** - If the cluster is still using this quorum server, performing this procedure will compromise cluster quorum.

---

1. **Assume the root role on the quorum server host.**
2. **Use the `clquorumserver clear` command to clean up the configuration file.**

```
clquorumserver clear -c clustername -I clusterID quorumserver [-y]
```

`-c clustername`      The name of the cluster that formerly used the quorum server as a quorum device.

You can obtain the cluster name by running `cluster show` on a cluster node.

`-I clusterID`      The cluster ID.

The cluster ID is an 8-digit hexadecimal number. You can obtain the cluster ID by running `cluster show` on a cluster node.

*quorumserver*

An identifier for one or more quorum servers.

The quorum server can be identified by a port number or an instance name. The port number is used by the cluster nodes to communicate with the quorum server. The instance name is specified in the quorum server configuration file, `/etc/scqsd/scqsd.conf`.

`-y`

Force the `clquorumserver clear` command to clean up cluster information from the configuration file without first prompting for confirmation.

Use this option only if you are confident that you want outdated cluster information to be removed from the quorum server.

**3. (Optional) If no other quorum devices are configured on this server instance, stop the quorum server.**

**Example 6-16** Cleaning Up Outdated Cluster Information From the Quorum Server Configuration

This example removes information about the cluster named `sc-cluster` from the quorum server that uses port 9000.

```
clquorumserver clear -c sc-cluster -I 0x4308D2CF 9000
```

```
The quorum server to be unconfigured must have been removed from the cluster.
Unconfiguring a valid quorum server could compromise the cluster quorum. Do you
want to continue? (yes or no) y
```

## Administering Cluster Interconnects and Public Networks

---

This chapter provides the software procedures for administering the Oracle Solaris Cluster interconnects and public networks.

Administering the cluster interconnects and public networks consists of both hardware and software procedures. Typically, you configure the cluster interconnects and public networks, including Internet Protocol (IP) Network Multipathing groups, when you initially install and configure the cluster. Multipathing is installed automatically with the Oracle Solaris 11 OS, and you must enable it to use it. If you later need to alter a cluster interconnect network configuration, you can use the software procedures in this chapter. For information about configuring IP Network Multipathing groups in a cluster, see the section [“Administering the Public Network” on page 205](#).

This chapter provides information and procedures for the following topics.

- [“Administering the Cluster Interconnects” on page 189](#)
- [“Administering the Public Network” on page 205](#)

For a high-level description of the related procedures in this chapter, see [Table 7-1](#) and [Table 7-3](#).

Refer to the [Oracle Solaris Cluster Concepts Guide](#) for background and overview information about the cluster interconnects and public networks.

### Administering the Cluster Interconnects

This section provides the procedures for reconfiguring cluster interconnects, such as cluster transport adapters and cluster transport cables. These procedures require that you install Oracle Solaris Cluster software.

Most of the time, you can use the `clsetup` utility to administer the cluster transport for the cluster interconnects. See the `clsetup(1CL)` man page for more information. All cluster interconnect commands must be run from a global-cluster node.

You can also use the Oracle Solaris Cluster Manager GUI to perform some of these tasks. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

For cluster software installation procedures, see the [Oracle Solaris Cluster Software Installation Guide](#) . For procedures about servicing cluster hardware components, see the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#) .

---

**Note** - You can usually choose to use the default port name, where appropriate, during cluster interconnect procedures. The default port name is the same as the internal node ID number of the node that hosts the adapter end of the cable.

---

**TABLE 7-1** Task List: Administering the Cluster Interconnect

Task	Instructions
Administer the cluster transport by using <code>clsetup(1CL)</code>	<a href="#">“How to Access the Cluster Configuration Utilities”</a> on page 32
Check the status of the cluster interconnect by using <code>clinterconnect status</code>	<a href="#">“How to Check the Status of the Cluster Interconnect”</a> on page 191
Add a cluster transport cable, transport adapter, or switch by using <code>clsetup</code>	<a href="#">“How to Add Cluster Transport Cables, Transport Adapters, or Transport Switches”</a> on page 192
Remove a cluster transport cable, transport adapter, or transport switch by using <code>clsetup</code>	<a href="#">“How to Remove Cluster Transport Cables, Transport Adapters, and Transport Switches”</a> on page 195
Enable a cluster transport cable by using <code>clsetup</code>	<a href="#">“How to Enable a Cluster Transport Cable”</a> on page 197
Disable a cluster transport cable by using <code>clsetup</code>	<a href="#">“How to Disable a Cluster Transport Cable”</a> on page 199
Determining an transport adapter's instance number	<a href="#">“How to Determine a Transport Adapter's Instance Number”</a> on page 201
Changing the IP address or the address range of an existing cluster	<a href="#">“How to Change the Private Network Address or Address Range of an Existing Cluster”</a> on page 201

## Dynamic Reconfiguration With Cluster Interconnects

You must consider a few issues when completing dynamic reconfiguration (DR) operations on cluster interconnects.

- All of the requirements, procedures, and restrictions that are documented for the Oracle Solaris dynamic reconfiguration feature also apply to Oracle Solaris Cluster dynamic reconfiguration support (except for the operating system quiescence operation). Therefore, review the documentation for the Oracle Solaris dynamic reconfiguration feature *before* using the dynamic reconfiguration feature with Oracle Solaris Cluster software. You should review in particular the issues that affect non-network IO devices during a dynamic reconfiguration detach operation.

- The Oracle Solaris Cluster software rejects dynamic reconfiguration remove-board operations performed on active private interconnect interfaces.
- You must completely remove an active adapter from the cluster in order to perform dynamic reconfiguration on an active cluster interconnect. Use the `clsetup` menu or the appropriate commands.



**Caution** - Oracle Solaris Cluster software requires that each cluster node has at least one functioning path to every other cluster node. Do not disable a private interconnect interface that supports the last path to any cluster node.

Complete the following procedures in the order indicated when performing dynamic reconfiguration operations on public network interfaces.

**TABLE 7-2** Task Map: Dynamic Reconfiguration with Public Network Interfaces

Task	Instructions
1. Disable and remove the interface from the active interconnect	<a href="#">“Dynamic Reconfiguration With Public Network Interfaces” on page 207</a>
2. Perform the dynamic reconfiguration operation on the public network interface.	

## ▼ How to Check the Status of the Cluster Interconnect

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You do not need to be logged in as the `root` role to perform this procedure.

You can also use the Oracle Solaris Cluster Manager GUI to check the status of the cluster interconnect. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

### 1. Check the status of the cluster interconnect.

```
% clinterconnect status
```

### 2. Refer to the following table for common status messages.

Status Message	Description and Possible Action
Path online	The path is currently functioning correctly. No action is necessary.
Path waiting	The path is currently being initialized. No action is necessary.
Faulted	The path is not functioning. This can be a transient state when paths are going between the waiting and online state. If the message persists when <code>clinterconnect status</code> is rerun, take corrective action.

**Example 7-1** Checking the Status of the Cluster Interconnect

The following example shows the status of a functioning cluster interconnect.

```
% clinterconnect status
-- Cluster Transport Paths --
 Endpoint Endpoint Status
 ----- -
Transport path: phys-schost-1:net0 phys-schost-2:net0 Path online
Transport path: phys-schost-1:net4 phys-schost-2:net4 Path online
Transport path: phys-schost-1:net0 phys-schost-3:net0 Path online
Transport path: phys-schost-1:net4 phys-schost-3:net4 Path online
Transport path: phys-schost-2:net0 phys-schost-3:net0 Path online
Transport path: phys-schost-2:net4 phys-schost-3:net4 Path online
```

## ▼ How to Add Cluster Transport Cables, Transport Adapters, or Transport Switches

For information about the requirements for the cluster private transport, see [“Interconnect Requirements and Restrictions” in Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to add cables, transport adapters, and private adapters to your cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

**1. Ensure that the physical cluster transport cables are installed.**

For the procedure on installing a cluster transport cable, see the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).



2. **Assume the root role on any node in the cluster.**

3. **Start the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

4. **Type the number for the option for displaying the Cluster Interconnect Menu.**

5. **Type the number for the option for adding a transport cable.**

Follow the instructions and type the requested information.

6. **Type the number for the option for adding the transport adapter to a node.**

Follow the instructions and type the requested information.

If you plan to use any of the following adapters for the cluster interconnect, add the relevant entry to the `/etc/system` file on each cluster node. The entry becomes effective after the next system boot.

Adapter	Entry
nge	set nge:nge_taskq_disable=1
e1000g	set e1000g:e1000g_taskq_disable=1

7. **Type the number for the option for adding the transport switch.**

Follow the instructions and type the requested information.

8. **Verify that the cluster transport cable, transport adapter, or transport switch is added.**

```
clinterconnect show node:adapter,adapternode
```

```
clinterconnect show node:adapter
```

```
clinterconnect show node:switch
```

**Example 7-2** Adding a Cluster Transport Cable, Transport Adapter, or Transport Switch

The following example shows how to add a transport cable, transport adapter, or transport switch to a node by using the `clsetup` utility. The example contains settings for the Data Link Provider Interface (DLPI) transport type.

```
[Ensure that the physical cable is installed.]
```

```
[Start the clsetup utility:]
```

```
clsetup
```

```
[Select Cluster interconnect]
```

```
[Select either Add a transport cable,
```

```

Add a transport adapter to a node,
or Add a transport switch.}
[Answer the questions when prompted.]
[You Will Need:]
[Information: Example:[
node names phys-schost-1
adapter names net5
switch names hub2
transport type dlpi
[Verify that the clinterconnect
command completed successfully:]Command completed successfully.
Quit the clsetup Cluster Interconnect Menu and Main Menu.
[Verify that the cable, adapter, and switch are added:]
clinterconnect show phys-schost-1:net5,hub2
===Transport Cables ===
Transport Cable: phys-schost-1:net5@0,hub2
Endpoint1: phys-schost-2:net4@0
Endpoint2: hub2@2
State: Enabled

clinterconnect show phys-schost-1:net5
=== Transport Adepters for net5
Transport Adapter: net5
Adapter State: Enabled
Adapter Transport Type: dlpi
Adapter Property (device_name): net6
Adapter Property (device_instance): 0
Adapter Property (lazy_free): 1
Adapter Property (dlpi_heartbeat_timeout): 10000
Adpater Property (dlpi_heartbeat_quantum): 1000
Adapter Property (nw_bandwidth): 80
Adapter Property (bandwidth): 70
Adapter Property (ip_address): 172.16.0.129
Adapter Property (netmask): 255.255.255.128
Adapter Port Names: 0
Adapter Port State (0): Enabled

clinterconnect show phys-schost-1:hub2

=== Transport Switches ===
Transport Switch: hub2
Switch State: Enabled
Switch Type: switch
Switch Port Names: 1 2
Switch Port State(1): Enabled
Switch Port State(2): Enabled

```

**Next Steps** To check the interconnect status of your cluster transport cable see [“How to Check the Status of the Cluster Interconnect” on page 191.](#)

## ▼ How to Remove Cluster Transport Cables, Transport Adapters, and Transport Switches

Use the following procedure to remove cluster transport cables, transport adapters, and transport switches from a node configuration. When a cable is disabled, the two endpoints of the cable remain configured. An adapter cannot be removed if it is still in use as an endpoint on a transport cable.




---

**Caution** - Each cluster node needs at least one functioning transport path to every other node in the cluster. No two nodes should be isolated from one another. Always verify the status of a node's cluster interconnect before disabling a cable. Only disable a cable connection after you have verified that it is redundant. That is, ensure that another connection is available. Disabling a node's last remaining working cable takes the node out of cluster membership.

---

The `phys - schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to remove cables, transport adapters, and private adapters from your cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume the root role on any node in the cluster.**
2. **Check the status of the remaining cluster transport path.**

```
clinterconnect status
```




---

**Caution** - If you receive an error such as “path faulted” while attempting to remove one node of a two-node cluster, investigate the problem before continuing with this procedure. Such a problem could indicate that a node path is unavailable. Removing the remaining operational path takes the node out of cluster membership and could result in a cluster reconfiguration.

---

3. **Start the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

4. **Type the number for the option for accessing the Cluster Interconnect menu.**
5. **Type the number for the option for disabling the transport cable.**

Follow the instructions and type the requested information. You need to know the applicable node names, adapter names, and switch names.

**6. Type the number for the option for removing the transport cable.**

Follow the instructions and type the requested information. You need to know the applicable node names, adapter names, and switch names.

---

**Note** - If you are removing a physical cable, disconnect the cable between the port and the destination device.

---

**7. Type the number for the option for removing the transport adapter from a node.**

Follow the instructions and type the requested information. You need to know the applicable node names, adapter names, and switch names.

If you are removing a physical adapter from a node, see the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#) for hardware service procedures.

**8. Type the number for the option for removing a transport switch.**

Follow the instructions and type the requested information. You need to know the applicable node names, adapter names, and switch names.

---

**Note** - A switch cannot be removed if any of the ports are still in use as endpoints on any transport cables.

---

**9. Verify that the cable, adapter, or switch has been removed.**

```
clinterconnect show node:adapter,adapternode
clinterconnect show node:adapter
clinterconnect show node:switch
```

The transport cable or adapter removed from the respective node should not appear in the output from this command.

**Example 7-3** Removing a Transport Cable, Transport Adapter, or Transport Switch

The following example shows how to remove a transport cable, transport adapter, or transport switch by using the `clsetup` command.

```
[Assume the root role on any node in the cluster.]
[Start the utility:]
clsetup
[Select Cluster interconnect.]
[Select either Remove a transport cable,
Remove a transport adapter to a node,
or Remove a transport switch.]
[Answer the questions when prompted.]
```

```

You Will Need:
Information Example:
node names phys-schost-1
adapter names net0
switch names hub1
[Verify that the clinterconnect
command was completed successfully:]
Command completed successfully.
[Quit the clsetup utility Cluster Interconnect Menu and Main Menu.]
[Verify that the cable, adapter, or switch is removed:]
clinterconnect show phys-schost-1:net5,hub2@0
===Transport Cables ===
Transport Cable: phys-schost-1:net5,hub2@0
Endpoint1: phys-schost-1:net5
Endpoint2: hub2@0
State: Enabled

clinterconnect show phys-schost-1:net5
=== Transport Adepters for net5
Transport Adapter: net5
Adapter State: Enabled
Adapter Transport Type: dlpi
Adapter Property (device_name): net6
Adapter Property (device_instance): 0
Adapter Property (lazy_free): 1
Adapter Property (dlpi_heartbeat_timeout): 10000
Adapter Property (dlpi_heartbeat_quantum): 1000
Adapter Property (nw_bandwidth): 80
Adapter Property (bandwidth): 70
Adapter Property (ip_address): 172.16.0.129
Adapter Property (netmask): 255.255.255.128
Adapter Port Names: 0
Adapter Port State (0): Enabled

clinterconnect show hub2
=== Transport Switches ===
Transport Switch: hub2
State: Enabled
Type: switch
Port Names: 1 2
Port State(1): Enabled
Port State(2): Enabled

```

## ▼ How to Enable a Cluster Transport Cable

This option is used to enable an existing cluster transport cable.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to enable a cable. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager”](#) on page 290.

**1. Assume the root role on any node in the cluster.**

**2. Start the clsetup utility.**

```
clsetup
```

The Main Menu is displayed.

**3. Type the number for the option for accessing the Cluster Interconnect menu and press the Return key.**

**4. Type the number for the option for enabling the transport cable and press the Return key.**

Follow the instructions when prompted. You need to provide both the node and the adapter names of one of the endpoints of the cable that you are trying to identify.

**5. Verify that the cable is enabled.**

```
clinterconnect show node:adapter,adapternode
```

**Example 7-4** Enabling a Cluster Transport Cable

This example shows how to enable a cluster transport cable on adapter net0, located on the node phys-schost-2.

[Assume the root role on any node.]

[ Start the clsetup utility:]

```
clsetup
```

[Select Cluster interconnect>Enable a transport cable.]

[Answer the questions when prompted.]

[You will need the following information.]

*You Will Need:*

<i>Information:</i>	<i>Example:</i>
node names	phys-schost-2
adapter names	net0
switch names	hub1

[Verify that the scinterconnect command was completed successfully:]

```
clinterconnect enable phys-schost-2:net0
```

```

Command completed successfully.
[Quit the clsetup Cluster Interconnect Menu and Main Menu.]
[Verify that the cable is enabled:]
clinterconnect show phys-schost-1:net5,hub2
Transport cable: phys-schost-2:net0@0 ethernet-1@2 Enabled
Transport cable: phys-schost-3:net5@1 ethernet-1@3 Enabled
Transport cable: phys-schost-1:net5@0 ethernet-1@1 Enabled

```

## ▼ How to Disable a Cluster Transport Cable

You might need to disable a cluster transport cable to temporarily shut down a cluster interconnect path. A temporary shutdown is useful when troubleshooting a cluster interconnect problem or when replacing cluster interconnect hardware.

When a cable is disabled, the two endpoints of the cable remain configured. An adapter cannot be removed if it is still in use as an endpoint in a transport cable.




---

**Caution** - Each cluster node needs at least one functioning transport path to every other node in the cluster. No two nodes should be isolated from one another. Always verify the status of a node's cluster interconnect before disabling a cable. Only disable a cable connection after you have verified that it is redundant. That is, ensure that another connection is available. Disabling a node's last remaining working cable takes the node out of cluster membership.

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to disable a cable. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume the root role on any node in the cluster.**
2. **Check the status of the cluster interconnect before disabling a cable.**

```
clinterconnect status
```




---

**Caution** - If you receive an error such as “path faulted” while attempting to remove one node of a two-node cluster, investigate the problem before continuing with this procedure. Such a problem could indicate that a node path is unavailable. Removing the remaining operational path takes the node out of cluster membership and could result in a cluster reconfiguration.

---

3. **Start the `clsetup` utility.**

```
clsetup
```

The Main Menu is displayed.

4. **Type the number for the option for accessing the Cluster Interconnect Menu and press the Return key.**
5. **Type the number for the option for disabling the transport cable and press the Return key.**

Follow the instructions and provide the requested information. All of the components on this cluster interconnect will be disabled. You need to provide both the node and the adapter names of one of the endpoints of the cable that you are trying to identify.

6. **Verify that the cable is disabled.**

```
clinterconnect show node:adapter,adapternode
```

**Example 7-5** Disabling a Cluster Transport Cable

This example shows how to disable a cluster transport cable on adapter net0, located on the node phys-schost-2.

*[Assume the root role on any node.]*

*[Start the clsetup utility:]*

```
clsetup
```

*[Select Cluster interconnect>Disable a transport cable.]*

*[Answer the questions when prompted.]*

*[You will need the following information.]*

*[ You Will Need:]*

<i>Information:</i>	<i>Example:</i>
node names	phys-schost-2
adapter names	net0
switch names	hub1

*[Verify that the clinterconnect command was completed successfully:]*

Command completed successfully.

*[Quit the clsetup Cluster Interconnect Menu and Main Menu.]*

*[Verify that the cable is disabled:]*

```
clinterconnect show -p phys-schost-1:net5,hub2
Transport cable: phys-schost-2:net0@0 ethernet-1@2 Disabled
Transport cable: phys-schost-3:net5@1 ethernet-1@3 Enabled
Transport cable: phys-schost-1:net5@0 ethernet-1@1 Enabled
```



## ▼ How to Determine a Transport Adapter's Instance Number

You need to determine a transport adapter's instance number to ensure that you add and remove the correct transport adapter through the `clsetup` command. The adapter name is a combination of the type of the adapter and the adapter's instance number.

### 1. Based on the slot number, find the adapter's name.

The following screen is an example and might not reflect your hardware.

```
prtdiag
...
===== IO Cards =====
Bus Max
IO Port Bus Freq Bus Dev,
Type ID Side Slot MHz Freq Func State Name Model

XYZ 8 B 2 33 33 2,0 ok xyz11c8,0-xyz11c8,d665.11c8.0.0
XYZ 8 B 3 33 33 3,0 ok xyz11c8,0-xyz11c8,d665.11c8.0.0
...
```

### 2. Using the adapter's path, find the adapter's instance number.

The following screen is an example and might not reflect your hardware.

```
grep sci /etc/path_to_inst
"/xyz@1f,400/pci11c8,o@2" 0 "ttt"
"/xyz@1f,4000.pci11c8,0@4 "ttt"
```

### 3. Using the adapter's name and slot number, find the adapter's instance number.

The following screen is an example and might not reflect your hardware.

```
prtconf
...
xyz, instance #0
xyz11c8,0, instance #0
xyz11c8,0, instance #1
...
```

## ▼ How to Change the Private Network Address or Address Range of an Existing Cluster

Use this procedure to change a private network address or the range of network addresses used or both. To perform this task using the command line, see the [cluster\(1CL\)](#) man page.

**Before You Begin** Ensure that remote shell (`rsh(1M)`) or secure shell (`ssh(1)`) access for the root role is enabled to all cluster nodes.

**1. Reboot all cluster nodes into noncluster mode by performing the following substeps on each cluster node:**

**a. Assume a role that provides `solaris.cluster.admin` RBAC authorization on the cluster node to be started in noncluster mode.**

**b. Shut down the node by using the `clnode evacuate` and `cluster shutdown` commands.**

The `clnode evacuate` command switches over all device groups from the specified node to the next-preferred node. The command also switches all resource groups from the specified node to the next-preferred node.

```
clnode evacuate node
cluster shutdown -g0 -y
```

**2. From one node, start the `clsetup` utility.**

When run in noncluster mode, the `clsetup` utility displays the Main Menu for noncluster-mode operations.

**3. Choose the Change Network Addressing and Ranges for the Cluster Transport menu item.**

The `clsetup` utility displays the current private network configuration, then asks if you would like to change this configuration.

**4. To change either the private network IP address or the IP address range, type `yes` and press the Return key.**

The `clsetup` utility displays the default private network IP address, `172.16.0.0`, and asks if it is okay to accept this default.

**5. Change or accept the private-network IP address.**

■ **To accept the default private network IP address and proceed to changing the IP address range, type `yes` and press the Return key.**

■ **To change the default private network IP address:**

**a. Type `no` in response to the `clsetup` utility question about whether it is okay to accept the default address, then press the Return key.**

The `clsetup` utility will prompt for the new private-network IP address.

**b. Type the new IP address and press the Return key.**

The `clsetup` utility displays the default netmask and then asks if it is okay to accept the default netmask.

**6. Change or accept the default private network IP address range.**

The default netmask is `255.255.240.0`. This default IP address range supports up to 64 nodes, 12 zone clusters, and 10 private networks in the cluster.

- **To accept the default IP address range, type `yes` and press the Return key.**

- **To change the IP address range:**

- a. **Type `no` in response to the `clsetup` utility's question about whether it is okay to accept the default address range, then press the Return key.**

When you decline the default netmask, the `clsetup` utility prompts you for the number of nodes and private networks, and zone clusters that you expect to configure in the cluster.

- b. **Provide the number of nodes, private networks, and zone clusters that you expect to configure in the cluster.**

From these numbers, the `clsetup` utility calculates two proposed netmasks:

- The first netmask is the minimum netmask to support the number of nodes, private networks, and zone clusters that you specified.
- The second netmask supports twice the number of nodes, private networks, and zone clusters that you specified, to accommodate possible future growth.

- c. **Specify either of the calculated netmasks, or specify a different netmask that supports the expected number of nodes, private networks, and zone clusters.**

**7. Type `yes` in response to the `clsetup` utility's question about proceeding with the update.**

**8. When finished, exit the `clsetup` utility.**

**9. Reboot each cluster node back into cluster mode by completing the following substeps for each cluster node:**

**a. Boot the node.**

- On SPARC based systems, run the following command.

```
ok boot
```

- On x86 based systems, run the following commands.

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

**10. Verify that the node has booted without error, and is online.**

```
cluster status -t node
```

## Troubleshooting Cluster Interconnects

This section provides a troubleshooting procedure to disable and then enable a cluster interconnect, such as cluster transport adapters and transport cables.

Do not use the `ipadm` commands to administer cluster transport adapters. If a transport adapter was disabled using the `ipadm disable-if` command, you must use the `clinterconnect` commands to disable the transport path and then enable it.

This procedure requires that you have Oracle Solaris Cluster software installed. These commands must be run from a `global-cluster` node.

### ▼ How to Enable a Cluster Interconnect

You can also use the Oracle Solaris Cluster Manager GUI to enable a cluster interconnect. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

**1. Check the status of the cluster interconnect.**

```
% clinterconnect status

=== Cluster Transport Paths===
Endpoint1 Endpoint2 Status

pnode1:net1 pnode2:net1 waiting
pnode1:net5 pnode2:net5 Path online
```

**2. Disable the cluster interconnect path.**

**a. Check the cluster interconnect path.**

```
% clinterconnect show | egrep -ie "cable.*pnode1"
Transport Cable: pnode1:net5,switch2@1
Transport Cable: pnode1:net1,switch1@1
```

**b. Disable the cluster interconnect path.**

```
% clinterconnect disable pnode1:net1,switch1@1
```

### 3. Enable the cluster interconnect path.

```
% clinterconnect enable pnode1:net1,switch1@1
```

### 4. Verify that the cluster interconnect is enabled.

```
% clinterconnect status
```

```
=== Cluster Transport Paths===
Endpoint1 Endpoint2 Status

pnode1:net1 pnode2:net1 Path online
pnode1:net5 pnode2:net5 Path online
```

## Administering the Public Network

Oracle Solaris Cluster software supports the Oracle Solaris software implementation of Internet Protocol network Multipathing (IPMP) for public networks. Basic IPMP administration is the same for both cluster and noncluster environments. Multipathing is automatically installed when you install the Oracle Solaris 11 OS, and you must enable it to use it. Multipathing administration is covered in the appropriate Oracle Solaris OS documentation. However, review the guidelines that follow before administering IPMP in an Oracle Solaris Cluster environment.

## How to Administer IP Network Multipathing Groups in a Cluster

Before performing IPMP procedures on a cluster, consider the following guidelines.

- When configuring a scalable service resource (SCALABLE=TRUE in the resource type registration file for the resource type) that uses the `SUNW.SharedAddress` network resource, PNM can be configured to monitor IPMP group status on all IPMP groups on the cluster nodes in addition to the one the `SUNW.SharedAddress` is configured to use. This configuration allows the service to be restarted and failed over if any of the IPMP groups on the cluster nodes has failed in order to maximize service availability for network clients that are co-located on the same subnets as the cluster nodes. For example:

```
echo ssm_monitor_all > /etc/cluster/pnm/pnm.conf
```

Reboot the node.

- Each public network adapter that is used for data-service traffic must belong to an IPMP group. If a public network adapter is not used for data-service traffic, you do not have to configure it in an IPMP group.
- The `local-mac-address?` variable must have a value of `true` for Ethernet adapters.

- You can use probe-based IPMP groups or link-based IPMP groups in a cluster. A probe-based IPMP group tests the target IP address and provides the most protection by recognizing more conditions that might compromise availability.

If you are using iSCSI storage as a quorum device, ensure that the probe-based IPMP device is configured correctly. If the iSCSI network is a private network containing only the cluster nodes and iSCSI storage device and there are no other hosts present on the iSCSI network, then the probe-based IPMP mechanism can break when all but one of the cluster nodes goes down. The problem occurs because there are no other hosts on the iSCSI network for IPMP to probe, so IPMP treats this as a network failure when only one node remains in the cluster. IPMP offlines the iSCSI network adapter, and then the remaining node loses access to the iSCSI storage and thus the quorum device. To resolve this problem, you could add a router to the iSCSI network so that other hosts outside the cluster respond to the probes and prevent IPMP from offlining the network adapter. Alternatively, you could configure IPMP with link-based failover instead of probe-based failover.

- Unless there are one or more non-link local IPv6 public network interfaces in the public network configuration, the `scinstall` utility automatically configures a multiple-adapter IPMP group for each set of public-network adapters in the cluster that uses the same subnet. These groups are link-based with transitive probes. Test addresses can be added if probe-based failure detection is required.
- Test IP addresses for all adapters in the same multipathing group must belong to a single IP subnet.
- Test IP addresses must not be used by normal applications because they are not highly available.
- No restrictions are placed on multipathing group naming. However, when configuring a resource group, the `netiflist` naming convention is any multipathing name followed by either the nodeID number or the node name. For example, given a multipathing group named `sc_ipmp0`, the `netiflist` naming could be either `sc_ipmp0@1` or `sc_ipmp0@phys-schost-1`, where the adapter is on the node `phys-schost-1`, which has the nodeID of 1.
- Do not unconfigure (unplumb) or bring down an adapter of an IP Network Multipathing group without first switching over the IP addresses from the adapter to be removed to an alternate adapter in the group, using the `if_mpadm(1M)` command.
- Do not unplumb or remove a network interface from the IPMP group where the Oracle Solaris Cluster HA IP address is plumbed. This IP address can belong to the Logical Host resource or the Shared Address resource. However, if you unplumb the active interface using the `ifconfig` command, Oracle Solaris Cluster now recognizes this event. It fails over the resource group to some other healthy node if the IPMP group has become unusable in the process. Oracle Solaris Cluster could also restart the resource group on the same node if the IPMP group is valid but an HA IP address is missing. The IPMP group becomes unusable for several reasons: loss of IPv4 connectivity, loss of IPv6 connectivity, or both. For more information, see the `if_mpadm(1M)` man page.
- Avoid rewiring adapters to different subnets without first removing them from their respective multipathing groups.
- Logical adapter operations can be done on an adapter even if monitoring is on for the multipathing group.

- You must maintain at least one public network connection for each node in the cluster. The cluster is inaccessible without a public network connection.
- To view the status of IP Network Multipathing groups on a cluster, use the `ipmpstat -g` command.

For more information about IP Network Multipathing, see the appropriate documentation in the Oracle Solaris OS system administration documentation set.

**TABLE 7-3** Task Map: Administering the Public Network

Oracle Solaris OS Release	Instructions
Oracle Solaris 11 OS	<a href="#">Chapter 3, “Administering IPMP,” in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.2</i></a>

For cluster software installation procedures, see the [Oracle Solaris Cluster Software Installation Guide](#) . For procedures about servicing public networking hardware components, see the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#) .

## Dynamic Reconfiguration With Public Network Interfaces

You must consider a few issues when completing dynamic reconfiguration (DR) operations on public network interfaces in a cluster.

- All of the requirements, procedures, and restrictions that are documented for the Oracle Solaris dynamic reconfiguration feature also apply to Oracle Solaris Cluster dynamic reconfiguration support (except for the operating system quiescence operation). Therefore, review the documentation for the Oracle Solaris dynamic reconfiguration feature *before* using the dynamic reconfiguration feature with Oracle Solaris Cluster software. You should review in particular the issues that affect non-network IO devices during a dynamic reconfiguration detach operation.
- Dynamic reconfiguration remove-board operations can succeed only when public network interfaces are not active. Before removing an active public network interface, switch the IP addresses from the adapter to be removed to another adapter in the multipathing group, using the `if_mpadm` command. For more information, see the `if_mpadm(1M)` man page.
- If you try to remove a public network interface card without having properly disabled it as an active network interface, Oracle Solaris Cluster rejects the operation and identifies the interface that would be affected by the operation.



**Caution** - For multipathing groups with two adapters, if the remaining network adapter fails while you are performing the dynamic reconfiguration remove operation on the disabled network adapter, availability is impacted. The remaining adapter has no place to fail over for the duration of the dynamic reconfiguration operation.

Complete the following procedures in the order indicated when performing dynamic reconfiguration operations on public network interfaces.

**TABLE 7-4** Task Map: Dynamic Reconfiguration With Public Network Interfaces

Task	Instructions
1. Switch the IP addresses from the adapter to be removed to another adapter in the multipathing group, using the <code>if_mpadm</code> command	<a href="#">if_mpadm(1M)</a> man page. <a href="#">“How to Move an Interface From One IPMP Group to Another IPMP Group”</a> in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.2</i>
2. Remove the adapter from the multipathing group by using the <code>ipadm</code> command	<a href="#">ipadm(1M)</a> man page <a href="#">“How to Remove an Interface From an IPMP Group”</a> in <i>Administering TCP/IP Networks, IPMP, and IP Tunnels in Oracle Solaris 11.2</i>
3. Perform the dynamic reconfiguration operation on the public network interface	



## Administering Cluster Nodes

---

This chapter provides instructions on how to add a node to a cluster and how to remove a node:

- “Adding a Node to a Cluster or Zone Cluster” on page 209
- “Restoring Cluster Nodes” on page 212
- “Removing a Node From a Cluster” on page 217

For information about cluster maintenance tasks, see [Chapter 9, “Administering the Cluster”](#).

### Adding a Node to a Cluster or Zone Cluster

This section describes how to add a node to a global cluster or a zone cluster. You can create a new zone-cluster node on a node of the global cluster that hosts the zone cluster, as long as that global-cluster node does not already host a node of that particular zone cluster.

---

**Note** - The node that you add must run the same version of the Oracle Solaris Cluster software as the cluster it is joining.

---

Specifying an IP address and NIC for each zone cluster node is optional.

---

**Note** - If you do not configure an IP address for each zone cluster node, two things will occur:

1. That specific zone cluster will not be able to configure NAS devices for use in the zone cluster. The cluster uses the IP address of the zone cluster node when communicating with the NAS device, so not having an IP address prevents cluster support for fencing NAS devices.
  2. The cluster software will activate any Logical Host IP address on any NIC.
- 

If the original zone cluster node did not have a IP address or NIC specified, then you do not need to specify that information for the new zone cluster node.

In this chapter, `phys - schost#` reflects a global-cluster prompt. The `clzonecluster` interactive shell prompt is `clzc:schost>`.

The following table lists the tasks to perform to add a node to an existing cluster. Perform the tasks in the order shown.

**TABLE 8-1** Task Map: Adding a Node to an Existing Global or Zone Cluster

Task	Instructions
Install the host adapter on the node and verify that the existing cluster interconnects can support the new node	<a href="#">Oracle Solaris Cluster 4.2 Hardware Administration Manual</a>
Add shared storage	Add shared storage manually by following the instructions in the <a href="#">Oracle Solaris Cluster 4.2 Hardware Administration Manual</a> .  You can also use the Oracle Solaris Cluster Manager GUI to add a shared storage device to a zone cluster. For GUI log-in instructions, see “How to Access Oracle Solaris Cluster Manager” on page 290.
Add the node to the authorized node list	<code>/usr/cluster/bin/claccess allow -h node-being-added</code>
Install and configure the software on the new cluster node	Chapter 2, “Installing Software on Global-Cluster Nodes,” in <a href="#">Oracle Solaris Cluster Software Installation Guide</a>
Add the new node to an existing cluster	“How to Add a Node to an Existing Cluster or Zone Cluster” on page 210
If the cluster is configured in an Oracle Solaris Cluster Geographic Edition partnership, configure the new node as an active participant in the configuration	“How to Add a New Node to a Cluster in a Partnership” in <a href="#">Oracle Solaris Cluster Geographic Edition System Administration Guide</a>

## ▼ How to Add a Node to an Existing Cluster or Zone Cluster

Before adding an Oracle Solaris host or a virtual machine to an existing global cluster or a zone cluster, ensure that the node has all of the necessary hardware correctly installed and configured, including an operational physical connection to the private cluster interconnect.

For hardware installation information, refer to the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#) or the hardware documentation that shipped with your server.

This procedure enables a machine to install itself into a cluster by adding its node name to the list of authorized nodes for that cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **On a current global-cluster member, assume the `root` role on the current cluster member. Perform these steps from a node of a global cluster.**
2. **Ensure that you have correctly completed all prerequisite hardware installation and configuration tasks that are listed in the task map for [Table 8-1](#).**

3. **Install and configure the software on the new cluster node.**

Use the `scinstall` utility to complete the installation and configuration of the new node, as described in the [Oracle Solaris Cluster Software Installation Guide](#) .

4. **Use the `scinstall` utility on the new node to configure that node in the cluster.**
5. **To manually add a node to a zone cluster, you must specify the Oracle Solaris host and the virtual node name.**

You must also specify a network resource to be used for public network communication on each node. In the following example, the zone name is `sczone`, and `sc_ipmp0` is the IPMP group name.

```
clzc:sczone>add node
clzc:sczone:node>set physical-host=phys-cluster-3
clzc:sczone:node>set hostname=hostname3
clzc:sczone:node>add net
clzc:sczone:node:net>set address=hostname3
clzc:sczone:node:net>set physical=sc_ipmp0
clzc:sczone:node:net>end
clzc:sczone:node>end
clzc:sczone>exit
```

For detailed instructions on configuring the node, see “[Creating and Configuring a Zone Cluster](#)” in [Oracle Solaris Cluster Software Installation Guide](#) .

6. **If the new zone cluster node will be a `solaris10` brand and does not have Oracle Solaris Cluster software installed on the zone cluster, provide the path to the DVD image and install the software.**

```
clzc install-cluster -d dvd-image zoneclustername
```

7. **After you configure the node, reboot the node into cluster mode and install the zone cluster on the node.**

```
clzc install zoneclustername
```

8. **To prevent any new machines from being added to the cluster, from the `clsetup` utility type the number for the option to instruct the cluster to ignore requests to add new machines.**

Press the Return key.

Follow the `clsetup` prompts. This option tells the cluster to ignore all requests over the public network from any new machine that is trying to add itself to the cluster.

### 9. Quit the `clsetup` utility.

#### Example 8-1 Adding a Global-Cluster Node to the Authorized Node List

The following example shows how to add a node named `phys-schost-3` to the authorized node list in an existing cluster.

```
[Assume the root role and execute the clsetup utility.]
phys-schost# clsetup
[Select New nodes>Specify the name of a machine which may add itself.]
[Answer the questions when prompted.]
[Verify that the command completed successfully.]

claccess allow -h phys-schost-3

Command completed successfully.
[Select Prevent any new machines from being added to the cluster.]
[Quit the clsetup New Nodes Menu and Main Menu.]
[Install the cluster software.]
```

**See Also** [clsetup\(1CL\)](#) man page.

For a complete list of tasks for adding a cluster node, see [Table 8-1](#), “Task Map: Adding a Cluster Node.”

To add a node to an existing resource group, see the [Oracle Solaris Cluster Data Services Planning and Administration Guide](#) .

## Restoring Cluster Nodes

You can use the Unified Archives to restore a cluster node so that it is exactly the same as the archive. Before you restore the node, you must first create a *recovery* archive on the cluster nodes. Only a *recovery* archive can be used; a *clone* archive cannot be used to restore a cluster node. See [Step 1](#) below for instructions on creating the recovery archive.

This procedure prompts you for the cluster name, node names and their MAC addresses, and the path to the Unified Archives. For each archive that you specify, the `scinstall` utility verifies that the archive's source node name is the same as the node you are restoring. For instructions on restoring the nodes in a cluster from a Unified Archive, see “[How to Restore a Node from the Unified Archive](#)” on page 213.

## ▼ How to Restore a Node from the Unified Archive

This procedure uses the interactive form of the `scinstall` utility on the Automated Installer server. You must have already set up the AI server and installed the `ha-cluster/system/install` packages from the Oracle Solaris Cluster repositories. The node name of the archive must be the same as the node that you are restoring.

Follow these guidelines to use the interactive `scinstall` utility in this procedure:

- Interactive `scinstall` enables you to type ahead. Therefore, do not press the Return key more than once if the next menu screen does not appear immediately.
- Unless otherwise noted, you can press Control-D to return to either the start of a series of related questions or to the Main Menu.
- Default answers or answers to previous sessions are displayed in brackets ([ ]) at the end of a question. Press Return to enter the response that is in brackets without typing it.

### 1. Assume the root role on a node of the global cluster and create a recovery archive.

```
phys-schost# archiveadm create -r archive-location
```

When you create an archive, exclude the ZFS datasets that are on the shared storage. If you plan to restore the data on the shared storage, use the traditional method.

For more information on using the `archiveadm` command, see the [archiveadm\(1M\)](#) man page.

### 2. Log into the Automated Installer server and assume the root role.

### 3. Start the `scinstall` utility.

```
phys-schost# scinstall
```

### 4. Type the option number to restore a cluster and press Return.

```
*** Main Menu ***
```

```
Please select from one of the following (*) options:
```

- ```
* 1) Install, restore, or replicate a cluster from this Automated Installer server
* 2) Securely install, restore, or replicate a cluster from this Automated Installer server
* 3) Print release information for this Automated Installer install server
```

```
* ?) Help with menu options
```

```
* q) Quit
```

```
Option: 2
```

Choose Option 1 to restore a cluster node using a non-secure AI server installation. Choose Option 2 to restore a cluster node using the secure AI server installation.

The Custom Automated Installer Menu or Custom Secure Automated Installer Menu is displayed.

- 5. Type the option number to Restore Cluster Nodes from Unified Archives and press Return.**

The Cluster Name screen is displayed.

- 6. Type the cluster name that contains the nodes you want to restore and press Return.**

The Cluster Nodes screen is displayed.

- 7. Type the names of the cluster nodes that you want to restore from the Unified Archives.**

Type one node name per line and press Return. When you are done, press Control-D and confirm the list by typing yes and pressing Return. If you want to restore all the nodes in the cluster, specify all the nodes.

If the `scinstall` utility is unable to find the MAC address of the nodes, type in each address when prompted and press Return.

- 8. Type the full path to the recovery archive and press Return.**

The archive used to restore a node *must* be a recovery archive. The archive file you use to restore a particular node must be created on the same node. Repeat this for each cluster node you want to restore.

- 9. For each node, confirm the options you chose so that the `scinstall` utility performs the necessary configuration to install the cluster nodes from this AI server.**

The utility also prints instructions to add the DHCP macros on the DHCP server, and adds or clears the security keys for SPARC nodes (if you chose secure installation). Follow those instructions.

- 10. (Optional) To customize the target device, update the AI manifest for each node.**

The AI manifest is located in the following directory:

```
/var/cluster/logs/install/autoscinstall.d/ \  
cluster-name/node-name/node-name_aimanifest.xml
```

- a. To customize the target device, update the target element in the manifest file.**

Update the target element in the manifest file based on how you want to use the supported criteria to locate the target device for the installation. For example, you can specify the `disk_name` sub-element.

Note - `scinstall` assumes the existing boot disk in the manifest file to be the target device. To customize the target device, update the `target` element in the manifest file. For more information, see [Part III, “Installing Using an Install Server,” in *Installing Oracle Solaris 11.2 Systems*](#) and the `ai_manifest(4)` man page.

b. Run the `installadm` command for each node.

```
# installadm update-manifest -n cluster-name-{sparc|i386} \
-f /var/cluster/logs/install/autoscinstall.d/cluster-name/node-name/node-
name_aimanifest.xml \
-m node-name_manifest
```

Note that SPARC and i386 is the architecture of the cluster node.

11. If you are using a cluster administrative console, display a console screen for each node in the cluster.

- **If `pconsole` software is installed and configured on your administrative console, use the `pconsole` utility to display the individual console screens.**

As the root role, use the following command to start the `pconsole` utility:

```
adminconsole# pconsole host[:port] [...] &
```

The `pconsole` utility also opens a master window from which you can send your input to all individual console windows at the same time.

- **If you do not use the `pconsole` utility, connect to the consoles of each node individually.**

12. Shut down and boot each node to start the AI installation.

The Oracle Solaris software is installed with the default configuration.

Note - You cannot use this method if you want to customize the Oracle Solaris installation. If you choose the Oracle Solaris interactive installation, the Automated Installer is bypassed and Oracle Solaris Cluster software is not installed and configured. To customize Oracle Solaris during installation, instead follow instructions in [“How to Install Oracle Solaris Software” in *Oracle Solaris Cluster Software Installation Guide*](#) , then install and configure the cluster by following instructions in [“How to Install Oracle Solaris Cluster Software Packages” in *Oracle Solaris Cluster Software Installation Guide*](#) .

- **SPARC:**

a. Shut down each node.

```
phys-schost# cluster shutdown -g 0 -y
```

b. Boot the node with the following command

```
ok boot net:dhcp - install
```

Note - Surround the dash (-) in the command with a space on each side.

■ **x86:**

a. Reboot the node.

```
# reboot -p
```

b. During PXE boot, press Control-N.

The GRUB menu is displayed.

c. Immediately select the Automated Install entry and press Return.

Note - If you do not select the Automated Install entry within 20 seconds, installation proceeds using the default interactive text installer method, which will not install and configure the Oracle Solaris Cluster software.

Each node will be automatically rebooted to join the cluster after the installation is finished. The node is restored to the same state as when the archive was created. Oracle Solaris Cluster installation output is logged in the `/var/cluster/logs/install/sc_ai_config.log` file on each node.

13. From one node, verify that all nodes have joined the cluster.

```
phys-schost# clnode status
```

Output resembles the following.

```
=== Cluster Nodes ===
```

```
--- Node Status ---
```

| Node Name | Status |
|---------------|--------|
| ----- | ----- |
| phys-schost-1 | Online |
| phys-schost-2 | Online |
| phys-schost-3 | Online |

For more information, see the `clnode(1CL)` man page.

Removing a Node From a Cluster

This section provides instructions on how to remove a node on a global cluster or a zone cluster. You can also remove a specific zone cluster from a global cluster. The following table lists the tasks to perform to remove a node from an existing cluster. Perform the tasks in the order shown.



Caution - If you remove a node using only this procedure for a RAC configuration, the removal might cause the node to panic during a reboot. For instructions on how to remove a node from a RAC configuration, see [“How to Remove Support for Oracle RAC From Selected Nodes” in Oracle Solaris Cluster Data Service for Oracle Real Application Clusters Guide](#) . After you complete that process, remove a node for a RAC configuration, follow the appropriate steps below.

TABLE 8-2 Task Map: Removing a Node

| Task | Instructions |
|--|---|
| Move all resource groups and device groups off the node to be removed. If you have a zone cluster, log into the zone cluster and evacuate the zone cluster node that is on the physical node getting uninstalled. Then remove the node from the zone cluster before you bring the physical node down. If the affected physical node has already failed, simply remove the node from the cluster. | <code>clnode evacuate node</code>

“How to Remove a Node From a Zone Cluster” on page 218 |
| Verify that the node can be removed by checking the allowed hosts. | <code>claccess show</code>

<code>claccess allow -h node-to-remove</code> |
| If the node is not listed by the <code>claccess show</code> command, it cannot be removed. Give the node access to the cluster configuration. | |
| Remove the node from all device groups. | “How to Remove a Node From a Device Group (Solaris Volume Manager)” on page 131 |
| Remove all quorum devices connected to the node being removed. | This step is optional if you are removing a node from a two-node cluster.

“How to Remove a Quorum Device” on page 171

Note that although you must remove the quorum device before you remove the storage device in the next step, you can add the quorum device back immediately afterward.

“How to Remove the Last Quorum Device From a Cluster” on page 173 |

| Task | Instructions |
|---|--|
| Put the node being removed into noncluster mode. | “How to Put a Node Into Maintenance State” on page 238 |
| Remove a node from the cluster software configuration. | “How to Remove a Node From the Cluster Software Configuration” on page 219 |
| (Optional) Uninstall Oracle Solaris Cluster software from a cluster node. | “How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241 |

▼ How to Remove a Node From a Zone Cluster

You can remove a node from a zone cluster by halting the node, uninstalling it, and removing the node from the configuration. If you decide later to add the node back into the zone cluster, follow the instructions in [Table 8-1](#). Most of these steps are performed from the global-cluster node.

You can also use the Oracle Solaris Cluster Manager GUI to shut down a zone-cluster node, but not to remove a node. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume the root role on a node of the global cluster.**
2. **Shut down the zone-cluster node you want to remove by specifying the node and its zone cluster.**

```
phys-schost# clzonecluster halt -n node zoneclustername
```

You can also use the `clnode evacuate` and `shutdown` commands within a zone cluster.

3. **Remove the node from all resource groups in the zone cluster.**

```
phys-schost# clrg remove-node -n zonehostname -Z zoneclustername rg-name
```

If you use the procedure described in the Note in Step 2, the resource groups should be automatically removed so you might be able to skip this step.

4. **Uninstall the zone-cluster node.**

```
phys-schost# clzonecluster uninstall -n node zoneclustername
```

5. **Remove the zone-cluster node from the configuration.**

Use the following commands:

```
phys-schost# clzonecluster configure zoneclustername
```

```
clzc:sczone> remove node physical-host=node
```

```
clzc:sczone> exit
```

Note - If the zone cluster node you want to remove resides on a system that is inaccessible or unable to join the cluster, remove the node with the `clzonecluster` interactive shell:

```
clzc:sczone> remove -F node physical-host=node
```

If you use this method to remove the last zone cluster node, you will be prompted to delete the zone cluster entirely. If you choose not to, the last node will not be removed. This deletion has the same effect as `clzonecluster delete -F zoneclustername`.

6. Verify that the node was removed from the zone cluster.

```
phys-schost# clzonecluster status
```

▼ How to Remove a Node From the Cluster Software Configuration

Perform this procedure to remove a node from the global cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Ensure that you have removed the node from all resource groups, device groups, and quorum device configurations and put it into maintenance state before you continue with this procedure.**
2. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on the node that you want to remove.**

Perform all steps in this procedure from a node of the global cluster.

3. **Boot the global-cluster node that you want to remove into noncluster mode.**

For a zone-cluster node, follow the instructions in [“How to Remove a Node From a Zone Cluster” on page 218](#) before you perform this step.

- On SPARC based systems, run the following command.

```
ok boot -x
```

- On x86 based systems, run the following commands.

```
shutdown -g -y -i0
```

Press any key to continue

- a. **In the GRUB menu, use the arrow keys to select the appropriate Oracle Solaris entry and type `e` to edit its commands.**

For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#) .

- b. **In the boot parameters screen, use the arrow keys to select the kernel entry and type `e` to edit the entry.**

- c. **Add `-x` to the command to specify system boot into noncluster mode.**

[Minimal BASH-like line editing is supported. For the first word, TAB lists possible command completions. Anywhere else TAB lists the possible completions of a device/filename. ESC at any time exits.]

```
grub edit> kernel$ /platform/i86pc/kernel/#ISADIR/unix -B $ZFS-BOOTFS -x
```

- d. **Press the Enter key to accept the change and return to the boot parameters screen.**

The screen displays the edited command.

- e. **Type `b` to boot the node into noncluster mode.**

This change to the kernel boot parameter command does not persist over the system boot. The next time you reboot the node, it will boot into cluster mode. To boot into noncluster mode instead, perform these steps again to add the `-x` option to the kernel boot parameter command.

4. Delete the node from the cluster.

- a. **Run the following command from an active node:**

```
phys-schost# clnode clear -F nodename
```

If you have resource groups that are have `rg_system=true`, you must change them to `rg_system=false` so that the `clnode clear -F` command will succeed. After you run `clnode clear -F`, reset the resource groups back to `rg_system=true`.

- b. **Run the following command from the node you want to remove:**

```
phys-schost# clnode remove -F
```

Note - If the node to be removed is not available or can no longer be booted, run the following command on any active cluster node: `clnode clear -F <node-to-be-removed>`. Verify the node removal by running `clnode status <nodename>`.

If you are removing the last node in the cluster, the node must be in noncluster mode with no active nodes left in the cluster.

5. From another cluster node, verify the node removal.

```
phys-schost# clnode status nodename
```

6. Complete the node removal.

- If you intend to uninstall the Oracle Solaris Cluster software from the removed node, proceed to [“How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241](#). You could also choose to remove the node from the cluster and uninstall the Oracle Solaris Cluster software at the same time. Change to a directory that does not contain any Oracle Solaris Cluster files and type `scinstall -r`.
- If you do not intend to uninstall the Oracle Solaris Cluster software from the removed node, you can physically remove the node from the cluster by removing the hardware connections as described in [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).

Example 8-2 Removing a Node From the Cluster Software Configuration

This example shows how to remove a node (`phys-schost-2`) from a cluster. The `clnode remove` command is run in noncluster mode from the node you want to remove from the cluster (`phys-schost-2`).

```
[Remove the node from the cluster:]
phys-schost-2# clnode remove
phys-schost-1# clnode clear -F phys-schost-2
[Verify node removal:]
phys-schost-1# clnode status
-- Cluster Nodes --
      Node name      Status
      -
Cluster node:  phys-schost-1  Online
```

See Also To uninstall Oracle Solaris Cluster software from the removed node, see [“How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241](#).

For hardware procedures, see the [Oracle Solaris Cluster 4.2 Hardware Administration Manual](#).

For a comprehensive list of tasks for removing a cluster node, see [Table 8-2](#).

To add a node to an existing cluster, see [“How to Add a Node to an Existing Cluster or Zone Cluster” on page 210](#).

▼ How to Remove Connectivity Between an Array and a Single Node, in a Cluster With Greater Than Two-Node Connectivity

Use this procedure to detach a storage array from a single cluster node, in a cluster that has three-node or four-node connectivity.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Back up all database tables, data services, and volumes that are associated with the storage array that you are removing.**
2. **Determine the resource groups and device groups that are running on the node to be disconnected.**

```
phys-schost# clresourcegroup status
phys-schost# cldevicegroup status
```

3. **If necessary, move all resource groups and device groups off the node to be disconnected.**



Caution (SPARC only) - If your cluster is running Oracle RAC software, shut down the Oracle RAC database instance that is running on the node before you move the groups off the node. For instructions, see the *Oracle Database Administration Guide*.

```
phys-schost# clnode evacuate node
```

The `clnode evacuate` command switches over all device groups from the specified node to the next-preferred node. The command also switches all resource groups from the specified node to the next-preferred node.

4. **Put the device groups into maintenance state.**

For the procedure on putting a device group in maintenance state, see [“How to Put a Node Into Maintenance State” on page 238](#).

5. Remove the node from the device groups.

If you use a raw disk, use the `cldevicegroup(1CL)` command to remove the device groups.

6. For each resource group that contains an `HASStoragePlus` resource, remove the node from the resource group's node list.

```
phys-schost# clresourcegroup remove-node -n node + | resourcegroup
```

`node` The name of the node.

See the *Oracle Solaris Cluster Data Services Planning and Administration Guide* for more information about changing a resource group's node list.

Note - Resource type, resource group, and resource property names are case sensitive when `clresourcegroup` is executed.

7. If the storage array that you are removing is the last storage array that is connected to the node, disconnect the fiber-optic cable between the node and the hub or switch that is connected to this storage array.

Otherwise, skip this step.

8. If you are removing the host adapter from the node that you are disconnecting, and power off the node.

If you are removing the host adapter from the node that you are disconnecting, skip to [Step 11](#).

9. Remove the host adapter from the node.

For the procedure on removing host adapters, see the documentation for the node.

10. Without booting the node, power on the node.

11. If Oracle RAC software has been installed, remove the Oracle RAC software package from the node that you are disconnecting.

```
phys-schost# pkg uninstall /ha-cluster/library/ucmm
```



Caution (SPARC only) - If you do not remove the Oracle RAC software from the node that you disconnected, the node panics when the node is reintroduced to the cluster and potentially causes a loss of data availability.

12. Boot the node in cluster mode.

- On SPARC based systems, run the following command.

```
ok boot
```

- On x86 based systems, run the following commands.

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

- 13. On the node, update the device namespace by updating the `/devices` and `/dev` entries.**

```
phys-schost# devfsadm -C  
cldevice refresh
```

- 14. Bring the device groups back online.**

For information about bringing a device group online, see [“How to Bring a Node Out of Maintenance State” on page 239](#).

▼ How to Correct Error Messages

To correct any error messages that occurred while attempting to perform any of the cluster node removal procedures, perform the following procedure.

- 1. Attempt to rejoin the node to the global cluster.**

Perform this procedure only on a global cluster.

```
phys-schost# boot
```

- 2. Did the node successfully rejoin the cluster?**

- If no, proceed to [Step 2b](#).
- If yes, perform the following steps to remove the node from device groups.

- a. If the node successfully rejoins the cluster, remove the node from the remaining device group or groups.**

Follow procedures in [“How to Remove a Node From All Device Groups” on page 130](#).

- b. After you remove the node from all device groups, return to [“How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241](#) and repeat the procedure.**

- 3. If the node could not rejoin the cluster, rename the node's `/etc/cluster/ccr` file to any other name you choose, for example, `ccr.old`.**

```
# mv /etc/cluster/ccr /etc/cluster/ccr.old
```

- 4. Return to [“How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241](#) and repeat the procedure.**

Administering the Cluster

This chapter provides administrative procedures that affect an entire global cluster or a zone cluster:

- [“Overview of Administering the Cluster” on page 225](#)
- [“Performing Zone Cluster Administrative Tasks” on page 254](#)
- [“Troubleshooting” on page 265](#)

For information about adding or removing a node from the cluster, see [Chapter 8, “Administering Cluster Nodes”](#).

Overview of Administering the Cluster

This section describes how to perform administrative tasks for the entire global cluster or zone cluster. The following table lists these administrative tasks and the associated procedures. You generally perform cluster administrative tasks in the global zone. To administer a zone cluster, at least one machine that will host the zone cluster must be up in cluster mode. All zone cluster nodes are not required to be up and running; Oracle Solaris Cluster replays any configuration changes when the node that is currently out of the cluster rejoins the cluster.

Note - By default, power management is disabled so that it does not interfere with the cluster. If you enable power management for a single-node cluster, the cluster is still running but it can become unavailable for a few seconds. The power management feature attempts to shut down the node, but it does not succeed.

In this chapter, `phys-schost#` reflects a global-cluster prompt. The `clzonecluster` interactive shell prompt is `clzc:schost>`.

TABLE 9-1 Task List: Administering the Cluster

| Task | Instructions |
|-------------------------------------|--|
| Add or remove a node from a cluster | Chapter 8, “Administering Cluster Nodes” |

| Task | Instructions |
|---|--|
| Change the name of the cluster | “How to Change the Cluster Name” on page 226 |
| List node IDs and their corresponding node names | “How to Map Node ID to Node Name” on page 227 |
| Permit or deny new nodes to add themselves to the cluster | “How to Work With New Cluster Node Authentication” on page 228 |
| Change the time for a cluster by using the NTP | “How to Reset the Time of Day in a Cluster” on page 230 |
| Shut down a node to the OpenBoot PROM ok prompt on a SPARC based system or to the Press any key to continue message in a GRUB menu on an x86 based system | “How to Display the OpenBoot PROM (OBP) on a Node” on page 232 |
| Add or change the private hostname | “How to Change the Node Private Hostname” on page 233 |
| Put a cluster node in maintenance state | “How to Put a Node Into Maintenance State” on page 238 |
| Rename a Node | “How to Rename a Node” on page 235 |
| Bring a cluster node out of maintenance state | “How to Bring a Node Out of Maintenance State” on page 239 |
| Uninstall cluster software from a cluster node | “How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241 |
| Add and manage an SNMP Event MIB | “How to Enable an SNMP Event MIB” on page 246
“How to Add an SNMP User on a Node” on page 250 |
| Configure load limits for each node | “How to Configure Load Limits on a Node” on page 253 |
| Move a zone cluster; prepare a zone cluster for applications, remove a zone cluster | “Performing Zone Cluster Administrative Tasks” on page 254 |

▼ How to Change the Cluster Name

If necessary, you can change the cluster name after initial installation.



Caution - Do not perform this procedure if the cluster is in an Oracle Solaris Cluster Geographic Edition partnership. Instead, follow procedures in [“Renaming a Cluster That Is in a Partnership” in Oracle Solaris Cluster Geographic Edition System Administration Guide](#) .

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume the root role on any node in the global cluster.**
2. **Start the `clsetup` utility.**

```
phys-schost# clsetup
```

The Main Menu is displayed.

3. **To change the cluster name, type the number for the option for Other Cluster Properties.**

The Other Cluster Properties menu is displayed.

4. **Make your selection from the menu and follow the onscreen instructions.**
5. **If you want the service tag for Oracle Solaris Cluster to reflect the new cluster name, delete the existing Oracle Solaris Cluster tag and restart the cluster.**

To delete the Oracle Solaris Cluster service tag instance, complete the following substeps on all nodes in the cluster.

- a. **List all of the service tags.**

```
phys-schost# stclient -x
```

- b. **Find the Oracle Solaris Cluster service tag instance number, then run the following command.**

```
phys-schost# stclient -d -i service_tag_instance_number
```

- c. **Reboot all the nodes in the cluster.**

```
phys-schost# reboot
```

Example 9-1 Changing the Cluster Name

The following example shows the `cluster` command generated from the `clsetup` utility to change to the new cluster name, `dromedary`.

```
phys-schost# cluster rename -c dromedary
```

For more information, see the [cluster\(1CL\)](#) and [clsetup\(1CL\)](#) man pages.

▼ How to Map Node ID to Node Name

During Oracle Solaris Cluster installation, each node is automatically assigned a unique node ID number. The node ID number is assigned to a node in the order in which it joins the cluster for the first time. After the node ID number is assigned, the number cannot be changed. The node ID number is often used in error messages to identify which cluster node the message concerns. Use this procedure to determine the mapping between node IDs and node names.

You do not need to be the root role to list configuration information for a global cluster or a zone cluster. One step in this procedure is performed from a node of the global cluster. The other step is performed from a zone-cluster node.

1. **Use the `clnode` command to list the cluster configuration information for the global cluster.**

```
phys-schost# clnode show | grep Node
```

For more information, see the [clnode\(1CL\)](#) man page.

2. **You can also list the Node IDs for a zone cluster.**

The zone-cluster node has the same Node ID as the global cluster-node where it is running.

```
phys-schost# zlogin szone clnode -v | grep Node
```

Example 9-2 Mapping the Node ID to the Node Name

The following example shows the node ID assignments for a global cluster.

```
phys-schost# clnode show | grep Node
=== Cluster Nodes ===
Node Name:   phys-schost1
Node ID:    1
Node Name:   phys-schost2
Node ID:    2
Node Name:   phys-schost3
Node ID:    3
```

▼ How to Work With New Cluster Node Authentication

Oracle Solaris Cluster enables you to determine if new nodes can add themselves to the global cluster and the type of authentication to use. You can permit any new node to join the cluster over the public network, deny new nodes from joining the cluster, or indicate a specific node that can join the cluster. New nodes can be authenticated by using either standard UNIX or Diffie-Hellman (DES) authentication. If you select DES authentication, you must also configure all necessary encryption keys before a node can join. See the [keyserv\(1M\)](#) and [publickey\(4\)](#) man pages for more information.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. Assume the root role on any node in the global cluster.

2. Start the `clsetup` utility.

```
phys-schost# clsetup
```

The Main Menu is displayed.

3. To work with cluster authentication, type the number for the option for new nodes.

The New Nodes menu is displayed.

4. Make your selection from the menu and follow the onscreen instructions.

Example 9-3 Preventing a New Machine From Being Added to the Global Cluster

The `clsetup` utility generates the `claccess` command. The following example shows the `claccess` command that prevents new machines from being added to the cluster.

```
phys-schost# claccess deny -h hostname
```

Example 9-4 Permitting All New Machines to Be Added to the Global Cluster

The `clsetup` utility generates the `claccess` command. The following example shows the `claccess` command that enables all new machines to be added to the cluster.

```
phys-schost# claccess allow-all
```

Example 9-5 Specifying a New Machine to Be Added to the Global Cluster

The `clsetup` utility generates the `claccess` command. The following example shows the `claccess` command that enables a single new machine to be added to the cluster.

```
phys-schost# claccess allow -h hostname
```

Example 9-6 Setting the Authentication to Standard UNIX

The `clsetup` utility generates the `claccess` command. The following example shows the `claccess` command that resets to standard UNIX authentication for new nodes that are joining the cluster.

```
phys-schost# claccess set -p protocol=sys
```

Example 9-7 Setting the Authentication to DES

The `clsetup` utility generates the `claccess` command. The following example shows the `claccess` command that uses DES authentication for new nodes that are joining the cluster.

```
phys-schost# claccess set -p protocol=des
```

When using DES authentication, you must also configure all necessary encryption keys before a node can join the cluster. For more information, see the [keyserv\(1M\)](#) and [publickey\(4\)](#) man pages.

▼ How to Reset the Time of Day in a Cluster

Oracle Solaris Cluster software uses the NTP to maintain time synchronization between cluster nodes. Adjustments in the global cluster occur automatically as needed when nodes synchronize their time. For more information, see the [Oracle Solaris Cluster Concepts Guide](#) and the [Network Time Protocol's User's Guide](#) at <http://download.oracle.com/docs/cd/E19065-01/servers.10k/>.



Caution - When using NTP, do not attempt to adjust the cluster time while the cluster is up and running. Do not adjust the time by using the `date`, `rdate`, or `svcadm` commands interactively or within the `cron` scripts. For more information, see the [date\(1\)](#), [rdate\(1M\)](#), [svcadm\(1M\)](#), or [cron\(1M\)](#) man pages. The `ntpd(1M)` man page is delivered in the `service/network/ntp` Oracle Solaris 11 package.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume the root role on any node in the global cluster.**
2. **Shut down the global cluster.**

```
phys-schost# cluster shutdown -g0 -y -i 0
```
3. **Verify that the node is showing the `ok` prompt on a SPARC based system or the `Press any key to continue` message on the GRUB menu on an x86 based system.**
4. **Boot the node in noncluster mode.**

- On SPARC based systems, run the following command.

```
ok boot -x
```

- On x86 based systems, run the following commands.

```
# shutdown -g -y -i0
```

Press any key to continue

- a. **In the GRUB menu, use the arrow keys to select the appropriate Oracle Solaris entry and type `e` to edit its commands.**

The GRUB menu appears.

For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#).

- b. **In the boot parameters screen, use the arrow keys to select the kernel entry and type `e` to edit the entry.**

The GRUB boot parameters screen appears.

- c. **Add `-x` to the command to specify system boot into noncluster mode.**

```
[ Minimal BASH-like line editing is supported. For the first word, TAB
lists possible command completions. Anywhere else TAB lists the possible
completions of a device/filename. ESC at any time exits. ]
```

```
grub edit> kernel$ /platform/i86pc/kernel/$ISADIR/unix _B $ZFS-BOOTFS -x
```

- d. **Press the Enter key to accept the change and return to the boot parameters screen.**

The screen displays the edited command.

- e. **Type `b` to boot the node into noncluster mode.**

Note - This change to the kernel boot parameter command does not persist over the system boot. The next time you reboot the node, it will boot into cluster mode. To boot into noncluster mode instead, perform these steps again to add the `-x` option to the kernel boot parameter command.

5. **On a single node, set the time of day by running the `date` command.**

```
phys-schost# date HHMM.SS
```

6. **On the other machines, synchronize the time to that node by running the `rdate(1M)` command.**

```
phys-schost# rdate hostname
```

7. Boot each node to restart the cluster.

```
phys-schost# reboot
```

8. Verify that the change occurred on all cluster nodes.

On each node, run the date command.

```
phys-schost# date
```

▼ SPARC: How to Display the OpenBoot PROM (OBP) on a Node

Use this procedure if you need to configure or change OpenBoot™ PROM settings.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. Connect to the console on the node to be shut down.

```
# telnet tc_name tc_port_number
```

tc_name Specifies the name of the terminal concentrator.

tc_port_number Specifies the port number on the terminal concentrator. Port numbers are configuration dependent. Typically, ports 2 and 3 (5002 and 5003) are used for the first cluster installed at a site.

2. Shut down the cluster node gracefully by using the `clnode evacuate` command, then the `shutdown` command.

The `clnode evacuate` command switches over all device groups from the specified node to the next-preferred node. The command also switches all resource groups from the global cluster's specified node to the next-preferred node.

```
phys-schost# clnode evacuate node
# shutdown -g0 -y
```



Caution - Do not use `send brk` on a cluster console to shut down a cluster node.

3. **Execute the OBP commands.**

▼ How to Change the Node Private Hostname

Use this procedure to change the private hostname of a cluster node after installation has been completed.

Default private host names are assigned during initial cluster installation. The default private hostname takes the form `clusternode<nodeid>-priv`, for example: `clusternode3-priv`. Change a private hostname only if the name is already in use in the domain.



Caution - Do not attempt to assign IP addresses to new private host names. The clustering software assigns them.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Disable, on all nodes in the cluster, any data service resources or other applications that might cache private host names.**

```
phys-schost# clresource disable resource[,...]
```

Include the following in the applications you disable.

- HA-DNS and HA-NFS services, if configured
- Any application that has been custom-configured to use the private hostname
- Any application that is being used by clients over the private interconnect

For information about using the `clresource` command, see the [clresource\(1CL\)](#) man page and the [Oracle Solaris Cluster Data Services Planning and Administration Guide](#).

2. **If your NTP configuration file refers to the private hostname that you are changing, bring down the NTP daemon on each node of the cluster.**

Use the `svcadm` command to shut down the NTP daemon. See the [svcadm\(1M\)](#) man page for more information about the NTP daemon.

```
phys-schost# svcadm disable ntp
```

3. **Run the `clsetup` utility to change the private hostname of the appropriate node.**

Run the utility from only one of the nodes in the cluster. For more information, see the [clsetup\(1CL\)](#) man page.

Note - When selecting a new private hostname, ensure that the name is unique to the cluster node.

You can also run the `clnode` command instead of the `clsetup` utility to change the private hostname. In the example below, the cluster node name is `pred1`. After you run the `clnode` command below, go to [Step 6](#).

```
phys-schost# /usr/cluster/bin/clnode set -p privatehostname=New-private-nodename pred1
```

4. **In the `clsetup` utility, type the number for the option for the private hostname.**
5. **In the `clsetup` utility, type the number for the option for changing a private hostname.**

Answer the questions when prompted. You are asked the name of the node whose private hostname you are changing (`clusternode< nodeid>-priv`), and the new private hostname.

6. **Flush the name service cache.**

Perform this step on each node in the cluster. Flushing prevents the cluster applications and data services from trying to access the old private hostname.

```
phys-schost# nscd -i hosts
```

7. **If you changed a private hostname in your NTP configuration or include file, update the NTP file on each node.**

If you changed a private hostname in your NTP configuration file (`/etc/inet/ntp.conf`) and you have peer host entries or a pointer to the include file for the peer hosts in your NTP configuration file (`/etc/inet/ntp.conf.include`), update the file on each node. If you changed a private hostname in your NTP include file, update the `/etc/inet/ntp.conf.sc` file on each node.

- a. **Use the editing tool of your choice.**

If you perform this step at installation, also remember to remove names for nodes that are configured. Typically, the `ntp.conf.sc` file is identical on each cluster node.

- b. **Verify that you can successfully ping the new private hostname from all cluster nodes.**

- c. **Restart the NTP daemon.**

Perform this step on each node of the cluster.

Use the `svcadm` command to restart the NTP daemon.

```
# svcadm enable svc:network/ntp:default
```

8. Enable all data service resources and other applications that were disabled in Step 1.

```
phys-schost# clresource enable resource[,...]
```

For information about using the `clresource` command, see the `clresource(1CL)` man page and the *Oracle Solaris Cluster Data Services Planning and Administration Guide*.

Example 9-8 Changing the Private Hostname

The following example changes the private hostname from `clusternode2-priv` to `clusternode4-priv`, on node `phys-schost-2`. Perform this action on each node.

```
[Disable all applications and data services as necessary.]
phys-schost-1# svcadm disable ntp
phys-schost-1# clnode show | grep node
...
private hostname:                clusternode1-priv
private hostname:                clusternode2-priv
private hostname:                clusternode3-priv
...
phys-schost-1# clsetup
phys-schost-1# nscd -i hosts
phys-schost-1# pfedit /etc/inet/ntp.conf.sc
...
peer clusternode1-priv
peer clusternode4-priv
peer clusternode3-priv
phys-schost-1# ping clusternode4-priv
phys-schost-1# svcadm enable ntp
[Enable all applications and data services disabled at the beginning of the procedure.]
```

▼ How to Rename a Node

You can change the name of a node that is part of an Oracle Solaris Cluster configuration. You must rename the Oracle Solaris hostname before you can rename the node. Use the `clnode rename` command to rename the node.

The following instructions apply to any application that is running in a global cluster.

1. **On the global cluster, assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **(Optional) If you are renaming a node in an Oracle Solaris Cluster Geographic Edition cluster that is in a partnership, determine whether to switch over the protection group.**

If the cluster where you are performing the rename procedure is primary for the protection group, and you want to have the application in the protection group online, you can switch the protection group to the secondary cluster during the rename procedure.

For more information on Geographic Edition clusters and nodes, see [Chapter 5, “Administering Cluster Partnerships,” in *Oracle Solaris Cluster Geographic Edition System Administration Guide*](#).

- 3. Rename the Oracle Solaris host names by completing the steps in “How to Change a System’s Identity” in *Managing System Information, Processes, and Performance in Oracle Solaris 11.2*, except do *not* perform a reboot at the end of the procedure.**

Instead, perform a cluster shutdown after you complete these steps.

- 4. Boot all cluster nodes into noncluster mode.**

```
ok> boot -x
```

- 5. In noncluster mode on the node where you renamed the Oracle Solaris hostname, rename the node and run the `cmd` command on each renamed host.**

Rename one node at a time.

```
# clnode rename -n newnodename oldnodename
```

- 6. Update any existing references to the previous hostname in the applications that run on the cluster.**

- 7. Confirm that the node was renamed by checking the command messages and log files.**

- 8. Reboot all nodes into cluster mode.**

```
# sync;sync;sync;reboot
```

- 9. Verify the node displays the new name.**

```
# clnode status -v
```

- 10. Update your Geographic Edition configuration to use the new cluster node name.**

The configuration information used by the protection groups and your data replication product might specify the node name.

- 11. You can choose to change the logical hostname resources' `hostnameList` property.**

See [“How to Change the Logical Hostnames Used by Existing Oracle Solaris Cluster Logical Hostname Resources” on page 237](#) for instructions on this optional step.

▼ How to Change the Logical Hostnames Used by Existing Oracle Solaris Cluster Logical Hostname Resources

You can choose to change the logical hostname resource's `hostnameList` property either before or after you rename the node by following the steps in [“How to Rename a Node” on page 235](#). This step is optional.

1. **On the global cluster, assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Optionally, you can change the logical hostnames used by any of the existing Oracle Solaris Cluster Logical Hostname resources.**

The following steps show how to configure the `apache-lh-res` resource to work with the new logical hostname, and must be executed in cluster mode.

- a. **In cluster mode, take the Apache resource groups that contain the logical hostnames offline.**

```
# clrg offline apache-rg
```

- b. **Disable the Apache logical hostname resources.**

```
# clr disable apache-lh-res
```

- c. **Provide the new hostname list.**

```
# clr set -p HostnameList=test-2 apache-lh-res
```

- d. **Change the application's references for previous entries in the `hostnameList` property to reference the new entries.**

- e. **Enable the new Apache logical hostname resources.**

```
# clr enable apache-lh-res
```

- f. **Bring the Apache resource groups online.**

```
# clrg online -eM apache-rg
```

- g. **Confirm that the application started correctly by running the following command checking a client.**

```
# clr status apache-rs
```

▼ How to Put a Node Into Maintenance State

Put a global-cluster node into maintenance state when taking the node out of service for an extended period of time. This way, the node does not contribute to the quorum count while it is being serviced. To put a node into maintenance state, the node must be shut down with the `clnode evacuate` and `shutdown` commands. For more information, see the `clnode(1CL)` and `cluster(1CL)` man pages.

You can also use the Oracle Solaris Cluster Manager GUI to evacuate a node and switch all resource groups and device groups to the next-preferred node. For log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

Note - The Oracle Solaris `shutdown` command shuts down a single node, while the `cluster shutdown` command shuts down the entire cluster.

When a cluster node is shut down and put in maintenance state, all quorum devices that are configured with ports to the node have their quorum vote counts decremented by one. The node and quorum device vote counts are incremented by one when the node is removed from maintenance mode and brought back online.

Use the `clquorum disable` command from another node that is still a cluster member to put a cluster node into maintenance state. For more information, see the `clquorum(1CL)` man page.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on the global-cluster node that you are putting into maintenance state.**

2. **Evacuate any resource groups and device groups from the node.**

The `clnode evacuate` command switches over all resource groups and device groups from the specified node to the next-preferred node.

```
phys-schost# clnode evacuate node
```

3. **Shut down the node that you evacuated.**

```
phys-schost# shutdown -g0 -y -i 0
```

4. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on another node in the cluster and put the node that you shut down in [Step 3](#) in maintenance state.**

```
phys-schost# clquorum disable node
```

node Specifies the name of a node that you want to put into maintenance mode.

5. Verify that the global-cluster node is now in maintenance state.

```
phys-schost# clquorum status node
```

The node that you put into maintenance state should have a Status of offline and 0 (zero) for Present and Possible quorum votes.

Example 9-9 Putting a Global-Cluster Node Into Maintenance State

The following example puts a cluster node into maintenance state and verifies the results. The `clnode status` output shows the Node votes for `phys-schost-1` to be 0 (zero) and the status to be Offline. The Quorum Summary should also show reduced vote counts. Depending on your configuration, the Quorum Votes by Device output might indicate that some quorum disk devices are offline as well.

[On the node to be put into maintenance state:]

```
phys-schost-1# clnode evacuate phys-schost-1
phys-schost-1# shutdown -g0 -y -i0
```

[On another node in the cluster:]

```
phys-schost-2# clquorum disable phys-schost-1
phys-schost-2# clquorum status phys-schost-1
```

-- Quorum Votes by Node --

| Node Name | Present | Possible | Status |
|---------------|---------|----------|---------|
| ----- | ----- | ----- | ----- |
| phys-schost-1 | 0 | 0 | Offline |
| phys-schost-2 | 1 | 1 | Online |
| phys-schost-3 | 1 | 1 | Online |

See Also To bring a node back online, see [“How to Bring a Node Out of Maintenance State” on page 239](#).

▼ How to Bring a Node Out of Maintenance State

Use the following procedure to bring a global-cluster node back online and reset the quorum vote count to the default. For cluster nodes, the default quorum count is one. For quorum devices, the default quorum count is $N-1$, where N is the number of nodes with nonzero vote counts that have ports to the quorum device.

When a node has been put in maintenance state, the node's quorum vote count is decremented by one. All quorum devices that are configured with ports to the node will also have their quorum vote counts decremented. When the quorum vote count is reset and a node removed from maintenance state, both the node's quorum vote count and the quorum device vote count are incremented by one.

Run this procedure any time a global-cluster node has been put in maintenance state and you are removing it from maintenance state.



Caution - If you do not specify either the `globaldev` or `node` options, the quorum count is reset for the entire cluster.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- 1. Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the global cluster other than the one in maintenance state.**
- 2. Depending on the number of nodes that you have in your global cluster configuration, perform one of the following steps:**
 - If you have two nodes in your cluster configuration, go to [Step 4](#).
 - If you have more than two nodes in your cluster configuration, go to [Step 3](#).
- 3. If the node that you are removing from maintenance state will have quorum devices, reset the cluster quorum count from a node other than the one in maintenance state.**

You must reset the quorum count from a node other than the node in maintenance state before rebooting the node, or the node might hang while waiting for quorum.

```
phys-schost# clquorum reset
```

```
reset
```

The change flag that resets quorum.

- 4. Boot the node that you are removing from maintenance state.**
- 5. Verify the quorum vote count.**

```
phys-schost# clquorum status
```

The node that you removed from maintenance state should have a status of `online` and show the appropriate vote count for `Present` and `Possible` quorum votes.

Example 9-10 Removing a Cluster Node From Maintenance State and Resetting the Quorum Vote Count

The following example resets the quorum count for a cluster node and its quorum devices to their defaults and verifies the result. The `cluster status` output shows the Node votes for `phys-schost-1` to be 1 and the status to be `online`. The Quorum Summary should also show an increase in vote counts.

```
phys-schost-2# clquorum reset
```

- On SPARC based systems, run the following command.

```
ok boot
```

- On x86 based systems, run the following commands.

When the GRUB menu is displayed, select the appropriate Oracle Solaris entry and press Enter.

```
phys-schost-1# clquorum status
```

```
--- Quorum Votes Summary ---
```

| Needed | Present | Possible |
|--------|---------|----------|
| 4 | 6 | 6 |

```
--- Quorum Votes by Node ---
```

| Node Name | Present | Possible | Status |
|---------------|---------|----------|--------|
| phys-schost-2 | 1 | 1 | Online |
| phys-schost-3 | 1 | 1 | Online |

```
--- Quorum Votes by Device ---
```

| Device Name | Present | Possible | Status |
|----------------------|---------|----------|--------|
| /dev/did/rdisk/d3s2 | 1 | 1 | Online |
| /dev/did/rdisk/d17s2 | 0 | 1 | Online |
| /dev/did/rdisk/d31s2 | 1 | 1 | Online |

▼ How to Uninstall Oracle Solaris Cluster Software From a Cluster Node

Perform this procedure to unconfigure Oracle Solaris Cluster software from a global-cluster node before you disconnect it from a fully established cluster configuration. You can use this procedure to uninstall software from the last remaining node of a cluster.

Note - To uninstall Oracle Solaris Cluster software from a node that has not yet joined the cluster or is still in installation mode, do not perform this procedure. Instead, go to [“How to Unconfigure Oracle Solaris Cluster Software to Correct Installation Problems”](#) in *Oracle Solaris Cluster Software Installation Guide* .

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. Ensure that you have correctly completed all prerequisite tasks in the task map to remove a cluster node.

See [Table 8-2](#).

Ensure that you have removed the node from the cluster configuration by using `clnode remove` before you continue with this procedure. Other steps might include adding the node you plan to uninstall to the cluster's node-authentication list, uninstalling a zone cluster, and so on.

Note - To unconfigure the node but leave Oracle Solaris Cluster software installed on the node, do not proceed further after you run the `clnode remove` command.

2. Assume the `root` role on the node to uninstall.

3. If your node has a dedicated partition for the global devices namespace, reboot the global-cluster node into noncluster mode.

- On a SPARC based system, run the following command.

```
# shutdown -g0 -y -i0 ok boot -x
```

- On an x86 based system, run the following commands.

```
# shutdown -g0 -y -i0
```

```
...
```

```
<<< Current Boot Parameters >>>
```

```
Boot path: /pci@0,0/pci8086,2545@3/pci8086,1460@1d/pci8086,341a@7,1/
```

```
sd@0,0:a
```

```
Boot args:
```

```
Type    b [file-name] [boot-flags] <ENTER>  to boot with options
```

```
or      i <ENTER>                          to enter boot interpreter
```

```
or      <ENTER>                              to boot with defaults
```

```
<<< timeout in 5 seconds >>>
```

Select (b)oot or (i)nterpreter: **b -x**

4. In the `/etc/vfstab` file, remove all globally mounted file-system entries *except* the `/global/.devices` global mounts.

5. Reboot the node into noncluster mode.

- On SPARC based systems, perform the following command:

```
ok boot -x
```

- On x86 based systems, perform the following commands:

- a. In the GRUB menu, use the arrow keys to select the appropriate Oracle Solaris entry and type `e` to edit its commands.

For more information about GRUB based booting, see [“Booting a System” in *Booting and Shutting Down Oracle Solaris 11.2 Systems*](#) .

- b. In the boot parameters screen, use the arrow keys to select the kernel entry and type `e` to edit the entry.

- c. Add `-x` to the command to specify that the system boot into noncluster mode.

- d. Press Enter to accept the change and return to the boot parameters screen.

The screen displays the edited command.

- e. Type `b` to boot the node into noncluster mode.

Note - This change to the kernel boot parameter command does not persist over the system boot. The next time you reboot the node, it will boot into cluster mode. To boot into noncluster mode instead, perform these steps to again add the `-x` option to the kernel boot parameter command.

6. Change to a directory, such as the root (`/`) directory, that does not contain any files that are delivered by the Oracle Solaris Cluster packages.

```
phys-schost# cd /
```

7. To unconfigure the node and remove Oracle Solaris Cluster software, run the following command.

```
phys-schost# scinstall -r [-b bename]
```

- r Removes cluster configuration information and uninstalls Oracle Solaris Cluster framework and data-service software from the cluster node. You can then reinstall the node or remove the node from the cluster.
- b Specifies the name of a new boot environment, which is where you boot into after the uninstall process completes. Specifying a name is optional. If you do not specify a name for the boot environment, one is automatically generated.

See the [scinstall\(1M\)](#) man page for more information.

8. **If you intend to reinstall the Oracle Solaris Cluster software on this node after the uninstall completes, reboot the node to boot into the new boot environment.**
9. **If you do not intend to reinstall the Oracle Solaris Cluster software on this cluster, disconnect the transport cables and the transport switch, if any, from the other cluster devices.**
 - a. **If the uninstalled node is connected to a storage device that uses a parallel SCSI interface, install a SCSI terminator to the open SCSI connector of the storage device after you disconnect the transport cables.**

If the uninstalled node is connected to a storage device that uses Fibre Channel interfaces, no termination is necessary.
 - b. **Follow the documentation that shipped with your host adapter and server for disconnection procedures.**

Tip - For more information about migrating a global-devices namespace to a lofi, see [“Migrating the Global-Devices Namespace” on page 122.](#)

Troubleshooting a Node Uninstallation

This section describes error messages that you might receive when you run the `clnode remove` command and the corrective actions to take.

Unremoved Cluster File System Entries

The following error messages indicate that the global-cluster node you removed still has cluster file systems referenced in its `vfstab` file.

```
Verifying that no unexpected global mounts remain in /etc/vfstab ... failed
clnode: global-mount1 is still configured as a global mount.
```

```
clnode: global-mount1 is still configured as a global mount.
clnode: /global/dg1 is still configured as a global mount.

clnode: It is not safe to uninstall with these outstanding errors.
clnode: Refer to the documentation for complete uninstall instructions.
clnode: Uninstall failed.
```

To correct this error, return to [“How to Uninstall Oracle Solaris Cluster Software From a Cluster Node” on page 241](#) and repeat the procedure. Ensure that you successfully complete [Step 4](#) in the procedure before you rerun the `clnode remove` command.

Unremoved Listing in Device Groups

The following error messages indicate that the node you removed is still listed with a device group.

```
Verifying that no device services still reference this node ... failed
clnode: This node is still configured to host device service "service".
clnode: This node is still configured to host device service "service2".
clnode: This node is still configured to host device service "service3".
clnode: This node is still configured to host device service "dg1".

clnode: It is not safe to uninstall with these outstanding errors.
clnode: Refer to the documentation for complete uninstall instructions.
clnode: Uninstall failed.
```

Creating, Setting Up, and Managing the Oracle Solaris Cluster SNMP Event MIB

This section describes how to create, set up, and manage the Simple Network Management Protocol (SNMP) event Management Information Base (MIB). This section also describes how to enable, disable, and change the Oracle Solaris Cluster SNMP event MIB.

The Oracle Solaris Cluster software currently supports one MIB, the event MIB. The SNMP manager software traps cluster events in real time. When enabled, the SNMP manager automatically sends trap notifications to all hosts that are defined by the `clsnmphost` command. Because clusters generate numerous notifications, only events with a severity of `min_severity` or greater are sent as trap notifications. By default, the `min_severity` value is set to `NOTICE`. The `log_number` value specifies the number of events to be logged in the MIB table before retiring older entries. The MIB maintains a read-only table of the most current events for which a trap has been sent. The number of events is limited by the `log_number` value. This information does not persist across reboots.

The SNMP event MIB is defined in the `sun-cluster-event-mib.mib` file and is located in the `/usr/cluster/lib/mib` directory. You can use this definition to interpret the SNMP trap information.

The default port number for the event SNMP module is 11161, and the default port for the SNMP traps is 11162. These port numbers can be changed by modifying the Common Agent Container property file, which is `/etc/cacao/instances/default/private/cacao.properties`.

Creating, setting up, and managing an Oracle Solaris Cluster SNMP event MIB can involve the following tasks.

TABLE 9-2 Task Map: Creating, Setting Up, and Managing the Oracle Solaris Cluster SNMP Event MIB

| Task | Instructions |
|---|---|
| Enable an SNMP event MIB | “How to Enable an SNMP Event MIB” on page 246 |
| Disable an SNMP event MIB | “How to Disable an SNMP Event MIB” on page 247 |
| Change an SNMP event MIB | “How to Change an SNMP Event MIB” on page 247 |
| Add an SNMP host to the list of hosts that will receive trap notifications for the MIBs | “How to Enable an SNMP Host to Receive SNMP Traps on a Node” on page 249 |
| Remove an SNMP host | “How to Disable an SNMP Host From Receiving SNMP Traps on a Node” on page 249 |
| Add an SNMP user | “How to Add an SNMP User on a Node” on page 250 |
| Remove an SNMP user | “How to Remove an SNMP User From a Node” on page 251 |

▼ How to Enable an SNMP Event MIB

This procedure shows how to enable an SNMP event MIB.

The `phys-schost#` prompt reflects a `global-cluster` prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

- 1. Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
- 2. Enable the SNMP event MIB.**

```
phys-schost-1# clsnmpmib enable [-n node] MIB
```

`[-n node]` Specifies the *node* on which the event MIB that you want to enable is located. You can specify a node ID or a node name. If you do not specify this option, the current node is used by default.

MIB Specifies the name of the MIB that you want to enable. In this case, the MIB name must be event.

▼ How to Disable an SNMP Event MIB

This procedure shows how to disable an SNMP event MIB.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Disable the SNMP event MIB.**

```
phys-schost-1# clsnmpmib disable -n node MIB
```

-n node Specifies the *node* on which the event MIB that you want to disable is located. You can specify a node ID or a node name. If you do not specify this option, the current node is used by default.

MIB Specifies the type of the MIB that you want to disable. In this case, you must specify event.

▼ How to Change an SNMP Event MIB

This procedure shows how to change the protocol, minimum severity value, and event logging for an SNMP event MIB.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Change the protocol, minimum severity value, and event logging of the SNMP event MIB.**

```
phys-schost-1# clsnmpmib set -n node
```

```
-p version=SNMPv3 \  
-p min_severity=WARNING \  
-p log_number=100 MIB
```

-n *node*

Specifies the *node* on which the event MIB that you want to change is located. You can specify a node ID or a node name. If you do not specify this option, the current node is used by default.

-p version=*value*

Specifies the version of SNMP protocol to use with the MIBs. You specify the *value* as follows:

- version=SNMPv2
- version=snmpv2
- version=2
- version=SNMPv3
- version=snmpv3
- version=3

-p min_severity=*value*

Specifies the minimum severity value to use with MIBs. You specify the *value* as follows:

- min_severity=NOTICE
- min_severity=WARNING
- min_severity=ERROR
- min_severity=CRITICAL
- min_severity=FATAL

-p log_number=*number*

Specifies the number of events to be logged in the MIB table before retiring the older entries. The default value is 100. Values must range from 100-500. You specify the *value* as follows: `log_number=100`.

MIB

Specifies the name of the MIB or MIBs to which to apply the subcommand. In this case, you must specify `event`. If you do not specify this operand, the subcommand uses the default plus sign (+), which means all MIBs. If you use the *MIB* operand, specify the MIB in a space-delimited list after all other command-line options.

For more information, see the [clsnmplib\(1CL\)](#) man page.

▼ How to Enable an SNMP Host to Receive SNMP Traps on a Node

This procedure shows how to add an SNMP host on a node to the list of hosts that will receive trap notifications for the MIBs.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Add the host to the SNMP host list of a community on another node.**

```
phys-schost-1# clnmphost add -c SNMPcommunity [-n node] host
```

-c SNMPcommunity

Specifies the SNMP community name that is used in conjunction with the hostname. The host is a system in the network which can be configured to receive the traps

You must specify the SNMP community name *SNMPcommunity* when you add a host to a community other than `public`. If you use the `add` subcommand without the `-c` option, the subcommand uses `public` as the default community name.

If the specified community name does not exist, this command creates the community.

-n node

Specifies the name of the cluster *node* of the SNMP host that is provided access to the SNMP MIBs in the cluster. You can specify a node name or a node ID. If you do not specify this option, the default is the node where the command is run.

host

Specifies the name, IP address, or IPv6 address of a host that is provided access to the SNMP MIBs in the cluster. This can be a host outside the cluster or a cluster node itself trying to get SNMP traps.

▼ How to Disable an SNMP Host From Receiving SNMP Traps on a Node

This procedure shows how to remove an SNMP host on a node from the list of hosts that will receive trap notifications for the MIBs.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Remove the host from the SNMP host list of a community on the specified node.**

```
phys-schost-1# clnmphot remove -c SNMPcommunity -n node host
```

`remove`

Removes the specified SNMP host from the specified node.

`-c SNMPcommunity`

Specifies the name of the SNMP community from which the SNMP host is removed.

`-n node`

Specifies the name of the cluster *node* on which the SNMP host is removed from the configuration. You can specify a node name or a node ID. If you do not specify this option, the default is the node where the command is run.

`host`

Specifies the name, IP address, or IPv6 address of the host that is removed from the configuration. This can be a host outside the cluster or a cluster node itself trying to get SNMP traps.

To remove all hosts in the specified SNMP community, use a plus sign (+) for *host* with the `-c` option. To remove all hosts, use the plus sign (+) for *host*.

▼ How to Add an SNMP User on a Node

This procedure shows how to add an SNMP user to the SNMP user configuration on a node.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**

2. Add the SNMP user.

```
phys-schost-1# clsnmpuser create -n node -a authentication \
-f password user
```

- n node** Specifies the node on which the SNMP user is added. You can specify a node ID or a node name. If you do not specify this option, the current node is used by default.
- a authentication** Specifies the authentication protocol that is used to authorize the user. The value of the authentication protocol can be SHA or MD5.
- f password** Specifies a file that contains the SNMP user passwords. If you do not specify this option when you create a new user, the command prompts for a password. This option is valid only with the add subcommand. You must specify user passwords on separate lines in the following format:
- ```
user:password
```
- Passwords cannot contain the following characters or a space:
- ; (semicolon)
  - : (colon)
  - \ (backslash)
  - \n (newline)
- user** Specifies the name of the SNMP user that you want to add.

## ▼ How to Remove an SNMP User From a Node

This procedure shows how to remove an SNMP user from the SNMP user configuration on a node.

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Remove the SNMP user.**

```
phys-schost-1# clsnmpuser delete -n node user
```

<code>-n node</code>	Specifies the node from which the SNMP user is removed. You can specify a node ID or a node name. If you do not specify this option, the current node is used by default.
<code>user</code>	Specifies the name of the SNMP user that you want to remove.

## Configuring Load Limits

You can enable the automatic distribution of resource group load across nodes by setting load limits. You can configure a set of load limits for each cluster node. You assign load factors to resource groups, and the load factors correspond to the defined load limits of the nodes. The default behavior is to distribute resource group load evenly across all the available nodes in the resource group's node list.

The resource groups are started on a node from the resource group's node list by the RGM so that the node's load limits are not exceeded. As resource groups are assigned to nodes by the RGM, the resource groups' load factors on each node are summed up to provide a total load. The total load is then compared against that node's load limits.

A load limit consists of the following items:

- A user-assigned name.
- A soft limit value – You can temporarily exceed a soft load limit.
- A hard limit value – Hard load limits can never be exceeded and are strictly enforced.

You can set both the hard limit and the soft limit in a single command. If one of the limits is not explicitly set, the default value is used. Hard and soft load limits for each node are created and modified with the `clnode create-loadlimit`, `clnode set-loadlimit`, and `clnode delete-loadlimit` commands. See the [clnode\(1CL\)](#) man page for more information.

You can configure a resource group to have a higher priority so that it is less likely to be displaced from a specific node. You can also set a `preemption_mode` property to determine if a resource group will be preempted from a node by a higher-priority resource group because of node overload. A `concentrate_load` property also allows you to concentrate the resource group load onto as few nodes as possible. The default value of the `concentrate_load` property is `FALSE` by default.

---

**Note** - You can configure load limits on nodes in a global cluster or a zone cluster. You can use the command line, the `clsetup` utility, or the Oracle Solaris Cluster Manager GUI to configure load limits. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#). The following procedure illustrates how to configure load limits using the command line.

---

## ▼ How to Configure Load Limits on a Node

You can also use the Oracle Solaris Cluster Manager GUI to create and configure a load limit on a global-cluster node or a zone-cluster node. You can also use the GUI to edit or delete an existing node load limit. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on any node of the global cluster.**
2. **Create and set a load limit for the nodes that you want to use load balancing.**

```
clnode create-loadlimit -p limitname=mem_load -Z zc1 -p
softlimit=11 -p hardlimit=20 node1 node2 node3
```

In this example, the zone cluster name is `zc1`. The sample property is called `mem_load` and has a soft limit of 11 and a hard load limit of 20. Hard and soft limits are optional arguments and default to unlimited if you do not specifically define them. See the [`clnode\(1CL\)`](#) man page for more information.

3. **Assign load factor values to each resource group.**

```
clresourcegroup set -p load_factors=mem_load@50,factor2@1 rg1 rg2
```

In this example, the load factors are set on the two resource groups, `rg1` and `rg2`. The load factor settings correspond to the defined load limits of the nodes. You can also perform this step during the creation of the resource group with the `clresourcegroup create` command. See the [`clresourcegroup\(1CL\)`](#) man page for more information.

4. **If desired, you can redistribute the existing load (`clrg remaster`).**

```
clresourcegroup remaster rg1 rg2
```

This command can move resource groups off their current master to other nodes to achieve uniform load distribution.

5. **If desired, you can give some resource groups a higher priority than others.**

```
clresourcegroup set -p priority=600 rg1
```

The default priority is 500. Resource groups with higher priority values get precedence in node assignment over resource groups with lower priorities.

6. **If desired, you can set the `Preemption_mode` property.**

```
clresourcegroup set -p Preemption_mode=No_cost rg1
```

See the [`clresourcegroup\(1CL\)`](#) man page for more information on the `HAS_COST`, `NO_COST`, and `NEVER` options.

**7. If desired, you can also set the `Concentrate_load` flag.**

```
cluster set -p Concentrate_load=TRUE
```

**8. If desired, you can specify an affinity between resource groups.**

A strong positive or negative affinity takes precedence over load distribution. A strong affinity can never be violated, nor can a hard load limit. If you set both strong affinities and hard load limits, some resource groups might be forced to remain offline if both constraints cannot be satisfied.

The following example specifies a strong positive affinity between resource group `rg1` in zone cluster `zc1` and resource group `rg2` in zone cluster `zc2`.

```
clresourcegroup set -p RG_affinities=++zc2:rg2 zc1:rg1
```

**9. Verify the status of all global-cluster nodes and zone-cluster nodes in the cluster.**

```
clnode status -Z all -v
```

The output includes any load limit settings that are defined on the node.

## Performing Zone Cluster Administrative Tasks

You can perform other administrative tasks on a zone cluster, such as moving the zone path, preparing a zone cluster to run applications, and cloning a zone cluster. All of these commands must be performed from a node of the global cluster.

You can create a new zone cluster or add a file system or storage device to an existing zone cluster by using the `clsetup` utility to launch the zone cluster configuration wizard. The zones in a zone cluster are configured when you run `clzonecluster install -c` to configure the profiles. See [“Creating and Configuring a Zone Cluster” in \*Oracle Solaris Cluster Software Installation Guide\*](#) for instructions on using the `clsetup` utility or the `-c config_profile` option.

You can also use the Oracle Solaris Cluster GUI to create a zone cluster, or add a file system or storage device to it. You can also use the Oracle Solaris Cluster GUI to edit the zone cluster's Resource Security property. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

---

**Note** - The Oracle Solaris Cluster commands that you run only from a node in the global cluster are not valid for use with zone clusters. See the appropriate Oracle Solaris Cluster man page for information about the valid use of a command in zones.

---

**TABLE 9-3** Other Zone-Cluster Tasks

Task	Instructions
Move the zone path to a new zone path	<code>clzonecluster move -f zonepath zoneclustername</code>
Prepare the zone cluster to run applications	<code>clzonecluster ready -n nodename zoneclustername</code>
Restore the nodes from the Unified Archives	<a href="#">“How to Restore a Node from the Unified Archive” on page 213</a>
Configure or install a zone cluster from the Unified Archive	<a href="#">“How to Configure a Zone Cluster from the Unified Archive” on page 255</a>  <a href="#">“How to Install a Zone Cluster from the Unified Archive” on page 256</a>  Use a command: <code>clzonecluster clone -Z target- zoneclustername [-m copymethod] source- zoneclustername</code>  Halt the source zone cluster before you use the <code>clone</code> subcommand. The target zone cluster must already be configured.
Add a network address to a zone cluster	<a href="#">“How to Add a Network Address to a Zone Cluster” on page 258</a>
Add a node to a zone cluster	<a href="#">“How to Add a Node to an Existing Cluster or Zone Cluster” on page 210</a>
Remove a node from a zone cluster	<a href="#">“How to Remove a Node From a Zone Cluster” on page 218</a>
Remove a zone cluster	<a href="#">“How to Remove a Zone Cluster” on page 259</a>
Remove a file system from a zone cluster	<a href="#">“How to Remove a File System From a Zone Cluster” on page 260</a>
Remove a storage device from a zone cluster	<a href="#">“How to Remove a Storage Device From a Zone Cluster” on page 263</a>
Restore zone cluster nodes from the Unified Archive	<a href="#">“How to Restore a Node from the Unified Archive” on page 213</a>
Troubleshoot a node uninstallation	<a href="#">“Troubleshooting a Node Uninstallation” on page 244</a>
Create, set up, and manage the Oracle Solaris Cluster SNMP Event MIB	<a href="#">“Creating, Setting Up, and Managing the Oracle Solaris Cluster SNMP Event MIB” on page 245</a>

## ▼ How to Configure a Zone Cluster from the Unified Archive

Use the `clzonecluster` command to launch an interactive utility to configure a `solaris10` or labeled brand zone cluster from the Unified Archive. The `clzonecluster configure` utility lets you specify a *recovery* archive or a *clone* archive.

If you prefer to use the command line rather than the interactive utility to configure a zone cluster from an archive, use the `clzonecluster configure -f command-file` command. See the [clzonecluster\(1CL\)](#) man page for more information.

---

**Note** - If the zone cluster that you want to install was already configured using other supported methods, you do not have to configure the zone cluster from a Unified Archive.

---

**1. Create a recovery or clone archive.**

```
phys-schost# archiveadm create -r archive-location
```

Use the `create` command to create a clone archive or the `-r` option to create a recovery archive. For more information on using the `archiveadm` command, see the [archiveadm\(1M\)](#) man page.

**2. Assume the `root` role on a node of the global cluster that will host the zone cluster.**

**3. Configure the zone cluster from the recovered or cloned archive in the Unified Archive.**

```
phys-schost-1# clzonecluster configure zone-cluster-name
```

The `clzonecluster configure zone-cluster-name` command launches the interactive utility, where you can specify `create -a archive [other-options-such-as-"x"]`. The archive can be either a clone archive or a recovery archive.

---

**Note** - The zone cluster members must be added to the configuration before a zone cluster can be created.

---

The `configure` subcommand uses the `zonecfg` command to configure a zone on each specified machine. The `configure` subcommand lets you specify properties that apply to each node of the zone cluster. These properties have the same meaning as established by the `zonecfg` command for individual zones. The `configure` subcommand supports the configuration of properties that are unknown to the `zonecfg` command. The `configure` subcommand launches an interactive shell if you do not specify the `-foption`. The `-f` option takes a command file as its argument. The `configure` subcommand uses this file to create or modify zone clusters non-interactively.

## ▼ How to Install a Zone Cluster from the Unified Archive

You can install a zone cluster from the Unified Archive. The `clzonecluster install` utility lets you specify the absolute path of the archive or the Oracle Solaris 10 image archive to use



for the installation. See the [solaris10\(5\)](#) man page for details regarding supported archive types. The absolute path of the archive should be accessible on all the physical nodes of the cluster where the zone cluster will be installed. The Unified Archive installation can use either a *recovery* archive or a *clone* archive.

If you prefer to use the command line rather than the interactive utility to install a zone cluster from an archive, use the `clzonecluster create -a archive -z archived-zone` command. See the [clzonecluster\(1CL\)](#) man page for more information.

- 1. Create a recovery or clone archive.**

```
phys-schost# archiveadm create -r archive-location
```

Use the `create` command to create a clone archive or the `-r` option to create a recovery archive. For more information on using the `archiveadm` command, see the [archiveadm\(1M\)](#) man page.

- 2. Assume the root role on a node of the global cluster that will host the zone cluster.**

- 3. Install the zone cluster from the recovered or cloned archive from the Unified Archive.**

```
phys-schost-1# clzonecluster install -a absolute_path_to_archive zoneclustername
```

The absolute path of the archive should be accessible on all the physical nodes of the cluster where the zone cluster will be installed. If you have an HTTPS Unified Archive location, specify the SSL certificate, Certificate Authority (CA) certificate, and key files using `-x cert|ca-cert|key=file`.

The Unified Archives do not contain zone cluster node resources. Node resources are specified when the cluster is configured. When you configure a zone cluster from a global zone using the Unified Archives, you must set the `zonpath`.

If the Unified Archive contains multiple zones, use the `zoneclustername` to specify the zone name of the source of the installation. See the [clzonecluster\(1CL\)](#) man page for more information.

---

**Note** - If the source you used to create the Unified Archive does not contain the Oracle Solaris Cluster packages, you must run `pkg install ha-cluster-packages` (substituting the specific package name, such as `ha-cluster-minimal` or `ha-cluster-framework-full`). You will need to boot the zone, run the `zlogin` command, and then run the `pkg install` command. This action installs the same packages on the target zone cluster as the global cluster.

---

- 4. Boot the new zone cluster.**

```
phys-schost-1# clzonecluster boot zoneclustername
```

## ▼ How to Add a Network Address to a Zone Cluster

This procedure adds a network address for use by an existing zone cluster. A network address is used to configure logical host or shared IP address resources in the zone cluster. You can run the `clsetup` utility multiple times to add as many network addresses as you need.

You can also add a network address to a zone cluster using the Oracle Solaris Cluster Manager GUI. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume the `root` role on a node of the global cluster that hosts the zone cluster.**
2. **On the global cluster, configure the cluster file system that you want to use in the zone cluster.**

Start the `clsetup` utility.

```
phys-schost# clsetup
```

The Main Menu is displayed.

3. **Choose the Zone Cluster menu item.**
4. **Choose the Add Network Address to a Zone Cluster menu item.**
5. **Choose the zone cluster where you want to add the network address.**
6. **Choose the property to specify the network address you want to add.**

```
address=value
```

Specifies the network address used to configure logical host or shared IP address resources in the zone cluster. For example, 192.168.100.101.

The following types of network addresses are supported:

- A valid IPv4 address, optionally followed by / and a prefix length.
- A valid IPv6 address, which must be followed by / and a prefix length.
- A hostname which resolves to an IPv4 address. Hostnames that resolve to IPv6 addresses are not supported.

See the [`zonecfg\(1M\)`](#) man page for more information about network addresses.

7. **To add an additional network address, type `a`.**
8. **Type `c` to save the configuration change.**

The results of your configuration change are displayed. For example:

```
>>> Result of Configuration Change to the Zone Cluster(sczone) <<<
```

```
Adding network address to the zone cluster...
```

```
The zone cluster is being created with the following configuration
```

```
/usr/cluster/bin/clzonecluster configure sczone
add net
set address=phys-schost-1
end
```

```
All network address added successfully to sczone.
```

9. **When finished, exit the `clsetup` utility.**

## ▼ How to Remove a Zone Cluster

You can delete a specific zone cluster or use a wildcard to remove all zone clusters that are configured on the global cluster. The zone cluster must be configured before you remove it.

You can also use the Oracle Solaris Cluster Manager GUI to delete a zone cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

1. **Assume a role that provides `solaris.cluster.modify RBAC` authorization on the node of the global cluster.**

Perform all steps in this procedure from a node of the global cluster.

2. **Delete all resource groups and their resources from the zone cluster.**

```
phys-schost# clresourcegroup delete -F -Z zoneclustername +
```

---

**Note** - This step is performed from a global-cluster node. To perform this step from a node of the zone cluster instead, log into the zone-cluster node and omit `-Z zonecluster` from the command.

---

3. **Halt the zone cluster.**

```
phys-schost# clzonecluster halt zoneclustername
```

4. **Uninstall the zone cluster.**

```
phys-schost# clzonecluster uninstall zoneclustername
```

5. **Unconfigure the zone cluster.**

```
phys-schost# clzonecluster delete zoneclustername
```

**Example 9-11** Removing a Zone Cluster From a Global Cluster

```
phys-schost# clresourcegroup delete -F -Z sczone +
phys-schost# clzonecluster halt sczone
phys-schost# clzonecluster uninstall sczone
phys-schost# clzonecluster delete sczone
```

## ▼ How to Remove a File System From a Zone Cluster

A file system can be exported to a zone cluster using either a direct mount or a loopback mount.

Zone clusters support direct mounts for the following:

- UFS local file system
- Sun QFS standalone file system
- Sun QFS shared file system, when used to support Oracle RAC
- Oracle Solaris ZFS (exported as a data set)
- NFS from supported NAS devices

Zone clusters can manage loopback mounts for the following:

- UFS local file system
- Sun QFS standalone file system
- Sun QFS shared file system, only when used to support Oracle RAC
- UFS cluster file system

You configure an `HASStoragePlus` or `ScalMountPoint` resource to manage the mounting of the file system. For instructions on adding a file system to a zone cluster, see [“Adding File Systems to a Zone Cluster” in \*Oracle Solaris Cluster Software Installation Guide\*](#).

An `HASStoragePlus` resource does not monitor a ZFS file system if the file system has its `mountpoint` property set to `none` or `legacy`, or its `canmount` property set to `off`. For all other ZFS file systems, the `HASStoragePlus` resource fault monitor checks if the file system is mounted. If the file system is mounted, the `HASStoragePlus` resource then probes the file system's accessibility by reading and writing to it, depending on the value of the `IOOption` property called `ReadOnly/ReadWrite`.

If the ZFS file system is not mounted or the probe of the file system fails, the resource fault monitor fails and the resource is set to `Faulted`. The RGM will attempt to restart it, determined by the `retry_count` and `retry_interval` properties of the resource. This action results in remounting the file system if the specific `mountpoint` and `canmount` property settings described

above are not in play. If the fault monitor continues to fail and exceeds the `retry_count` within the `retry_interval`, the RGM fails the resource over to another node.

The `phys-schost#` prompt reflects a global-cluster prompt. This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

You can also use the Oracle Solaris Cluster Manager GUI to remove a file system from a zone cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

- 1. Assume the root role on a node of the global cluster that hosts the zone cluster.**

Some steps in this procedure are performed from a node of the global cluster. Other steps are performed from a node of the zone cluster.

- 2. Delete the resources related to the file system being removed.**

- a. Identify and remove the Oracle Solaris Cluster resource types, such as `HASStoragePlus` and `SUNW.ScalMountPoint`, that are configured for the zone cluster's file system that you are removing.**

```
phys-schost# clresource delete -F -Z zoneclustername fs_zone_resources
```

- b. If applicable, identify and remove the Oracle Solaris Cluster resources of type `SUNW.qfs` that are configured in the global cluster for the file system that you are removing.**

```
phys-schost# clresource delete -F fs_global_resources
```

Use the `-F` option carefully because it forces the deletion of all the resources you specify, even if you did not disable them first. All the resources you specified are removed from the resource-dependency settings of other resources, which can cause a loss of service in the cluster. Dependent resources that are not deleted can be left in an invalid state or in an error state. For more information, see the [`clresource\(1CL\)`](#) man page.

---

**Tip** - If the resource group for the removed resource later becomes empty, you can safely delete the resource group.

---

- 3. Determine the path to the file-system mount point directory.**

For example:

```
phys-schost# clzonecluster configure zoneclustername
```

- 4. Remove the file system from the zone-cluster configuration.**

```
phys-schost# clzonecluster configure zoneclustername
```

```
clzc:zoneclustername> remove fs dir=filesystemdirectory
```

```
clzc:zoneclustername> commit
```

The file system mount point is specified by **dir=**.

## 5. Verify the removal of the file system.

```
phys-schost# clzonecluster show -v zoneclustername
```

### Example 9-12 Removing a Highly Available Local File System in a Zone Cluster

This example shows how to remove a file system with a mount-point directory (`/local/ufs-1`) that is configured in a zone cluster called `sczone`. The resource is `hasp-rs` and is of the type `HAStoragePlus`.

```
phys-schost# clzonecluster show -v sczone
...
Resource Name: fs
dir: /local/ufs-1
special: /dev/md/ds1/dsk/d0
raw: /dev/md/ds1/rdisk/d0
type: ufs
options: [logging]
...
phys-schost# clresource delete -F -Z sczone hasp-rs
phys-schost# clzonecluster configure sczone
clzc:sczone> remove fs dir=/local/ufs-1
clzc:sczone> commit
phys-schost# clzonecluster show -v sczone
```

### Example 9-13 Removing a Highly Available ZFS File System in a Zone Cluster

This example shows to remove a ZFS file systems in a ZFS pool called `HAzpool`, which is configured in the `sczone` zone cluster in resource `hasp-rs` of type `SUNW.HAStoragePlus`.

```
phys-schost# clzonecluster show -v sczone
...
Resource Name: dataset
name: HAzpool
...
phys-schost# clresource delete -F -Z sczone hasp-rs
phys-schost# clzonecluster configure sczone
clzc:sczone> remove dataset name=HAzpool
clzc:sczone> commit
phys-schost# clzonecluster show -v sczone
```

## ▼ How to Remove a Storage Device From a Zone Cluster

You can remove storage devices, such as Solaris Volume Manager disksets and DID devices, from a zone cluster. Perform this procedure to remove a storage device from a zone cluster.

You can also use the Oracle Solaris Cluster Manager GUI to remove a storage device from a zone cluster. For GUI log-in instructions, see [“How to Access Oracle Solaris Cluster Manager” on page 290](#).

### 1. Assume the root role on a node of the global cluster that hosts the zone cluster.

Some steps in this procedure are performed from a node of the global cluster. Other steps can be performed from a node of the zone cluster.

### 2. Delete the resources related to the devices being removed.

Identify and remove the Oracle Solaris Cluster resource types, such as SUNW.HAStoragePlus and SUNW.ScalDeviceGroup, that are configured for the zone cluster's devices that you are removing.

```
phys-schost# clresource delete -F -Z zoneclustername dev_zone_resources
```

### 3. Determine the match entry for the devices to be removed.

```
phys-schost# clzonecluster show -v zoneclustername
...
Resource Name: device
match: <device_match>
...
```

### 4. Remove the devices from the zone-cluster configuration.

```
phys-schost# clzonecluster configure zoneclustername
clzc:zoneclustername> remove device match=<devices_match>
clzc:zoneclustername> commit
clzc:zoneclustername> end
```

### 5. Reboot the zone cluster.

```
phys-schost# clzonecluster reboot zoneclustername
```

### 6. Verify the removal of the devices.

```
phys-schost# clzonecluster show -v zoneclustername
```

**Example 9-14** Removing an SVM Disk Set From a Zone Cluster

This example shows how to remove a Solaris Volume Manager disk set called `apachedg` configured in a zone cluster called `sczone`. The set number of the `apachedg` disk set is 3. The devices are used by the `zc_rs` resource that is configured in the cluster.

```
phys-schost# clzonecluster show -v sczone
...
Resource Name: device
match: /dev/md/apachedg/*dsk/*
Resource Name: device
match: /dev/md/shared/3/*dsk/*
...
phys-schost# clresource delete -F -Z sczone zc_rs

phys-schost# ls -l /dev/md/apachedg
lrwxrwxrwx 1 root root 8 Jul 22 23:11 /dev/md/apachedg -> shared/3
phys-schost# clzonecluster configure sczone
clzc:sczone> remove device match=/dev/md/apachedg/*dsk/*
clzc:sczone> remove device match=/dev/md/shared/3/*dsk/*
clzc:sczone> commit
clzc:sczone> end
phys-schost# clzonecluster reboot sczone
phys-schost# clzonecluster show -v sczone
```

**Example 9-15** Removing a DID Device From a Zone Cluster

This example shows how to remove DID devices `d10` and `d11`, which are configured in a zone cluster called `sczone`. The devices are used by the `zc_rs` resource that is configured in the cluster.

```
phys-schost# clzonecluster show -v sczone
...
Resource Name: device
match: /dev/did/*dsk/d10*
Resource Name: device
match: /dev/did/*dsk/d11*
...
phys-schost# clresource delete -F -Z sczone zc_rs
phys-schost# clzonecluster configure sczone
clzc:sczone> remove device match=/dev/did/*dsk/d10*
clzc:sczone> remove device match=/dev/did/*dsk/d11*
clzc:sczone> commit
clzc:sczone> end
phys-schost#
phys-schost# clzonecluster show -v sczone
```



## Troubleshooting

This section contains troubleshooting procedures that you can use for testing purposes.

### Running an Application Outside the Global Cluster

#### ▼ How to Take a Solaris Volume Manager Metaset From Nodes Booted in Noncluster Mode

Use this procedure to run an application outside the global cluster for testing purposes.

1. **Determine if the quorum device is used in the Solaris Volume Manager metaset, and determine if the quorum device uses SCSI2 or SCSI3 reservations.**

```
phys-schost# clquorum show
```

- a. **If the quorum device is in the Solaris Volume Manager metaset, add a new quorum device which is not part of the metaset to be taken later in noncluster mode.**

```
phys-schost# clquorum add did
```

- b. **Remove the old quorum device.**

```
phys-schost# clquorum remove did
```

- c. **If the quorum device uses a SCSI2 reservation, scrub the SCSI2 reservation from the old quorum and verify that no SCSI2 reservations remain.**

The following command finds the Persistent Group Reservation Emulation (PGRE) keys. If there are no keys on the disk, an *errno=22* message is displayed.

```
/usr/cluster/lib/sc/pgre -c pgre_inkeys -d /dev/did/rdisk/dids2
```

After you locate the keys, scrub the PGRE keys.

```
/usr/cluster/lib/sc/pgre -c pgre_scrub -d /dev/did/rdisk/dids2
```




---

**Caution** - If you scrub the active quorum device keys from the disk, the cluster will panic on the next reconfiguration with a *Lost operational quorum* message.

---

2. **Evacuate the global-cluster node that you want to boot in noncluster mode.**

```
phys-schost# clresourcegroup evacuate -n targetnode
```

3. **Take offline any resource group or resource groups that contain HAStorage or HAStoragePlus resources and contain devices or file systems affected by the metaset that you want to later take in noncluster mode.**

```
phys-schost# clresourcegroup offline resourcegroupname
```

4. **Disable all the resources in the resource groups that you took offline.**

```
phys-schost# clresource disable resourcename
```

5. **Unmanage the resource groups.**

```
phys-schost# clresourcegroup unmanage resourcegroupname
```

6. **Take offline the corresponding device group or device groups.**

```
phys-schost# cldevicegroup offline devicegroupname
```

7. **Disable the device group or device groups.**

```
phys-schost# cldevicegroup disable devicegroupname
```

8. **Boot the passive node into noncluster mode.**

```
phys-schost# reboot -x
```

9. **Verify that the boot process has been completed on the passive node before proceeding.**

```
phys-schost# svcs -x
```

10. **Determine if any SCSI3 reservations exist on the disks in the metasets.**

Run the following command on all disks in the metasets.

```
phys-schost# /usr/cluster/lib/sc/scsi -c inkeys -d /dev/did/rdisk/dids2
```

11. **If any SCSI3 reservations exist on the disks, scrub them.**

```
phys-schost# /usr/cluster/lib/sc/scsi -c scrub -d /dev/did/rdisk/dids2
```

12. **Take the metaset on the evacuated node.**

```
phys-schost# metaset -s name -C take -f
```

13. **Mount the file system or file systems that contain the defined device on the metaset.**

```
phys-schost# mount device mountpoint
```

14. **Start the application and perform the desired test. After finishing the test, stop the application.**

15. **Reboot the node and wait until the boot process has ended.**

```
phys-schost# reboot
```

16. **Bring online the device group or device groups.**

```
phys-schost# cldevicegroup online -e devicegroupname
```

17. **Start the resource group or resource groups.**

```
phys-schost# clresourcegroup online -eM resourcegroupname
```

## Restoring a Corrupted Diskset

Use this procedure if a diskset is corrupted or in a state that the nodes in the cluster are unable to take ownership of the diskset. If your attempts to clear the state have failed, use this procedure as a last attempt to fix the diskset.

These procedures work for Solaris Volume Manager metaset and multi-owner Solaris Volume Manager metaset.

### ▼ How to Save the Solaris Volume Manager Software Configuration

Restoring a disk set from scratch can be time-consuming and error prone. A better alternative is to use the `metastat` command to regularly back up replicas or use Oracle Explorer (SUNWexplo) to create a backup. You can then use the saved configuration to recreate the diskset. You should save the current configuration into files (using the `prtvtoc` and the `metastat` commands), and then recreate the disk set and its components. See [“How to Recreate the Solaris Volume Manager Software Configuration” on page 269](#).

1. **Save the partition table for each disk in the disk set.**

```
/usr/sbin/prtvtoc /dev/global/rdisk/diskname > /etc/lvm/diskname.vtoc
```

2. **Save the Solaris Volume Manager software configuration.**

```
/bin/cp /etc/lvm/md.tab /etc/lvm/md.tab_ORIGINAL
```

```
/usr/sbin/metastat -p -s setname >> /etc/lvm/md.tab
```

---

**Note** - Other configuration files, such as the `/etc/vfstab` file, might reference the Solaris Volume Manager software. This procedure assumes that an identical Solaris Volume Manager software configuration is rebuilt and therefore, the mount information is the same. If Oracle Explorer (SUNWexplo) is run on a node that owns the set, it retrieves the `prtvtoc` and `metaset -p` information.

---

## ▼ How to Purge the Corrupted Diskset

Purging a set from a node or all nodes removes the configuration. To purge a diskset from a node, the node must not have ownership of the diskset.

### 1. Run the purge command on all nodes.

```
/usr/sbin/metaset -s setname -P
```

Running this command removes the diskset information from the database replicas, as well as the Oracle Solaris Cluster repository. The `-P` and `-C` options allow a diskset to be purged without the need to completely rebuild the Solaris Volume Manager environment.

---

**Note** - If a multi-owner diskset is purged while the nodes were booted out of cluster mode, you might need to remove the information from the `dc`s configuration files.

```
/usr/cluster/lib/sc/dcs_config -c remove -s setname
```

For more information, see the [dcs\\_config\(1M\)](#) man page.

---

### 2. If you want to remove only the diskset information from the database replicas, use the following command.

```
/usr/sbin/metaset -s setname -C purge
```

You should generally use the `-P` option, rather than the `-C` option. Using the `-C` option can cause a problem recreating the diskset because the Oracle Solaris Cluster software still recognizes the diskset.

- a. If you used the `-c` option with the `metaset` command, first create the diskset to see if a problem occurs.
- b. If a problem exists, remove the information from the `dc`s configuration files.

```
/usr/cluster/lib/sc/dcs_config -c remove -s setname
```

If the purge options fail, verify that you installed the latest kernel and metadvice updates and contact [My Oracle Support](#).

## ▼ How to Recreate the Solaris Volume Manager Software Configuration

Use this procedure only if you experience a complete loss of your Solaris Volume Manager software configuration. The steps assume that you have saved your current Solaris Volume Manager configuration and its components and purged the corrupted diskset.

---

**Note** - Mediators should be used only on two-node clusters.

---

### 1. Create a new diskset.

```
/usr/sbin/metaset -s setname -a -h nodename1 nodename2
```

If this is a multi-owner diskset, use the following command to create a new diskset.

```
/usr/sbin/metaset -s setname -aM -h nodename1 nodename2
```

### 2. On the same host where the set was created, add mediator hosts if required (two nodes only).

```
/usr/sbin/metaset -s setname -a -m nodename1 nodename2
```

### 3. Add the same disks back into the diskset from this same host.

```
/usr/sbin/metaset -s setname -a /dev/did/rdisk/diskname /dev/did/rdisk/diskname
```

### 4. If you purged the diskset and are recreating it, the Volume Table of Contents (VTOC) should remain on the disks, so you can skip this step.

However, if you are recreating a set to recover, you should format the disks according to a saved configuration in the `/etc/lvm/diskname.vtoc` file. For example:

```
/usr/sbin/fmthard -s /etc/lvm/d4.vtoc /dev/global/rdisk/d4s2
```

```
/usr/sbin/fmthard -s /etc/lvm/d8.vtoc /dev/global/rdisk/d8s2
```

You can run this command on any node.

### 5. Check the syntax in the existing `/etc/lvm/md.tab` file for each metadvice.

```
/usr/sbin/metainit -s setname -n -a metadvice
```

### 6. Create each metadvice from a saved configuration.

```
/usr/sbin/metainit -s setname -a metadvice
```

### 7. If a file system exists on the metadvice, run the `fsck` command.

```
/usr/sbin/fsck -n /dev/md/setname/rdisk/metadvice
```

If the `fsck` command displays only a few errors, such as superblock count, then the device was probably reconstructed correctly. You can then run the `fsck` command without the `-n` option. If multiple errors appear, verify that you reconstructed the metadvice correctly. If you have, review the `fsck` errors to determine if the file system can be recovered. If it cannot, you should restore the data from a backup.

- 8. Concatenate all other metaset on all cluster nodes to the `/etc/lvm/md.tab` file and then concatenate the local diskset.**

```
/usr/sbin/metastat -p >> /etc/lvm/md.tab
```

## Configuring Control of CPU Usage

---

If you want to control the usage of CPU, configure the CPU control facility. For more information about configuring the CPU control facility, see the [rg\\_properties\(5\)](#) man page. This chapter provides information about the following topics:

- “Introduction to CPU Control” on page 271
- “Configuring CPU Control” on page 272

### Introduction to CPU Control

Oracle Solaris Cluster software enables you to control the usage of CPU.

The CPU control facility builds on the functionality available in the Oracle Solaris OS. For information about zones, projects, resource pools, processor sets, and scheduling classes, see [Introduction to Oracle Solaris Zones](#) .

On the Oracle Solaris OS, you can do the following:

- Assign CPU shares to resource groups
- Assign processors to resource groups

You can also use the Oracle Solaris Cluster Manager GUI to view the configuration of a zone-cluster. For GUI log-in instructions, see “[How to Access Oracle Solaris Cluster Manager](#)” on page 290.

### Choosing a Scenario

Depending on the configuration choices you make and version of the operating system you choose, you can have different levels of CPU control. All aspects of CPU control described in this chapter are dependent on the resource group property `RG_SLM_TYPE` being set to `automated`.

[Table 10-1](#) provides a description of the different configuration scenarios available.

**TABLE 10-1** CPU Control Scenarios

Description	Instructions
Resource group runs in the global-cluster node.  Assign CPU shares to resource groups, providing values for <code>project.cpu-shares</code> and <code>zone.cpu-shares</code> .	<a href="#">“How to Control CPU Usage in a Global-Cluster Node” on page 272</a>

## Fair Share Scheduler

The first step in the procedures to assign CPU shares to resource groups is to set the scheduler for the system to be the fair share scheduler (FSS). By default, the scheduling class for the Oracle Solaris OS is timesharing schedule (TS). Set the scheduler to be FSS to have the shares configuration take effect.

You can create a dedicated processor set regardless of the scheduler class you choose.

## Configuring CPU Control

This section includes the following procedure:

- [“How to Control CPU Usage in a Global-Cluster Node” on page 272](#)

### ▼ How to Control CPU Usage in a Global-Cluster Node

Perform this procedure to assign CPU shares to a resource group that will be executed in a global-cluster node.

If a resource group is assigned CPU shares, Oracle Solaris Cluster software performs the following tasks when it starts a resource of the resource group in a global-cluster node:

- Augments the number of CPU shares assigned to the node (`zone.cpu-shares`) with the specified number of CPU shares, if this has not already been done.
- Creates a project named `SCSLM_resourcegroup_name` in the node, if this has not already been done. This project is specific to the resource group, and is assigned the specified number of CPU shares (`project.cpu-shares`).
- Starts the resource in the `SCSLM_resourcegroup_name` project.

For more information about configuring the CPU control facility, see the [rg\\_properties\(5\)](#) man page.



### 1. Set the default scheduler for the system to be fair share scheduler (FSS).

```
dispadmin -d FSS
```

FSS becomes the default scheduler on next reboot. To make this configuration take effect immediately, use the `priocntl` command.

```
priocntl -s -C FSS
```

Using the combination of the `priocntl` and `dispadmin` commands ensures that FSS becomes the default scheduler immediately and remains so after reboot. For more information about setting a scheduling class, see the [dispadmin\(1M\)](#) and [priocntl\(1\)](#) man pages.

---

**Note** - If the FSS is not the default scheduler, your CPU shares assignment will not take effect.

---

### 2. On each node to use CPU control, configure the number of shares for the global-cluster nodes and the minimum number of CPUs available in the default processor set.

If you do not assign a value to the `globalzonestshares` and `defaultpsetmin` properties, these properties take their default values.

```
clnode set [-p globalzonestshares=integer] \
[-p defaultpsetmin=integer] \
\
node
```

`-p defaultpsetmin=integer` Sets the minimum number of CPUs available in the default processor set. The default value is 1.

`-p globalzonestshares=integer` Sets the number of shares assigned to the node. The default value is 1.

`node` Specifies nodes on which properties are to be set.

In setting these properties, you are setting properties for the node.

### 3. Verify that you correctly set these properties.

```
clnode show node
```

For the node you specify, the `clnode` command prints the properties set and the values that are set for these properties. If you do not set the CPU control properties with `clnode`, they take the default value.

### 4. Configure the CPU control facility.

```
clresourcegroup create -p RG_SLM_TYPE=automated \
[-p RG_SLM_CPU_SHARES=value] resource_group_name
```

`-p` Enables you to control CPU usage and automates some steps to configure the Oracle Solaris OS for system resource management.

`-p` Specifies the number of CPU shares that are assigned to the resource group-specific project, `project.cpu-shares` and determines the number of CPU shares that are assigned to the node zone `.cpu-shares`.

`resource_group_name` Specifies the name of the resource group.

In this procedure, you do not set the `RG_SLM_PSET_TYPE` property. In the node, this property takes the value `default`.

This step creates a resource group. You could alternatively use the `clresourcegroup set` command to modify an existing resource group.

#### 5. Activate the configuration change.

```
clresourcegroup online -eM resource_group_name
```

`resource_group_name` Specifies the name of the resource group.

---

**Note** - Do not remove or modify the `SCSLM_resource_group_name` project. You can add more resource control manually to the project, for example, by configuring the `project.max-lwps` property. For more information, see the [projmod\(1M\)](#) man page.

---

## Updating Your Software

---

This chapter provides information and instructions for updating Oracle Solaris Cluster software in the following sections.

- “[Overview of Updating Oracle Solaris Cluster Software](#)” on page 275
- “[Updating Oracle Solaris Cluster Software](#)” on page 276
- “[Uninstalling a Package](#)” on page 280

### Overview of Updating Oracle Solaris Cluster Software

All cluster member nodes must have the same updates applied for proper cluster operation. When updating a node, you might occasionally need to temporarily remove a node from cluster membership or stop the entire cluster before performing the update.

There are two ways to update Oracle Solaris Cluster software.

- Upgrade - Upgrade the cluster to the latest major or minor Oracle Solaris Cluster release and update the Oracle Solaris OS by updating all packages. An example of a major release would be to upgrade from Oracle Solaris Cluster 4.0 to 5.0. An example of a minor release would be to upgrade from Oracle Solaris Cluster 4.1 to 4.2. Run the `scinstall` utility or the `scinstall -u` update command to create a new boot environment (a bootable instance of an image), mount the boot environment on a mount point that is not being used, update the bits, and activate the new boot environment. Creating the clone environment initially consumes no additional space and occurs instantaneously. After you perform this update, you must reboot the cluster. The upgrade also upgrades the Oracle Solaris OS to the latest compatible version. For detailed instructions, see the [Oracle Solaris Cluster Upgrade Guide](#).

If you have failover zones of brand type `solaris`, follow the instructions in “[How to Upgrade a Failover Zone](#)” in [Oracle Solaris Cluster Upgrade Guide](#).

If you have a `solaris10` brand zone in a zone cluster, follow the upgrade instructions in “[Upgrading a solaris10 Brand Zone in a Zone Cluster](#)” in [Oracle Solaris Cluster Upgrade Guide](#).

---

**Note** - Applying an Oracle Solaris Cluster Core SRU does not provide the same result as upgrading the software to another Oracle Solaris Cluster release.

---

- Update - Update specific Oracle Solaris Cluster packages to different SRU levels. You can use one of the `pkg` commands to update Image Packaging System (IPS) packages in a Service Repository Update (SRU). SRUs are generally released regularly and contain updated packages and defect fixes. The repository contains all IPS packages and the updated packages. Running the `pkg update` command updates both the Oracle Solaris operating system and the Oracle Solaris Cluster software to compatible versions. After you perform this update, you might need to reboot the cluster. For instructions, see [“How to Update a Specific Package” on page 277](#).

You must be a registered My Oracle Support user to view and download the required software updates for the Oracle Solaris Cluster product. If you do not have a My Oracle Support account, contact your Oracle service representative or sales engineer, or register online at <http://support.oracle.com>. For information about firmware updates, see your hardware documentation.

---

**Note** - Read the software update README before applying or removing any update.

---

Information about Oracle Enterprise Manager Ops Center 12c software update management options for the Oracle Solaris OS is available at <http://www.oracle.com/pls/topic/lookup?ctx=oc122> .

Information for using the Oracle Solaris package management utility, `pkg`, is provided in Chapter 3, “Installing and Updating Software Packages,” in *Adding and Updating Software in Oracle Solaris 11.2* .

## Updating Oracle Solaris Cluster Software

Consult the following table to determine how to upgrade or update an Oracle Solaris Cluster release or package in the Oracle Solaris Cluster software.

**TABLE 11-1** Updating Oracle Solaris Cluster Software

Task	Instructions
Upgrade the entire cluster to a new major or minor release	<a href="#">“How to Upgrade the Software (Standard Upgrade)” in Oracle Solaris Cluster Upgrade Guide</a>
Update a specific package	<a href="#">“How to Update a Specific Package” on page 277</a>
Update a quorum server or AI installation server	<a href="#">“How to Update a Quorum Server or AI Installation Server” on page 280</a>

Task	Instructions
Update a zone cluster	<a href="#">“How to Update a solaris Brand Zone Cluster” on page 279</a>  <a href="#">“How to Update a solaris10 Brand Zone Cluster” on page 279</a>
Remove Oracle Solaris Cluster packages	<a href="#">“How to Uninstall a Package” on page 280</a>  <a href="#">“How to Uninstall Quorum Server or AI Installation Server Packages” on page 281</a>

## Upgrading the Cluster to a New Release

You do not need to place the cluster in non-cluster mode before performing this upgrade because the upgrade always occurs in the new boot environment and the existing boot environment remains unchanged. You can specify a name for the new boot environment or you can use the auto-generated name. For instructions, see [“How to Upgrade the Software \(Standard Upgrade\)” in Oracle Solaris Cluster Upgrade Guide](#) .

Anytime you upgrade the Oracle Solaris Cluster software, you should also upgrade the data services and Geographic Edition software. However, if you want to upgrade the data services separately, see [“Overview of the Installation and Configuration Process” in Oracle Solaris Cluster Data Services Planning and Administration Guide](#) . If you want to upgrade Oracle Solaris Cluster Geographic Edition separately, see the [Oracle Solaris Cluster Geographic Edition Installation Guide](#) .

The Oracle Solaris OS is also updated to the latest release when you upgrade the Oracle Solaris Cluster software.

## Updating a Specific Package

IPS packages were introduced with the Oracle Solaris 11 operating system. Each IPS package is described by a Fault Managed Resource Indicator (FMRI), and you use the `pkg(1)` commands to perform the SRU update. Alternatively, you can also use the `scinstall -u` command to perform an SRU update.

You might want to update a specific package to use an updated Oracle Solaris Cluster data service agent.

### ▼ How to Update a Specific Package

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization.**

## 2. Update the package.

For example, to update a package from a specific publisher, specify the publisher name in the *pkg-fmri*.

```
pkg update pkg-fmri
```



---

**Caution** - If you use the `pkg update` command with no *pkg-fmri* specified, all installed packages that have updates available are updated.

---

If a newer version of an installed package is available and is compatible with the rest of the image, the package is updated to that version. If the package contains binaries that have the `reboot-needed` flag set to true, then performing a `pkg update pkg-fmri` automatically creates a new boot environment and after the update you boot into the new boot environment. If the package you are updating does not contain any binaries that force a reboot, then the `pkg update` command updates the live image and a reboot is not necessary.

## 3. If you are updating a data service agent (`ha-cluster/data-service/*` or the generic data service agent of `ha-cluster/ha-service/gds`), perform the following steps.

a. `# pkg change-facet facet.version-lock.pkg name=false`

b. `# pkg update pkg name`

For example:

```
pkg change-facet facet.version-lock.ha-cluster/data-service/weblogic=false
pkg update ha-cluster/data-service/weblogic
```

If you want to freeze an agent and prevent it from being updated, perform the following steps.

```
pkg change-facet facet.version-lock.pkg name=false
pkg freeze pkg name
```

For more information on freezing a specific agent, see [“Controlling Installation of Optional Components” in \*Adding and Updating Software in Oracle Solaris 11.2\*](#).

## 4. Verify that the package was updated.

```
pkg verify -v pkg-fmri
```

# Updating a Zone Cluster

To update a `solaris` brand zone cluster, apply an SRU by using the `scinstall-u update` command. To update a `solaris10` brand zone cluster, apply a patch by using the `clzonecluster install-cluster -p` command.

## ▼ How to Update a solaris Brand Zone Cluster

You can update a solaris brand zone cluster by using the `scinstall -u update` command to apply an SRU.

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on a node of the global cluster.**
2. **From a node of the global cluster, update the entire node.**

```
phys-schost# scinstall -u update [-b be-name]
```

Repeat this step on each cluster node.

3. **Reboot the cluster.**

```
phys-schost# clzonecluster reboot
```

## ▼ How to Update a solaris10 Brand Zone Cluster

You can update a solaris10 brand zone cluster by applying a patch.

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization on a node of the global cluster.**
2. **Ensure that the zone cluster is booted.**

Run either the `clzonecluster boot` or `clzonecluster reboot` command as described below. Do not run both commands.

If the zone cluster is not booted:

```
phys-schost# clzonecluster boot -o zoneclustername
```

If the zone cluster is booted, reboot it into Offline Running mode:

```
phys-schost# clzonecluster reboot -o zoneclustername
```

3. **From a node of the global cluster, update the entire solaris10 brand zone cluster.**

```
phys-schost# clzonecluster install-cluster -p patch-spec [options] zoneclustername
```

For more information about the `install-cluster` subcommand, see the [clzc\(1CL\)](#) man page.

4. **Reboot the zone cluster.**

```
phys-schost# clzonecluster reboot zoneclustername
```

## Updating a Quorum Server or AI Installation Server

Use the procedure below to update the packages for your quorum server or Oracle Solaris 11 Automated Installer (AI) installation server. For more information about quorum servers, see [“How to Install and Configure Oracle Solaris Cluster Quorum Server Software” in \*Oracle Solaris Cluster Software Installation Guide\*](#) . For more information about using the AI, see [“How to Install and Configure Oracle Solaris and Oracle Solaris Cluster Software \(IPS Repositories\)” in \*Oracle Solaris Cluster Software Installation Guide\*](#) .

### ▼ How to Update a Quorum Server or AI Installation Server

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization.**
2. **Update the quorum server or AI installation server packages.**

```
pkg update ha-cluster/*
```

If a newer version of the installed `ha-cluster` packages is available and is compatible with the rest of the image, the packages are updated to that version.



---

**Caution** - Running the `pkg update` command updates all `ha-cluster` packages installed on the system.

---

## Uninstalling a Package

You can remove a single package or multiple packages.

### ▼ How to Uninstall a Package

1. **Assume a role that provides `solaris.cluster.admin` RBAC authorization.**
2. **Uninstall an existing package.**

```
pkg uninstall pkg-fmri
```

If you want to uninstall more than one package, use the following syntax.

```
pkg uninstall pkg-fmri pkg-fmri
```

The `pkg uninstall` command will fail if there are other installed packages that depend on the `pkg-fmri` you are uninstalling. To uninstall the `pkg-fmri`, you must supply the `pkg uninstall`



command with all the *pkg-fmri* dependents. For additional information on uninstalling packages, see [Adding and Updating Software in Oracle Solaris 11.2](#) and the `pkg(1)` man page.

## ▼ How to Uninstall Quorum Server or AI Installation Server Packages

1. Assume a role that provides `solaris.cluster.admin` RBAC authorization.
2. Uninstall the quorum server or AI installation server packages.

```
pkg uninstall ha-cluster/*
```



---

**Caution** - This command uninstalls all `ha-cluster` packages installed on the system.

---

## Updating Tips

Use the following tips to administer Oracle Solaris Cluster updates more efficiently:

- Read the SRU's README file before performing the update.
- Check the update requirements of your storage devices.
- Apply all updates before running the cluster in a production environment.
- Check the hardware firmware levels and install any required firmware updates that might be needed. Consult your hardware documentation for information on firmware updates.
- All nodes acting as cluster members must have the same updates.
- Keep cluster subsystem updates up to date. These updates include, for example, volume management, storage device firmware, and cluster transport.
- Test failover after major updates. Be prepared to back out the update if cluster operation is degraded or impaired.
- If you are upgrading to a new Oracle Solaris Cluster version, follow the instructions in the [Oracle Solaris Cluster Upgrade Guide](#).



## Backing Up and Restoring a Cluster

---

This chapter provides the following sections:

- [“Backing Up a Cluster” on page 283](#)
- [“Restoring Cluster Files” on page 286](#)
- [“Restoring Cluster Nodes” on page 212](#)

### Backing Up a Cluster

Before you back up your cluster, find the names of the file systems you want to back up, calculate how many tapes you need to contain a full backup, and back up the ZFS root file system.

**TABLE 12-1** Task Map: Backing Up Cluster Files

Task	Instructions
Perform online backup for mirrored or plexed file systems	<a href="#">“How to Perform Online Backups for Mirrors (Solaris Volume Manager)” on page 283</a>
Back up the cluster configuration	<a href="#">“How to Back Up the Cluster Configuration” on page 285</a>
Back up disk partitioning configuration for storage disk	See the documentation for your storage disk

### ▼ How to Perform Online Backups for Mirrors (Solaris Volume Manager)

A mirrored Solaris Volume Manager volume can be backed up without unmounting it or taking the entire mirror offline. One of the submirrors must be taken offline temporarily, thus losing mirroring, but it can be placed online and resynchronized as soon as the backup is complete, without halting the system or denying user access to the data. Using mirrors to perform online backups creates a backup that is a “snapshot” of an active file system.

A problem might occur if a program writes data onto the volume immediately before the `lockfs` command is run. To prevent this problem, temporarily stop all the services running on this node. Also, ensure the cluster is running without errors before performing the backup procedure.

The `phys -schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume an equivalent role on the cluster node that you are backing up.**
2. **Use the `metaset` command to determine which node has the ownership on the backed-up volume.**

```
metaset -s setname
```

`-s setname` Specifies the disk set name.

For more information, see the [metaset\(1M\)](#) man page.

3. **Use the `lockfs` command with the `-w` option to lock the file system from writes.**

```
lockfs -w mountpoint
```

See the [lockfs\(1M\)](#) man page for more information.

4. **Use the `metastat` command to determine the names of the submirrors.**

```
metastat -s setname -p
```

`-p` Displays the status in a format similar to the `md.tab` file.

See the [metastat\(1M\)](#) man page for more information.

5. **Use the `metadetach` command to take one submirror offline from the mirror.**

```
metadetach -s setname mirror submirror
```

See the [metadetach\(1M\)](#) man page for more information.

---

**Note** - Reads continue to be made from the other submirrors. However, the offline submirror is unsynchronized as soon as the first write is made to the mirror. This inconsistency is corrected when the offline submirror is brought back online. You do not need to run `fsck`.

---

6. **Unlock the file systems and allow writes to continue, using the `lockfs` command with the `-u` option.**

```
lockfs -u mountpoint
```

7. **Perform a file system check.**

```
fsck /dev/md/diskset/rdisk/submirror
```

8. **Back up the offline submirror to tape or another medium.**

---

**Note** - Use the raw device (`/rdsk`) name for the submirror, rather than the block device (`/dsk`) name.

---

9. **Use the `metattach` command to place the metadvice or volume back online.**

```
metattach -s setname mirror submirror
```

When the metadvice or volume is placed online, it is automatically resynchronized with the mirror. See the [metattach\(1M\)](#) man page for more information.

10. **Use the `metastat` command to verify that the submirror is resynchronizing.**

```
metastat -s setname mirror
```

See [Managing ZFS File Systems in Oracle Solaris 11.2](#) for more information.

## ▼ How to Back Up the Cluster Configuration

To ensure that your cluster configuration is archived and to facilitate easy recovery of the your cluster configuration, periodically back up your cluster configuration. Oracle Solaris Cluster provides the ability to export your cluster configuration to an eXtensible Markup Language (XML) file.

1. **Log on to any node in the cluster, and assume a role that provides `solaris.cluster.read` RBAC authorization.**

2. **Export the cluster configuration information to a file.**

```
/usr/cluster/bin/cluster export -o configfile
```

*configfile*

The name of the XML configuration file that the `cluster` command is exporting the cluster configuration information to. For information about the XML configuration file, see the [clconfiguration\(5CL\)](#) man page.

3. **Verify that the cluster configuration information was successfully exported to the XML file.**

```
pfedit configfile
```

## Restoring Cluster Files

You can restore the ZFS root file system to a new disk.

You can restore a cluster or node from a unified archive, or you can restore specific files or file systems. Insert a new Sec 2 here for the content below.

Before you start to restore files or file systems, you need to know the following information.

- Which tapes you need
- The raw device name on which you are restoring the file system
- The type of tape drive you are using
- The device name (local or remote) for the tape drive
- The partition scheme of any failed disk, because the partitions and file systems must be exactly duplicated on the replacement disk

**TABLE 12-2** Task Map: Restoring Cluster Files

Task	Instructions
For Solaris Volume Manager, restore the ZFS root (/) file system	<a href="#">“How to Restore the ZFS Root (/) File System (Solaris Volume Manager)”</a> on page 286

### ▼ How to Restore the ZFS Root (/) File System (Solaris Volume Manager)

Use this procedure to restore the ZFS root (/) file systems to a new disk, such as after replacing a bad root disk. The node being restored should not be booted. Ensure that the cluster is running without errors before performing the restore procedure. UFS is supported, except as a root file system. UFS can be used on metadevices in Solaris Volume Manager metaset on shared disks.

---

**Note** - Because you must partition the new disk by using the same format as the failed disk, identify the partitioning scheme before you begin this procedure, and recreate file systems as appropriate.

---

The `phys-schost#` prompt reflects a global-cluster prompt. Perform this procedure on a global cluster.

This procedure provides the long forms of the Oracle Solaris Cluster commands. Most commands also have short forms. Except for the long and short forms of the command names, the commands are identical.

1. **Assume a role that provides `solaris.cluster.modify` RBAC authorization on a cluster node with access to the disksets to which the node to be restored is also attached.**

Use a node *other than* the node that you are restoring.

2. **Remove the hostname of the node being restored from all metaset.**

Run this command from a node in the metaset other than the node that you are removing. Because the recovering node is offline, the system will display an `RPC: Rpcbnd failure - RPC: Timed out` error. Ignore this error and continue to the next step.

```
metaset -s setname -f -d -h nodelist
```

-s setname                Specifies the disk set name.

-f                        Deletes the last host from the disk set.

-d                        Deletes from the disk set.

-h nodelist               Specifies the name of the node to delete from the disk set.

3. **Restore the ZFS root file system (/).**

For more information, see [“How to Replace a Disk in a ZFS Root Pool \(SPARC or x86/VTOC\)” in \*Managing ZFS File Systems in Oracle Solaris 11.2\*](#).

To recover the ZFS root pool or root pool snapshots, follow the procedure in [“How to Replace a Disk in a ZFS Root Pool \(SPARC or x86/VTOC\)” in \*Managing ZFS File Systems in Oracle Solaris 11.2\*](#).

---

**Note** - Ensure that you create the `/global/.devices/node@nodeid` file system.

---

If the `.globaldevices` backup file exists in the backup directory, it is restored along with ZFS root restoration. The file is not created automatically by the `globaldevices` SMF service.

4. **Reboot the node in multiuser mode.**

```
reboot
```

5. **Replace the device ID.**

```
cldevice repair rootdisk
```

6. **Use the `metadb` command to recreate the state database replicas.**

```
metadb -c copies -af raw-disk-device
```

-c copies                    Specifies the number of replicas to create.

-f raw-disk-device        Raw disk device on which to create replicas.

-a                         Adds replicas.

See the [metadb\(1M\)](#) man page for more information.

**7. From a cluster node other than the restored node add the restored node to all disksets.**

```
phys-schost-2# metaset -s setname -a -h nodelist
```

-a                         Creates and adds the host to the disk set.

The node is rebooted into cluster mode. The cluster is ready to use.

**Example 12-1** Restoring the ZFS Root (/) File System (Solaris Volume Manager)

The following example shows the root (/) file system restored to the node `phys-schost-1`. The `metaset` command is run from another node in the cluster, `phys-schost-2`, to remove and later add back node `phys-schost-1` to the disk set `schost-1`. All other commands are run from `phys-schost-1`. A new boot block is created on `/dev/rdisk/c0t0d0s0`, and three state database replicas are recreated on `/dev/rdisk/c0t0d0s4`. For more information on restoring data, see [“Resolving Data Problems in a ZFS Storage Pool”](#) in *Managing ZFS File Systems in Oracle Solaris 11.2*.

[Assume a role that provides `solaris.cluster.modify` RBAC authorization on a cluster node other than the node to be restored.]

[Remove the node from the metaset:]

```
phys-schost-2# metaset -s schost-1 -f -d -h phys-schost-1
```

[Replace the failed disk and boot the node:]

Restore the root (/) and /usr file system using the procedure in the Solaris system administration documentation

[Reboot:]

```
reboot
```

[Replace the disk ID:]

```
cldevice repair /dev/dsk/c0t0d0
```

[Re-create state database replicas:]

```
metadb -c 3 -af /dev/rdisk/c0t0d0s4
```

[Add the node back to the metaset:]

```
phys-schost-2# metaset -s schost-1 -a -h phys-schost-1
```



## Using the Oracle Solaris Cluster GUI

---

This chapter provides a description of the Oracle Solaris Cluster Manager graphical user interface (GUI) that you can use to administer many aspects of a cluster. The chapter also contains procedures to access and use Oracle Solaris Cluster Manager.

---

**Note** - Oracle Solaris Cluster Manager uses a private version of Oracle GlassFish Server software, which is shipped with the Oracle Solaris Cluster product. Do not attempt to install, or update to any patchsets, the public version of the Oracle GlassFish Server software. Doing so might cause package problems when updating Oracle Solaris Cluster software or installing Oracle Solaris Cluster SRUs. Any bug fixes to the private version of Oracle GlassFish Server that are needed by Oracle Solaris Cluster Manager are delivered in Oracle Solaris Cluster SRUs.

---

This chapter includes the following:

- [“Overview of Oracle Solaris Cluster Manager” on page 289](#)
- [“Accessing the Oracle Solaris Cluster Manager Software” on page 290](#)
- [“Using Topology to Monitor the Cluster” on page 293](#)

### Overview of Oracle Solaris Cluster Manager

Oracle Solaris Cluster Manager enables you to graphically display cluster information, check the status of cluster components, and monitor configuration changes. Oracle Solaris Cluster Manager also enables you to perform many administrative tasks for the following Oracle Solaris Cluster components:

- Data services
- Zone clusters
- Nodes
- Private adapters
- Cables
- Switches

- Device groups
- Disks
- NAS devices
- Node load limits
- Quorum devices
- Resource groups
- Resources
- Geographic Edition partnerships

---

**Note** - Oracle Solaris Cluster Manager currently cannot perform all Oracle Solaris Cluster administrative tasks. You must use the command-line interface for some operations.

---

## Accessing the Oracle Solaris Cluster Manager Software

The Oracle Solaris Cluster Manager GUI provides an easy way to administer many tasks in the Oracle Solaris Cluster software. See the Oracle Solaris Cluster Manager online help for more information.

The common agent container is started automatically when you boot the cluster. If you need to verify that the common agent container is running, see [“Troubleshooting” on page 291](#).

---

**Tip** - Do not click *Back* in the browser to exit from Oracle Solaris Cluster Manager.

---

### ▼ How to Access Oracle Solaris Cluster Manager

This procedure shows how to access Oracle Solaris Cluster Manager on your cluster.

1. **Assume the root role on a cluster node.**
2. **From the administrative console or any other machine outside the cluster, start a browser.**
3. **Ensure that the browser's disk and memory cache sizes are set to a value that is greater than 0.**
4. **Verify that Java and Javascript are enabled in the browser.**
5. **From the browser, connect to the Oracle Solaris Cluster Manager port on one node of the cluster.**

The default port number is 8998.

`https://node:8998/scm`

**6. Accept any certificates that are presented by the web browser.**

The Oracle Solaris Cluster Manager login page is displayed.

**7. Enter the name of a node in the cluster that you want to manage or accept the default of localhost to manage the current cluster.**

**8. Enter the node's user name and password.**

**9. Click Sign In.**

The Oracle Solaris Cluster Manager application launch page is displayed.

---

**Note** - If you have more than one cluster configured, you can select Other from the drop-down list and log into another cluster to display information for that cluster. If a cluster is a member of one or more partnerships, after you visit the Partnerships folder all partner names are automatically added to the drop-down list. After you authenticate, you can select Switch Cluster.

---

If you cannot connect to the Oracle Solaris Cluster Manager, see [“Troubleshooting” on page 291](#). If you choose a restricted network profile during Oracle Solaris installation, external access for the Oracle Solaris Cluster Manager is restricted. This network is required to use the Oracle Solaris Cluster Manager GUI.

## Troubleshooting

- Verify that the two manager services are running.

```
svcs system/cluster/manager*
```

```
STATE STIME FMRI
online Oct_30 svc:/system/cluster/manager-glassfish3:default
online Oct_30 svc:/system/cluster/manager:default
```

Use the `svcadm` command to disable or enable `system/cluster/manager-glassfish3`. This action stops and restarts the application server. You should keep `system/cluster/manager` online. You do not need to disable or enable it.

- If you cannot connect to Oracle Solaris Cluster Manager, determine if the common agent container is running by entering `usr/sbin/cacaoadm status`. If the common agent container is not running, you will get the login page but you cannot authenticate. You can manually start the common agent container by entering `/usr/sbin/cacaoadm start`.

## ▼ How to Configure Common Agent Container Security Keys

Oracle Solaris Cluster Manager uses strong encryption techniques to ensure secure communication between the Oracle Solaris Cluster Manager web server and each cluster node.

Cacao connection errors can occur when you are using the data service configuration wizards in the GUI or performing other GUI tasks. This procedure copies the security files for the common agent container to all cluster nodes. This ensures that security files for the common agent container are identical on all cluster nodes and that the copied files retain the correct file permissions. Performing this procedure synchronizes the security keys.

1. **On each node, stop the security file agent.**

```
phys-schost# /usr/sbin/cacaoadm stop
```

2. **On one node, change to the `/etc/cacao/instances/default/` directory.**

```
phys-schost-1# cd /etc/cacao/instances/default/
```

3. **Create a tar file of the `/etc/cacao/instances/default/` directory.**

```
phys-schost-1# tar cf /tmp/SECURITY.tar security
```

4. **Copy the `/tmp/Security.tar` file to each of the cluster nodes.**

5. **On each node where you copied the `/tmp/SECURITY.tar` file, extract the security files.**

Any security files that already exist in the `/etc/cacao/instances/default/` directory are overwritten.

```
phys-schost-2# cd /etc/cacao/instances/default/
phys-schost-2# tar xf /tmp/SECURITY.tar
```

6. **Delete each copy of the tar file to avoid security risks.**

You must delete each copy of the tar file to avoid security risks.

```
phys-schost-1# rm /tmp/SECURITY.tar
```

```
phys-schost-2# rm /tmp/SECURITY.tar
```

7. **On each node, start the security file agent.**

```
phys-schost# /usr/sbin/cacaoadm start
```

## ▼ How to Check the Network Bind Address

If you receive a System Error message when you try to view information about a node other than the node running the GUI, check whether the common agent container `network-bind-address` parameter is set to the correct value of `0.0.0.0`.

Perform the following steps on each node of the cluster.

### 1. Determine the network bind address.

```
phys-schost# cacoadm list-params | grep network
network-bind-address=0.0.0.0
```

If the network bind address is set to anything other than `0.0.0.0`, you will need to change it to the desired address.

### 2. Stop and start cacao before and after the change.

```
phys-schost# cacoadm stop
phys-schost# cacoadm set-param network-bind-address=0.0.0.0
phys-schost# cacoadm start
```







## Using Topology to Monitor the Cluster

### ▼ How to Use Topology to Monitor and Update Your Cluster

The Topology view helps you monitor your cluster and identify problems. You can quickly view relationships between objects and see which resource groups and resource belong to each node.

To get to the Topology page, log into the GUI, click Resource Groups, and click the Topology tab. Lines represent dependency and colocation relationships. The online help provides detailed instructions on the elements of the view, as well as how to select an object for filtering the view, and right-clicking to see a context menu of actions for that object. You can collapse or restore the online help by clicking the arrow next to it. You can also collapse or restore the Filter.

The following table provides a list of the controls on the Resource Topology page.

Control	Function	Description
	Zoom	Magnify or shrink a portion of a page.
	Overview	Drag the viewport over the diagram to pan the view.
	Isolate	Single-click a resource group or resource to remove all other objects from the display.
	Drill	Single-click a resource group to drill into its resources.
	Reset	Return to full view after isolating or drilling.
	Filter	Narrow what appears by selecting objects by type, instance, or status.

The following procedure shows how to monitor your cluster nodes for critical errors:

1. **In the Topology tab, locate the Potential Masters area.**
2. **Zoom in to see the status of each node in the cluster.**
3. **Locate a node that has a red Critical status icon and right-click the node and select Show Details.**
4. **From the node's Status page, click *System Log* to view and filter the log messages.**

## Example

---

### Configuring Host-Based Data Replication With Sun StorageTek Availability Suite Software

This appendix provides an alternative to host-based replication that does not use Oracle Solaris Cluster Geographic Edition. Use Oracle Solaris Cluster Geographic Edition for host-based replication to simplify the configuration and operation of host-based replication between clusters. See [“Understanding Data Replication” on page 97](#).

The example in this appendix shows how to configure host-based data replication between clusters using the Availability Suite feature of Oracle Solaris software. The example illustrates a complete cluster configuration for an NFS application that provides detailed information about how individual tasks can be performed. All tasks should be performed in the global cluster. The example does not include all of the steps that are required by other applications or other cluster configurations.

If you use role-based access control (RBAC) to access the cluster nodes, ensure that you can assume an RBAC role that provides authorization for all Oracle Solaris Cluster commands. This series of data replication procedures requires the following Oracle Solaris Cluster RBAC authorizations:

- `solaris.cluster.modify`
- `solaris.cluster.admin`
- `solaris.cluster.read`

See the [Securing Users and Processes in Oracle Solaris 11.2](#) for more information about using RBAC roles. See the Oracle Solaris Cluster man pages for the RBAC authorization that each Oracle Solaris Cluster subcommand requires.

### Understanding Sun StorageTek Availability Suite Software in a Cluster

This section introduces disaster tolerance and describes the data replication methods that Sun StorageTek Availability Suite software uses.

Disaster tolerance is the ability to restore an application on an alternate cluster when the primary cluster fails. Disaster tolerance is based on *data replication* and *takeover*. A takeover relocates an application service to a secondary cluster by bringing online one or more resource groups and device groups.

If data is replicated synchronously between the primary and secondary cluster, then no committed data is lost when the primary site fails. However, if data is replicated asynchronously, then some data may not have been replicated to the secondary cluster before the primary site failed, and thus is lost.

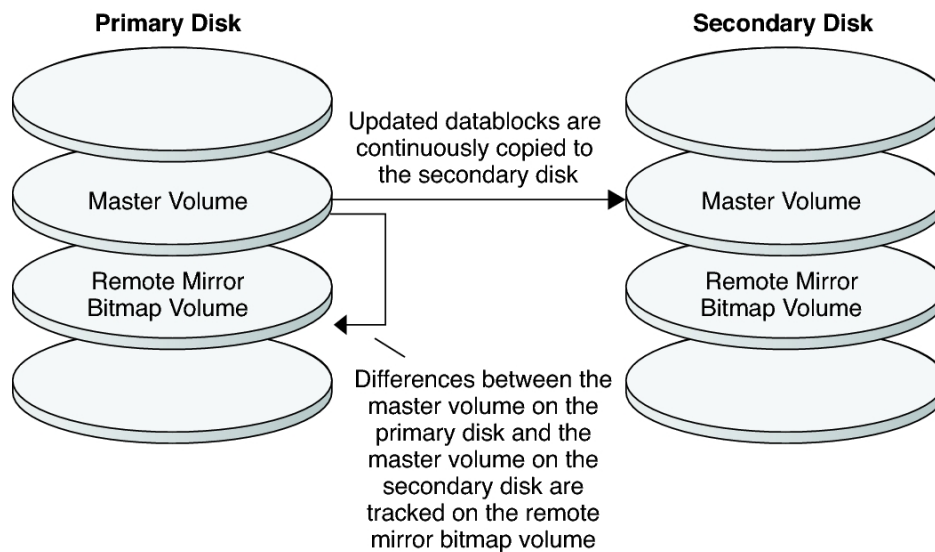
## Data Replication Methods Used by Sun StorageTek Availability Suite Software

This section describes the remote mirror replication method and the point-in-time snapshot method used by Sun StorageTek Availability Suite software. This software uses the `sndradm` and `iiadm` commands to replicate data. For more information, see the [sdradm\(1M\)](#) and [iiadm\(1M\)](#) man pages.

### Remote Mirror Replication

[Figure A-1](#) shows remote mirror replication. Data from the master volume of the primary disk is replicated to the master volume of the secondary disk through a TCP/IP connection. A remote mirror bitmap tracks differences between the master volume on the primary disk and the master volume on the secondary disk.



**FIGURE A-1** Remote Mirror Replication

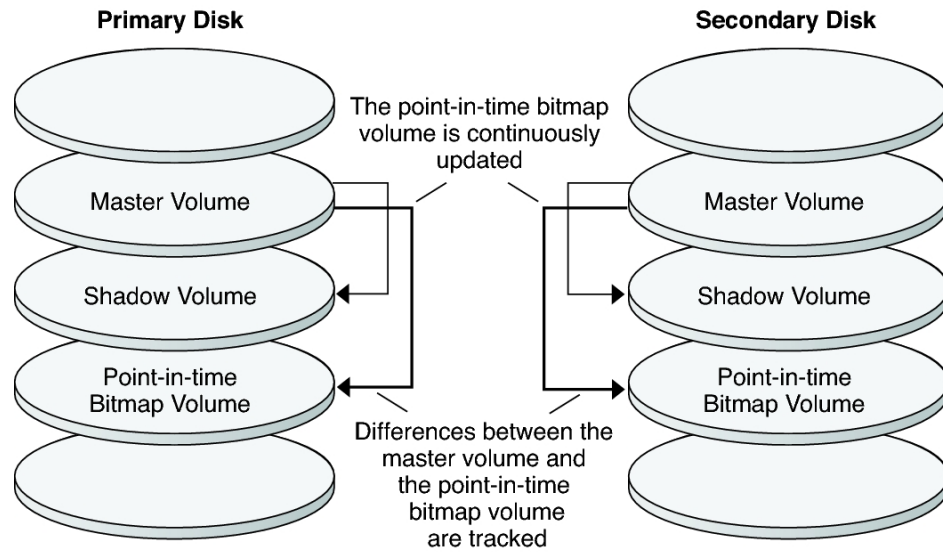
Remote mirror replication can be performed synchronously in real time, or asynchronously. Each volume set in each cluster can be configured individually, for synchronous replication or asynchronous replication.

- In synchronous data replication, a write operation is not confirmed as complete until the remote volume has been updated.
- In asynchronous data replication, a write operation is confirmed as complete before the remote volume is updated. Asynchronous data replication provides greater flexibility over long distances and low bandwidth.

### Point-in-Time Snapshot

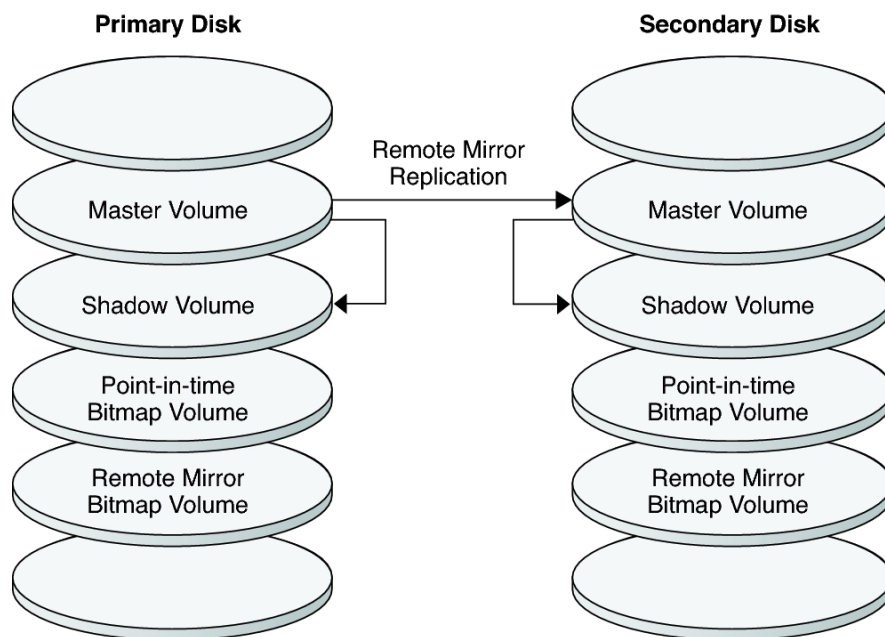
Figure A-2 shows a point-in-time snapshot. Data from the master volume of each disk is copied to the shadow volume on the same disk. The point-in-time bitmap tracks differences between the master volume and the shadow volume. When data is copied to the shadow volume, the point-in-time bitmap is reset.

**FIGURE A-2** Point-in-Time Snapshot



### Replication in the Example Configuration

Figure A-3 illustrates how remote mirror replication and point-in-time snapshot are used in this example configuration.

**FIGURE A-3** Replication in the Example Configuration

## Guidelines for Configuring Host-Based Data Replication Between Clusters

This section provides guidelines for configuring data replication between clusters. This section also contains tips for configuring replication resource groups and application resource groups. Use these guidelines when you are configuring data replication for your cluster.

This section discusses the following topics:

- [“Configuring Replication Resource Groups” on page 300](#)
- [“Configuring Application Resource Groups” on page 300](#)
  - [“Configuring Resource Groups for a Failover Application” on page 301](#)
  - [“Configuring Resource Groups for a Scalable Application” on page 302](#)
- [“Guidelines for Managing a Takeover” on page 303](#)

## Configuring Replication Resource Groups

Replication resource groups collocate the device group under Sun StorageTek Availability Suite software control with a logical hostname resource. A logical hostname must exist on each end of the data replication stream, and must be on the same cluster node that acts as the primary I/O path to the device. A replication resource group must have the following characteristics:

- Be a failover resource group  
A failover resource can run on only one node at a time. When a failover occurs, failover resources take part in the failover.
- Have a logical hostname resource  
A logical hostname is hosted on one node of each cluster (primary and secondary) and is used to provide source and target addresses for the Sun StorageTek Availability Suite software data replication stream.
- Have an HAStoragePlus resource  
The HAStoragePlus resource enforces the failover of the device group when the replication resource group is switched over or failed over. Oracle Solaris Cluster software also enforces the failover of the replication resource group when the device group is switched over. In this way, the replication resource group and the device group are always colocated, or mastered by the same node.

The following extension properties must be defined in the HAStoragePlus resource:

- `GlobalDevicePaths`. This extension property defines the device group to which a volume belongs.
- `AffinityOn` property = `True`. This extension property causes the device group to switch over or fail over when the replication resource group switches over or fails over. This feature is called an *affinity switchover*.

For more information about HAStoragePlus, see the [SUNW.HAStoragePlus\(5\)](#) man page.

- Be named after the device group with which it is colocated, followed by `-stor-rg`  
For example, `devgrp-stor-rg`.
- Be online on both the primary cluster and the secondary cluster

## Configuring Application Resource Groups

To be highly available, an application must be managed as a resource in an application resource group. An application resource group can be configured for a failover application or a scalable application.

The `ZPoolsSearchDir` extension property must be defined in the HAStoragePlus resource. This extension property is required to use the ZFS file system.

Application resources and application resource groups configured on the primary cluster must also be configured on the secondary cluster. Also, the data accessed by the application resource must be replicated to the secondary cluster.

This section provides guidelines for configuring the following application resource groups:

- “Configuring Resource Groups for a Failover Application” on page 301
- “Configuring Resource Groups for a Scalable Application” on page 302

## Configuring Resource Groups for a Failover Application

In a failover application, an application runs on one node at a time. If that node fails, the application fails over to another node in the same cluster. A resource group for a failover application must have the following characteristics:

- Have an `HASStoragePlus` resource to enforce the failover of the file system or zpool when the application resource group is switched over or failed over.

The device group is colocated with the replication resource group and the application resource group. Therefore, the failover of the application resource group enforces the failover of the device group and replication resource group. The application resource group, the replication resource group, and the device group are mastered by the same node.

Note, however, that a failover of the device group or the replication resource group does not cause a failover of the application resource group.

- If the application data is globally mounted, the presence of an `HASStoragePlus` resource in the application resource group is not required but is advised.
- If the application data is mounted locally, the presence of an `HASStoragePlus` resource in the application resource group is required.

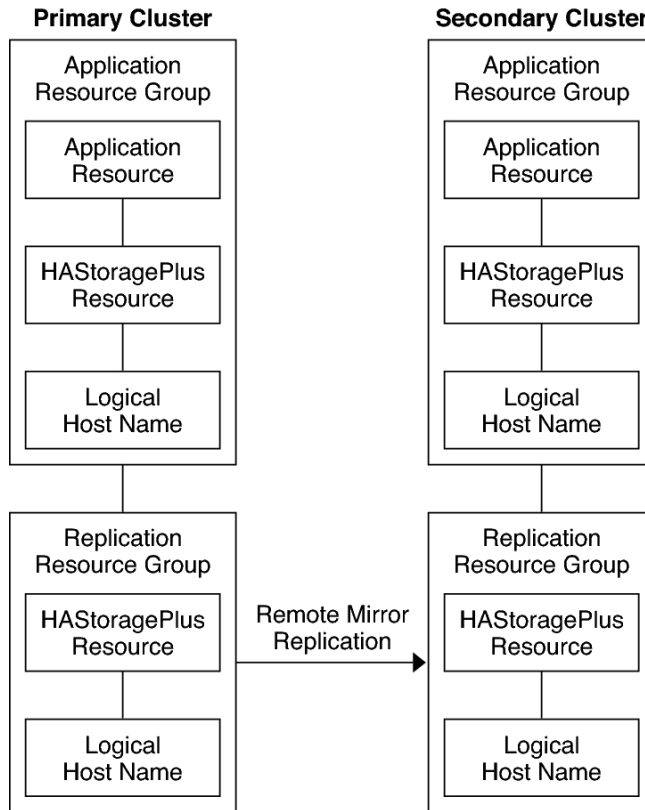
For more information about `HASStoragePlus`, see the `SUNW.HASStoragePlus(5)` man page.

- Must be online on the primary cluster and offline on the secondary cluster.

The application resource group must be brought online on the secondary cluster when the secondary cluster takes over as the primary cluster.

**Figure A-4** illustrates the configuration of an application resource group and a replication resource group in a failover application.

**FIGURE A-4** Configuration of Resource Groups in a Failover Application



## Configuring Resource Groups for a Scalable Application

In a scalable application, an application runs on several nodes to create a single, logical service. If a node that is running a scalable application fails, failover does not occur. The application continues to run on the other nodes.

When a scalable application is managed as a resource in an application resource group, it is not necessary to collocate the application resource group with the device group. Therefore, it is not necessary to create an HAStoragePlus resource for the application resource group.

A resource group for a scalable application must have the following characteristics:

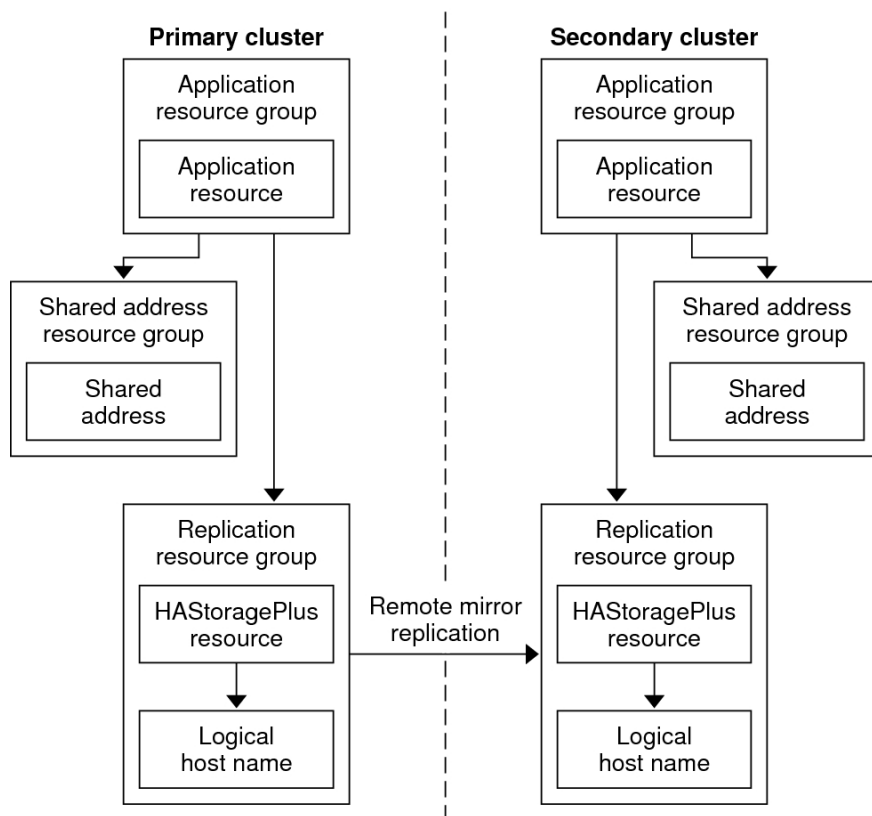
- Have a dependency on the shared address resource group

The nodes that are running the scalable application use the shared address to distribute incoming data.

- Be online on the primary cluster and offline on the secondary cluster

Figure A-5 illustrates the configuration of resource groups in a scalable application.

**FIGURE A-5** Configuration of Resource Groups in a Scalable Application

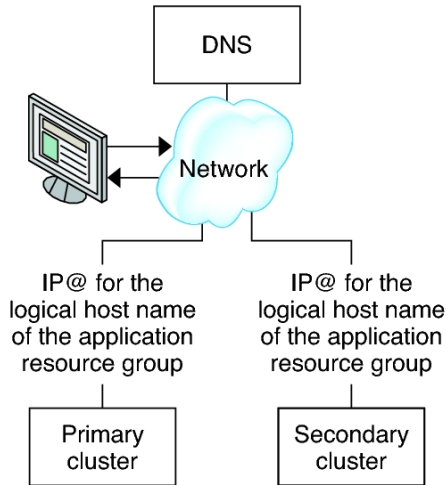


## Guidelines for Managing a Takeover

If the primary cluster fails, the application must be switched over to the secondary cluster as soon as possible. To enable the secondary cluster to take over, the DNS must be updated.

Clients use DNS to map an application's logical hostname to an IP address. After a takeover, where the application is moved to a secondary cluster, the DNS information must be updated to reflect the mapping between the application's logical hostname and the new IP address.

**FIGURE A-6** DNS Mapping of a Client to a Cluster



To update the DNS, use the `nsupdate` command. For information, see the [nsupdate\(1M\)](#) man page. For an example of how to manage a takeover, see [“Example of How to Manage a Takeover” on page 330](#).

After repair, the primary cluster can be brought back online. To switch back to the original primary cluster, perform the following tasks:

1. Synchronize the primary cluster with the secondary cluster to ensure that the primary volume is up-to-date. You can achieve this by stopping the resource group on the secondary node, so that the replication data stream can drain.
2. Reverse the direction of data replication so that the original primary is now, once again, replicating data to the original secondary.
3. Start the resource group on the primary cluster.
4. Update the DNS so that clients can access the application on the primary cluster.

## Task Map: Example of a Data Replication Configuration

[Table A-1](#) lists the tasks in this example of how data replication was configured for an NFS application by using Sun StorageTek Availability Suite software.



**TABLE A-1** Task Map: Example of a Data Replication Configuration

Task	Instructions
1. Connect and install the clusters	<a href="#">“Connecting and Installing the Clusters” on page 305</a>
2. Configure device groups, file systems for the NFS application, and resource groups on the primary cluster and on the secondary cluster	<a href="#">“Example of How to Configure Device Groups and Resource Groups” on page 307</a>
3. Enable data replication on the primary cluster and on the secondary cluster	<a href="#">“How to Enable Replication on the Primary Cluster” on page 322</a> <a href="#">“How to Enable Replication on the Secondary Cluster” on page 324</a>
4. Perform data replication	<a href="#">“How to Perform a Remote Mirror Replication” on page 325</a> <a href="#">“How to Perform a Point-in-Time Snapshot” on page 326</a>
5. Verify the data replication configuration	<a href="#">“How to Verify That Replication Is Configured Correctly” on page 327</a>

## Connecting and Installing the Clusters

[Figure A-7](#) illustrates the cluster configuration the example configuration uses. The secondary cluster in the example configuration contains one node, but other cluster configurations can be used.

**FIGURE A-7** Example Cluster Configuration

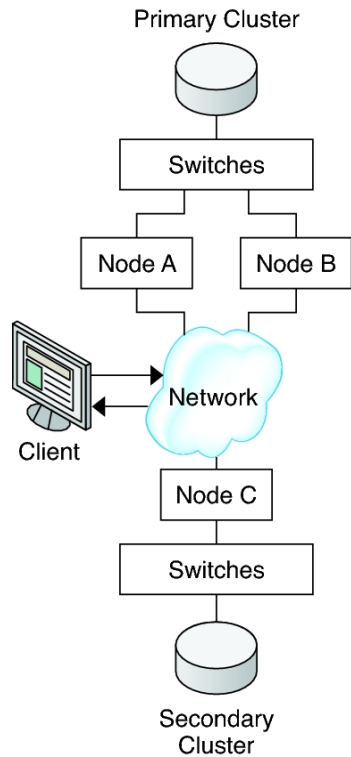


Table A-2 summarizes the hardware and software that the example configuration requires. The Oracle Solaris OS, Oracle Solaris Cluster software, and volume manager software must be installed on the cluster nodes *before* Sun StorageTek Availability Suite software and software updates are installed.

**TABLE A-2** Required Hardware and Software

Hardware or Software	Requirement
Node hardware	Sun StorageTek Availability Suite software is supported on all servers that use Oracle Solaris OS.  For information about which hardware to use, see the <a href="#">Oracle Solaris Cluster 4.2 Hardware Administration Manual</a> .
Disk space	Approximately 15 Mbytes.
Oracle Solaris OS	Oracle Solaris OS releases that are supported by Oracle Solaris Cluster software.

Hardware or Software	Requirement
	All nodes must use the same version of the Oracle Solaris OS.  For information about installation, see the <a href="#">Oracle Solaris Cluster Software Installation Guide</a> .
Oracle Solaris Cluster software	At least Oracle Solaris Cluster 4.1 software.  For information about installation, see the <a href="#">Oracle Solaris Cluster Software Installation Guide</a> .
Volume manager software	Solaris Volume Manager software.  All nodes must use the same version of volume manager software.  For information about installation, see <a href="#">Chapter 4, “Configuring Solaris Volume Manager Software,” in Oracle Solaris Cluster Software Installation Guide</a> .
Sun StorageTek Availability Suite software	Different clusters can use different versions of Oracle Solaris OS and Oracle Solaris Cluster software, but you must use the same version of Sun StorageTek Availability Suite software between clusters.  For information about how to install the software, see the installation manuals for your release of Sun StorageTek Availability Suite software.
Sun StorageTek Availability Suite software updates	For information about the latest software updates, log into <a href="#">My Oracle Support</a> .

## Example of How to Configure Device Groups and Resource Groups

This section describes how device groups and resource groups are configured for an NFS application. For additional information, see [“Configuring Replication Resource Groups” on page 300](#) and [“Configuring Application Resource Groups” on page 300](#).

This section contains the following procedures:

- [“How to Configure a Device Group on the Primary Cluster” on page 308](#)
- [“How to Configure a Device Group on the Secondary Cluster” on page 310](#)
- [“How to Configure the File System on the Primary Cluster for the NFS Application” on page 311](#)
- [“How to Configure the File System on the Secondary Cluster for the NFS Application” on page 312](#)
- [“How to Create a Replication Resource Group on the Primary Cluster” on page 313](#)
- [“How to Create a Replication Resource Group on the Secondary Cluster” on page 315](#)
- [“How to Create an NFS Application Resource Group on the Primary Cluster” on page 316](#)
- [“How to Create an NFS Application Resource Group on the Secondary Cluster” on page 319](#)
- [“How to Verify That Replication Is Configured Correctly” on page 327](#)

The following table lists the names of the groups and resources that are created for the example configuration.

**TABLE A-3** Summary of the Groups and Resources in the Example Configuration

Group or Resource	Name	Description
Device group	devgrp	The device group
Replication resource group and resources	devgrp-stor-rg	The replication resource group
	lhost-reprg-prim, lhost-reprg-sec	The logical host names for the replication resource group on the primary cluster and the secondary cluster
	devgrp-stor	The HAStoragePlus resource for the replication resource group
Application resource group and resources	nfs-rg	The application resource group
	lhost-nfsrg-prim, lhost-nfsrg-sec	The logical host names for the application resource group on the primary cluster and the secondary cluster
	nfs-dg-rs	The HAStoragePlus resource for the application
	nfs-rs	The NFS resource

With the exception of `devgrp-stor-rg`, the names of the groups and resources are example names that can be changed as required. The replication resource group must have a name with the format `devicegroupname-stor-rg`.

For information about Solaris Volume Manager software, see the [Chapter 4, “Configuring Solaris Volume Manager Software,”](#) in *Oracle Solaris Cluster Software Installation Guide*.

## ▼ How to Configure a Device Group on the Primary Cluster

**Before You Begin** Ensure that you have completed the following tasks:

- Read the guidelines and requirements in the following sections:
  - [“Understanding Sun StorageTek Availability Suite Software in a Cluster”](#) on page 295
  - [“Guidelines for Configuring Host-Based Data Replication Between Clusters”](#) on page 299
- Set up the primary and secondary clusters as described in [“Connecting and Installing the Clusters”](#) on page 305.

1. **Access nodeA by assuming the role that provides `solaris.cluster.modify` RBAC authorization.**

The node `nodeA` is the first node of the primary cluster. For a reminder of which node is `nodeA`, see [Figure A-7](#).

## 2. Create a metaset to contain the NFS data and associated replication.

```
nodeA# metaset -s nfsset a -h nodeA nodeB
```

## 3. Add disks to the metaset.

```
nodeA# metaset -s nfsset -a /dev/did/dsk/d6 /dev/did/dsk/d7
```

## 4. Add mediators to the metaset.

```
nodeA# metaset -s nfsset -a -m nodeA nodeB
```

## 5. Create the required volumes (or metadevices).

Create two components of a mirror:

```
nodeA# metainit -s nfsset d101 1 1 /dev/did/dsk/d6s2
nodeA# metainit -s nfsset d102 1 1 /dev/did/dsk/d7s2
```

Create the mirror with one of the components:

```
nodeA# metainit -s nfsset d100 -m d101
```

Attach the other component to the mirror and allow it to synchronize:

```
nodeA# metattach -s nfsset d100 d102
```

Create soft partitions from the mirror, following these examples:

- *d200* - The NFS data (master volume):

```
nodeA# metainit -s nfsset d200 -p d100 50G
```

- *d201* - The point-in-time copy volume for the NFS data:

```
nodeA# metainit -s nfsset d201 -p d100 50G
```

- *d202* - The point-in-time bitmap volume:

```
nodeA# metainit -s nfsset d202 -p d100 10M
```

- *d203* - The remote shadow bitmap volume:

```
nodeA# metainit -s nfsset d203 -p d100 10M
```

- *d204* - The volume for the Oracle Solaris Cluster SUNW.NFS configuration information:

```
nodeA# metainit -s nfsset d204 -p d100 100M
```

## 6. Create file systems for the NFS data and the configuration volume.

```
nodeA# yes | newfs /dev/md/nfsset/rdisk/d200
nodeA# yes | newfs /dev/md/nfsset/rdisk/d204
```

**Next Steps** Go to [“How to Configure a Device Group on the Secondary Cluster”](#) on page 310.

## ▼ How to Configure a Device Group on the Secondary Cluster

**Before You Begin** Complete the procedure [“How to Configure a Device Group on the Primary Cluster” on page 308](#).

1. **Access nodeC by assuming the role that provides `solaris.cluster.modify` RBAC authorization.**
2. **Create a metaset to contain the NFS data and associated replication.**

```
nodeC# metaset -s nfsset a -h nodeC
```

3. **Add disks to the metaset.**

In the example below, assume that the disk DID numbers are different.

```
nodeC# metaset -s nfsset -a /dev/did/dsk/d3 /dev/did/dsk/d4
```

---

**Note** - Mediators are not required on a single node cluster.

---

4. **Create the required volumes (or metadevices).**

Create two components of a mirror:

```
nodeC# metainit -s nfsset d101 1 1 /dev/did/dsk/d3s2
nodeC# metainit -s nfsset d102 1 1 /dev/did/dsk/d4s2
```

Create the mirror with one of the components:

```
nodeC# metainit -s nfsset d100 -m d101
```

Attach the other component to the mirror and allow it to synchronize:

```
metattach -s nfsset d100 d102
```

Create soft partitions from the mirror, following these examples:

- *d200* - The NFS data master volume:

```
nodeC# metainit -s nfsset d200 -p d100 50G
```

- *d201* - The point-in-time copy volume for the NFS data:

```
nodeC# metainit -s nfsset d201 -p d100 50G
```

- *d202* - The point-in-time bitmap volume:

```
nodeC# metainit -s nfsset d202 -p d100 10M
```

- *d203* - The remote shadow bitmap volume:

```
nodeC# metainit -s nfsset d203 -p d100 10M
```

- *d204* - The volume for the Oracle Solaris Cluster SUNW.NFS configuration information:

```
nodeC# metainit -s nfsset d204 -p d100 100M
```

**5. Create file systems for the NFS data and the configuration volume.**

```
nodeC# yes | newfs /dev/md/nfsset/rdisk/d200
nodeC# yes | newfs /dev/md/nfsset/rdisk/d204
```

**Next Steps** Go to [“How to Configure the File System on the Primary Cluster for the NFS Application”](#) on page 311.

## ▼ How to Configure the File System on the Primary Cluster for the NFS Application

**Before You Begin** Complete the procedure [“How to Configure a Device Group on the Secondary Cluster”](#) on page 310.

**1. On nodeA and nodeB, assume the role that provides `solaris.cluster.admin` RBAC authorization.**

**2. On nodeA and nodeB, create a mount-point directory for the NFS file system.**

For example:

```
nodeA# mkdir /global/mountpoint
```

**3. On nodeA and nodeB, configure the master volume to *not* be mounted automatically on the mount point.**

Add or replace the following text in the `/etc/vfstab` file on nodeA and nodeB. The text must be on a single line.

```
/dev/md/nfsset/dsk/d200 /dev/md/nfsset/rdisk/d200 \
/global/mountpoint ufs 3 no global,logging
```

**4. On nodeA and nodeB, create a mount point for metadvice d204.**

The following example creates the mount point `/global/etc`.

```
nodeA# mkdir /global/etc
```

**5. On nodeA and nodeB, configure metadvice d204 to be mounted automatically on the mount point.**

Add or replace the following text in the `/etc/vfstab` file on nodeA and nodeB. The text must be on a single line.

```
/dev/md/nfsset/dsk/d204 /dev/md/nfsset/rdisk/d204 \
```

```
/global/etc ufs 3 yes global,logging
```

**6. Mount metadvice d204 on nodeA.**

```
nodeA# mount /global/etc
```

**7. Create the configuration files and information for the Oracle Solaris Cluster HA for NFS data service.**

**a. Create a directory called /global/etc/SUNW.nfs ON nodeA.**

```
nodeA# mkdir -p /global/etc/SUNW.nfs
```

**b. Create the file /global/etc/SUNW.nfs/dfstab.nfs-rs ON nodeA.**

```
nodeA# touch /global/etc/SUNW.nfs/dfstab.nfs-rs
```

**c. Add the following line to the /global/etc/SUNW.nfs/dfstab.nfs-rs file ON nodeA.**

```
share -F nfs -o rw -d "HA NFS" /global/mountpoint
```

**Next Steps** Go to [“How to Configure the File System on the Secondary Cluster for the NFS Application” on page 312.](#)

## ▼ How to Configure the File System on the Secondary Cluster for the NFS Application

**Before You Begin** Complete the procedure [“How to Configure the File System on the Primary Cluster for the NFS Application” on page 311.](#)

**1. On nodeC, assume the role that provides solaris.cluster.admin RBAC authorization.**

**2. On nodeC, create a mount-point directory for the NFS file system.**

For example:

```
nodeC# mkdir /global/mountpoint
```

**3. On nodeC, configure the master volume to be mounted automatically on the mount point.**

Add or replace the following text in the /etc/vfstab file on nodeC. The text must be on a single line.

```
/dev/md/nfsset/dsk/d200 /dev/md/nfsset/rdisk/d200 \
/global/mountpoint ufs 3 yes global,logging
```



**4. Mount metadvice d204 on nodeA.**

```
nodeC# mount /global/etc
```

**5. Create the configuration files and information for the Oracle Solaris Cluster HA for NFS data service.****a. Create a directory called /global/etc/SUNW.nfs on nodeA.**

```
nodeC# mkdir -p /global/etc/SUNW.nfs
```

**b. Create the file /global/etc/SUNW.nfs/dfstab.nfs-rs ON nodeA.**

```
nodeC# touch /global/etc/SUNW.nfs/dfstab.nfs-rs
```

**c. Add the following line to the /global/etc/SUNW.nfs/dfstab.nfs-rs file ON nodeA.**

```
share -F nfs -o rw -d "HA NFS" /global/mountpoint
```

**Next Steps** Go to [“How to Create a Replication Resource Group on the Primary Cluster”](#) on page 313.

## ▼ How to Create a Replication Resource Group on the Primary Cluster

- Before You Begin**
- Complete the procedure [“How to Configure the File System on the Secondary Cluster for the NFS Application”](#) on page 312.
  - Ensure that the /etc/netmasks file has IP-address subnet and netmask entries for all logical hostnames. If necessary, edit the /etc/netmasks file to add any missing entries.

**1. Access nodeA as the role that provides solaris.cluster.modify, solaris.cluster.admin, and solaris.cluster.read RBAC authorization.****2. Register the SUNW.HASStoragePlus resource type.**

```
nodeA# clresourcetype register SUNW.HASStoragePlus
```

**3. Create a replication resource group for the device group.**

```
nodeA# clresourcegroup create -n nodeA,nodeB devgrp-stor-rg
```

-n nodeA,nodeB      Specifies that cluster nodes nodeA and nodeB can master the replication resource group.

devgrp-stor-rg      The name of the replication resource group. In this name, devgrp specifies the name of the device group.

**4. Add a SUNW.HASStoragePlus resource to the replication resource group.**

```
nodeA# clresource create -g devgrp-stor-rg -t SUNW.HASStoragePlus \
-p GlobalDevicePaths=nfsset \
-p AffinityOn=True \
devgrp-stor
```

-g Specifies the resource group to which resource is added.

-p GlobalDevicePaths= Specifies the device group that Sun StorageTek Availability Suite software relies on.

-p AffinityOn=True Specifies that the SUNW.HASStoragePlus resource must perform an affinity switchover for the global devices and cluster file systems defined by -p GlobalDevicePaths=. Therefore, when the replication resource group fails over or is switched over, the associated device group is switched over.

For more information about these extension properties, see the [SUNW.HASStoragePlus\(5\)](#) man page.

**5. Add a logical hostname resource to the replication resource group.**

```
nodeA# clreslogicalhostname create -g devgrp-stor-rg lhost-reprg-prim
```

The logical hostname for the replication resource group on the primary cluster is named lhost-reprg-prim.

**6. Enable the resources, manage the resource group, and bring the resource group online.**

```
nodeA# clresourcegroup online -emM -n nodeA devgrp-stor-rg
```

-e Enables associated resources.

-M Manages the resource group.

-n Specifies the node on which to bring the resource group online.

**7. Verify that the resource group is online.**

```
nodeA# clresourcegroup status devgrp-stor-rg
```

Examine the resource group state field to confirm that the replication resource group is online on nodeA.

**Next Steps** Go to [“How to Create a Replication Resource Group on the Secondary Cluster”](#) on page 315.

## ▼ How to Create a Replication Resource Group on the Secondary Cluster

- Before You Begin**
- Complete the procedure [“How to Create a Replication Resource Group on the Primary Cluster” on page 313](#).
  - Ensure that the `/etc/netmasks` file has IP-address subnet and netmask entries for all logical hostnames. If necessary, edit the `/etc/netmasks` file to add any missing entries.

**1. Access nodeC as the role that provides `solaris.cluster.modify`, `solaris.cluster.admin`, and `solaris.cluster.read` RBAC authorization.**

**2. Register `SUNW.HASStoragePlus` as a resource type.**

```
nodeC# clresourcetype register SUNW.HASStoragePlus
```

**3. Create a replication resource group for the device group.**

```
nodeC# clresourcegroup create -n nodeC devgrp-stor-rg
```

`create`                      Creates the resource group.

`-n`                              Specifies the node list for the resource group.

`devgrp`                        The name of the device group.

`devgrp-stor-rg`              The name of the replication resource group.

**4. Add a `SUNW.HASStoragePlus` resource to the replication resource group.**

```
nodeC# clresource create \
-t SUNW.HASStoragePlus \
-p GlobalDevicePaths=nfsset \
-p AffinityOn=True \
devgrp-stor
```

`create`                        Creates the resource.

`-t`                              Specifies the resource type.

`-p GlobalDevicePaths=`        Specifies the device group that Sun StorageTek Availability Suite software relies on.

`-p AffinityOn=True`           Specifies that the `SUNW.HASStoragePlus` resource must perform an affinity switchover for the global devices and cluster file systems defined by `-p GlobalDevicePaths=`. Therefore, when the replication resource group fails over or is switched over, the associated device group is switched over.

`devgrp-stor` The HAStoragePlus resource for the replication resource group.

For more information about these extension properties, see the [SUNW.HAStoragePlus\(5\)](#) man page.

**5. Add a logical hostname resource to the replication resource group.**

```
nodeC# clreslogicalhostname create -g devgrp-stor-rg lhost-reprg-sec
```

The logical hostname for the replication resource group on the secondary cluster is named `lhost-reprg-sec`.

**6. Enable the resources, manage the resource group, and bring the resource group online.**

```
nodeC# clresourcegroup online -eM -n nodeC devgrp-stor-rg
```

`online` Brings online.

`-e` Enables associated resources.

`-M` Manages the resource group.

`-n` Specifies the node on which to bring the resource group online.

**7. Verify that the resource group is online.**

```
nodeC# clresourcegroup status devgrp-stor-rg
```

Examine the resource group state field to confirm that the replication resource group is online on `nodeC`.

**Next Steps** Go to [“How to Create an NFS Application Resource Group on the Primary Cluster”](#) on page 316.

## ▼ How to Create an NFS Application Resource Group on the Primary Cluster

This procedure describes how application resource groups are created for NFS. This procedure is specific to this application and cannot be used for another type of application.

- Before You Begin**
- Complete the procedure [“How to Create a Replication Resource Group on the Secondary Cluster”](#) on page 315.
  - Ensure that the `/etc/netmasks` file has IP-address subnet and netmask entries for all logical hostnames. If necessary, edit the `/etc/netmasks` file to add any missing entries.

1. **Access nodeA as the role that provides `solaris.cluster.modify`, `solaris.cluster.admin`, and `solaris.cluster.read` RBAC authorization.**

2. **Register `SUNW.nfs` as a resource type.**

```
nodeA# clresourcetype register SUNW.nfs
```

3. **If `SUNW.HAStoragePlus` has not been registered as a resource type, register it.**

```
nodeA# clresourcetype register SUNW.HAStoragePlus
```

4. **Create an application resource group for the NFS service.**

```
nodeA# clresourcegroup create \
-p Pathprefix=/global/etc \
-p Auto_start_on_new_cluster=False \
-p RG_affinities=+++devgrp-stor-rg \
nfs-rg
```

```
Pathprefix=/global/etc
```

Specifies the directory into which the resources in the group can write administrative files.

```
Auto_start_on_new_cluster=False
```

Specifies that the application resource group is not started automatically.

```
RG_affinities=+++devgrp-stor-rg
```

Specifies the resource group with which the application resource group must be collocated. In this example, the application resource group must be collocated with the replication resource group `devgrp-stor-rg`.

If the replication resource group is switched over to a new primary node, the application resource group is automatically switched over. However, attempts to switch over the application resource group to a new primary node are blocked because that action breaks the collocation requirement.

```
nfs-rg
```

The name of the application resource group.

5. **Add a `SUNW.HAStoragePlus` resource to the application resource group.**

```
nodeA# clresource create -g nfs-rg \
-t SUNW.HAStoragePlus \
-p FileSystemMountPoints=/global/mountpoint \
-p AffinityOn=True \
nfs-dg-rs
```

```
create
```

Creates the resource.

-g

Specifies the resource group to which the resource is added.

-t SUNW.HAStoragePlus

Specifies that the resource is of the type SUNW.HAStoragePlus.

-p FileSystemMountPoints=/global/mountpoint

Specifies that the mount point for the file system is global.

-p AffinityOn=True

Specifies that the application resource must perform an affinity switchover for the global devices and cluster file systems defined by -p FileSystemMountPoints. Therefore, when the application resource group fails over or is switched over, the associated device group is switched over.

nfs-dg-rs

The name of the HAStoragePlus resource for the NFS application.

For more information about these extension properties, see the [SUNW.HAStoragePlus\(5\)](#) man page.

## 6. Add a logical hostname resource to the application resource group.

```
nodeA# clreslogicalhostname create -g nfs-rg \
lhost-nfsrg-prim
```

The logical hostname of the application resource group on the primary cluster is named lhost-nfsrg-prim.

## 7. Create the `dfstab.resource-name` configuration file and place it in the `SUNW.nfs` subdirectory under the `Pathprefix` directory of the containing resource group.

### a. Create a directory called `SUNW.nfs` on nodeA.

```
nodeA# mkdir -p /global/etc/SUNW.nfs
```

### b. Create a `dfstab.resource-name` file on nodeA.

```
nodeA# touch /global/etc/SUNW.nfs/dfstab.nfs-rs
```

### c. Add the following line to the `/global/etc/SUNW.nfs/dfstab.nfs-rs` file on nodeA.

```
share -F nfs -o rw -d "HA NFS" /global/mountpoint
```

## 8. Bring the application resource group online.

```
nodeA# clresourcegroup online -M -n nodeA nfs-rg
```

online	Brings the resource group online.
-e	Enables the associated resources.
-M	Manages the resource group.
-n	Specifies the node on which to bring the resource group online.
nfs-rg	The name of the resource group.

### 9. Verify that the application resource group is online.

```
nodeA# clresourcegroup status
```

Examine the resource group state field to determine whether the application resource group is online for nodeA and nodeB.

**Next Steps** Go to [“How to Create an NFS Application Resource Group on the Secondary Cluster” on page 319.](#)

## ▼ How to Create an NFS Application Resource Group on the Secondary Cluster

- Before You Begin**
- Complete the procedure [“How to Create an NFS Application Resource Group on the Primary Cluster” on page 316.](#)
  - Ensure that the `/etc/netmasks` file has IP-address subnet and netmask entries for all logical hostnames. If necessary, edit the `/etc/netmasks` file to add any missing entries.

1. **Access nodeC as the role that provides `solaris.cluster.modify`, `solaris.cluster.admin`, and `solaris.cluster.read` RBAC authorization.**
2. **Register `SUNW.nfs` as a resource type.**

```
nodeC# clresourcetype register SUNW.nfs
```

3. **If `SUNW.HAStoragePlus` has not been registered as a resource type, register it.**

```
nodeC# clresourcetype register SUNW.HAStoragePlus
```

4. **Create an application resource group for the device group.**

```
nodeC# clresourcegroup create \
-p Pathprefix=global/etc \

```

```
-p Auto_start_on_new_cluster=False \
-p RG_affinities=+++devgrp-stor-rg \
nfs-rg
```

create

Creates the resource group.

-p

Specifies a property of the resource group.

Pathprefix=/global/etc

Specifies a directory into which the resources in the group can write administrative files.

Auto\_start\_on\_new\_cluster=False

Specifies that the application resource group is not started automatically.

RG\_affinities=+++devgrp-stor-rg

Specifies the resource group where the application resource group must be collocated. In this example, the application resource group must be collocated with the replication resource group devgrp-stor-rg.

If the replication resource group is switched over to a new primary node, the application resource group is automatically switched over. However, attempts to switch over the application resource group to a new primary node are blocked because that breaks the collocation requirement.

nfs-rg

The name of the application resource group.

## 5. Add a SUNW.HASStoragePlus resource to the application resource group.

```
nodeC# clresource create -g nfs-rg \
-t SUNW.HASStoragePlus \
-p FileSystemMountPoints=/global/mountpoint \
-p AffinityOn=True \
nfs-dg-rs
```

create

Creates the resource.

-g

Specifies the resource group to which the resource is added.

-t SUNW.HASStoragePlus

Specifies that the resource is of the type SUNW.HASStoragePlus.



-p

Specifies a property of the resource.

`FileSystemMountPoints=/global/mountpoint`

Specifies that the mount point for the file system is global.

`AffinityOn=True`

Specifies that the application resource must perform an affinity switchover for the global devices and cluster file systems defined by `-p FileSystemMountPoints=`. Therefore, when the application resource group fails over or is switched over, the associated device group is switched over.

`nfs-dg-rs`

The name of the HAStoragePlus resource for the NFS application.

**6. Add a logical hostname resource to the application resource group.**

```
nodeC# clreslogicalhostname create -g nfs-rg \
lhost-nfsrg-sec
```

The logical hostname of the application resource group on the secondary cluster is named `lhost-nfsrg-sec`.

**7. Add an NFS resource to the application resource group.**

```
nodeC# clresource create -g nfs-rg \
-t SUNW.nfs -p Resource_dependencies=nfs-dg-rs nfs-rg
```

**8. If the global volume is mounted on the primary cluster, unmount the global volume from the secondary cluster.**

```
nodeC# umount /global/mountpoint
```

If the volume is mounted on a secondary cluster, the synchronization fails.

**Next Steps** Go to [“Example of How to Enable Data Replication” on page 321](#).

## Example of How to Enable Data Replication

This section describes how data replication is enabled for the example configuration. This section uses the Sun StorageTek Availability Suite software commands `sndradm` and `iiadm`. For more information about these commands, see the Sun StorageTek Availability Suite documentation.

This section contains the following procedures:

- [“How to Enable Replication on the Primary Cluster” on page 322](#)
- [“How to Enable Replication on the Secondary Cluster” on page 324](#)

## ▼ How to Enable Replication on the Primary Cluster

1. **Access nodeA as the role that provides `solaris.cluster.read` RBAC authorization.**
2. **Flush all transactions.**

```
nodeA# lockfs -a -f
```

3. **Confirm that the logical host names `lhost-reprg-prim` and `lhost-reprg-sec` are online.**

```
nodeA# clresourcegroup status
nodeC# clresourcegroup status
```

Examine the state field of the resource group.

4. **Enable remote mirror replication from the primary cluster to the secondary cluster.**

This step enables replication from the primary cluster to the secondary cluster. This step enables replication from the master volume (`d200`) on the primary cluster to the master volume (`d200`) on the secondary cluster. In addition, this step enables replication to the remote mirror bitmap on `d203`.

- If the primary cluster and secondary cluster are unsynchronized, run this command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -e lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

- If the primary cluster and secondary cluster are synchronized, run this command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -E lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

5. **Enable autosynchronization.**

Run this command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -a on lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

This step enables autosynchronization. When the active state of autosynchronization is set to on, the volume sets are resynchronized if the system reboots or a failure occurs.

## 6. Verify that the cluster is in logging mode.

Use the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -P
```

The output should resemble the following:

```
/dev/md/nfsset/rdisk/d200 ->
lhost-reprg-sec:/dev/md/nfsset/rdisk/d200
autosync: off, max q writes:4194304, max q fbas:16384, mode:sync,ctag:
devgrp, state: logging
```

In logging mode, the state is logging, and the active state of autosynchronization is off. When the data volume on the disk is written to, the bitmap file on the same disk is updated.

## 7. Enable point-in-time snapshot.

Use the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/iiadm -e ind \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d201 \
/dev/md/nfsset/rdisk/d202
nodeA# /usr/sbin/iiadm -w \
/dev/md/nfsset/rdisk/d201
```

This step enables the master volume on the primary cluster to be copied to the shadow volume on the same cluster. The master volume, shadow volume, and point-in-time bitmap volume must be in the same device group. In this example, the master volume is d200, the shadow volume is d201, and the point-in-time bitmap volume is d203.

## 8. Attach the point-in-time snapshot to the remote mirror set.

Use the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -I a \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d201 \
/dev/md/nfsset/rdisk/d202
```

This step associates the point-in-time snapshot with the remote mirror volume set. Sun StorageTek Availability Suite software ensures that a point-in-time snapshot is taken before remote mirror replication can occur.

**Next Steps** Go to [“How to Enable Replication on the Secondary Cluster”](#) on page 324.

## ▼ How to Enable Replication on the Secondary Cluster

**Before You Begin** Complete the procedure [“How to Enable Replication on the Primary Cluster”](#) on page 322.

**1. Access nodeC as the root role.**

**2. Flush all transactions.**

```
nodeC# lockfs -a -f
```

**3. Enable remote mirror replication from the primary cluster to the secondary cluster.**

Use the following command for Sun StorageTek Availability Suite software:

```
nodeC# /usr/sbin/sndradm -n -e lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

The primary cluster detects the presence of the secondary cluster and starts synchronization. Refer to the system log file `/var/adm` for Sun StorageTek Availability Suite for information about the status of the clusters.

**4. Enable independent point-in-time snapshot.**

Use the following command for Sun StorageTek Availability Suite software:

```
nodeC# /usr/sbin/iidm -e ind \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d201 \
/dev/md/nfsset/rdisk/d202
nodeC# /usr/sbin/iidm -w \
/dev/md/nfsset/rdisk/d201
```

**5. Attach the point-in-time snapshot to the remote mirror set.**

Use the following command for Sun StorageTek Availability Suite software:

```
nodeC# /usr/sbin/sndradm -I a \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d201 \
/dev/md/nfsset/rdisk/d202
```

**Next Steps** Go to [“Example of How to Perform Data Replication”](#) on page 325.

## Example of How to Perform Data Replication

This section describes how data replication is performed for the example configuration. This section uses the Sun StorageTek Availability Suite software commands `sndradm` and `iiadm`. For more information about these commands, see the Sun StorageTek Availability Suite documentation.

This section contains the following procedures:

- [“How to Perform a Remote Mirror Replication”](#) on page 325
- [“How to Perform a Point-in-Time Snapshot”](#) on page 326
- [“How to Verify That Replication Is Configured Correctly”](#) on page 327

### ▼ How to Perform a Remote Mirror Replication

In this procedure, the master volume of the primary disk is replicated to the master volume on the secondary disk. The master volume is `d200` and the remote mirror bitmap volume is `d203`.

1. **Access `nodeA` as the root role.**
2. **Verify that the cluster is in logging mode.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -P
```

The output should resemble the following:

```
/dev/md/nfsset/rdisk/d200 ->
lhost-reprg-sec:/dev/md/nfsset/rdisk/d200
autosync: off, max q writes:4194304, max q fbas:16384, mode:sync,ctag:
devgrp, state: logging
```

In logging mode, the state is `logging`, and the active state of autosynchronization is `off`. When the data volume on the disk is written to, the bitmap file on the same disk is updated.

3. **Flush all transactions.**

```
nodeA# lockfs -a -f
```
4. **Repeat [Step 1](#) through [Step 3](#) on `nodeC`.**
5. **Copy the master volume of `nodeA` to the master volume of `nodeC`.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -m lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

**6. Wait until the replication is complete and the volumes are synchronized.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -w lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

**7. Confirm that the cluster is in replicating mode.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -P
```

The output should resemble the following:

```
/dev/md/nfsset/rdisk/d200 ->
lhost-reprg-sec:/dev/md/nfsset/rdisk/d200
autosync: on, max q writes:4194304, max q fbas:16384, mode:sync,ctag:
devgrp, state: replicating
```

In replicating mode, the state is replicating, and the active state of autosynchronization is on. When the primary volume is written to, the secondary volume is updated by Sun StorageTek Availability Suite software.

**Next Steps** Go to [“How to Perform a Point-in-Time Snapshot” on page 326](#).

## ▼ How to Perform a Point-in-Time Snapshot

In this procedure, point-in-time snapshot is used to synchronize the shadow volume of the primary cluster to the master volume of the primary cluster. The master volume is d200, the bitmap volume is d203, and the shadow volume is d201.

**Before You Begin** Complete the procedure [“How to Perform a Remote Mirror Replication” on page 325](#).

- 1. Access nodeA as the role that provides solaris.cluster.modify and solaris.cluster.admin RBAC authorization.**
- 2. Disable the resource that is running on nodeA.**

```
nodeA# clresource disable nfs-rs
```

### 3. Change the primary cluster to logging mode.

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -l lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

When the data volume on the disk is written to, the bitmap file on the same disk is updated. No replication occurs.

### 4. Synchronize the shadow volume of the primary cluster to the master volume of the primary cluster.

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/iiadm -u s /dev/md/nfsset/rdisk/d201
nodeA# /usr/sbin/iiadm -w /dev/md/nfsset/rdisk/d201
```

### 5. Synchronize the shadow volume of the secondary cluster to the master volume of the secondary cluster.

Run the following command for Sun StorageTek Availability Suite software:

```
nodeC# /usr/sbin/iiadm -u s /dev/md/nfsset/rdisk/d201
nodeC# /usr/sbin/iiadm -w /dev/md/nfsset/rdisk/d201
```

### 6. Restart the application on nodeA.

```
nodeA# clresource enable nfs-rs
```

### 7. Resynchronize the secondary volume with the primary volume.

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -u lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

**Next Steps** Go to [“How to Verify That Replication Is Configured Correctly” on page 327](#).

## ▼ How to Verify That Replication Is Configured Correctly

**Before You Begin** Complete the procedure [“How to Perform a Point-in-Time Snapshot” on page 326](#).

1. **Access nodeA and nodeC as the role that provides `solaris.cluster.admin` RBAC authorization.**
2. **Verify that the primary cluster is in replicating mode, with autosynchronization on.**

Use the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -P
```

The output should resemble the following:

```
/dev/md/nfsset/rdisk/d200 ->
lhost-reprg-sec:/dev/md/nfsset/rdisk/d200
autosync: on, max q writes:4194304, max q fbas:16384, mode:sync,ctag:
devgrp, state: replicating
```

In replicating mode, the state is `replicating`, and the active state of autosynchronization is `on`. When the primary volume is written to, the secondary volume is updated by Sun StorageTek Availability Suite software.

3. **If the primary cluster is not in replicating mode, put it into replicating mode.**

Use the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -u lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

4. **Create a directory on a client machine.**
  - a. **Log in to a client machine as the root role.**

You see a prompt that resembles the following:

```
client-machine#
```

- b. **Create a directory on the client machine.**

```
client-machine# mkdir /dir
```

5. **Mount the primary volume on the application directory and display the mounted directory.**

- a. **Mount the primary volume on the application directory.**

```
client-machine# mount -o rw lhost-nfsrg-prim:/global/mountpoint /dir
```

- b. **Display the mounted directory.**



```
client-machine# ls /dir
```

**6. Unmount the primary volume from the application directory.**

**a. Unmount the primary volume from the application directory.**

```
client-machine# umount /dir
```

**b. Take the application resource group offline on the primary cluster.**

```
nodeA# clresource disable -g nfs-rg +
nodeA# clresourcegroup offline nfs-rg
```

**c. Change the primary cluster to logging mode.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -l lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

When the data volume on the disk is written to, the bitmap file on the same disk is updated. No replication occurs.

**d. Ensure that the PathPrefix directory is available.**

```
nodeC# mount | grep /global/etc
```

**e. Confirm that the file system is fit to be mounted on the secondary cluster.**

```
nodeC# fsck -y /dev/md/nfsset/rdisk/d200
```

**f. Bring the application into a managed state, and bring it online on the secondary cluster.**

```
nodeC# clresourcegroup online -eM nodeC nfs-rg
```

**g. Access the client machine as the root role.**

You see a prompt that resembles the following:

```
client-machine#
```

**h. Mount the application directory that was created in [Step 4](#) to the application directory on the secondary volume.**

```
client-machine# mount -o rw lhost-nfsrg-sec:/global/mountpoint /dir
```

i. **Display the mounted directory.**

```
client-machine# ls /dir
```

7. **Ensure that the directory displayed in [Step 5](#) is the same as the directory displayed in [Step 6](#).**

8. **Return the application on the primary volume to the mounted application directory.**

a. **Take the application resource group offline on the secondary volume.**

```
nodeC# clresource disable -g nfs-rg +
nodeC# clresourcegroup offline nfs-rg
```

b. **Ensure that the global volume is unmounted from the secondary volume.**

```
nodeC# umount /global/mountpoint
```

c. **Bring the application resource group into a managed state, and bring it online on the primary cluster.**

```
nodeA# clresourcegroup online -eM nodeA nfs-rg
```

d. **Change the primary volume to replicating mode.**

Run the following command for Sun StorageTek Availability Suite software:

```
nodeA# /usr/sbin/sndradm -n -u lhost-reprg-prim \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 lhost-reprg-sec \
/dev/md/nfsset/rdisk/d200 \
/dev/md/nfsset/rdisk/d203 ip sync
```

When the primary volume is written to, the secondary volume is updated by Sun StorageTek Availability Suite software.

**See Also** [“Example of How to Manage a Takeover” on page 330](#)

## Example of How to Manage a Takeover

This section describes how to update the DNS entries. For additional information, see [“Guidelines for Managing a Takeover” on page 303](#).

This section contains the following procedure:

- [“How to Update the DNS Entry” on page 331](#)

## ▼ How to Update the DNS Entry

For an illustration of how DNS maps a client to a cluster, see [Figure A-6](#).

### 1. Start the `nsupdate` command.

For more information, see the `nsupdate(1M)` man page.

### 2. Remove the current DNS mapping between the logical hostname of the application resource group and the cluster IP address for both clusters.

```
> update delete lhost-nfsrg-prim A
> update delete lhost-nfsrg-sec A
> update delete ipaddress1rev.in-addr.arpa ttl PTR lhost-nfsrg-prim
> update delete ipaddress2rev.in-addr.arpa ttl PTR lhost-nfsrg-sec
```

`ipaddress1rev`            The IP address of the primary cluster, in reverse order.

`ipaddress2rev`            The IP address of the secondary cluster, in reverse order.

`ttl`                        The time to live, in seconds. A typical value is 3600.

### 3. Create a new DNS mapping between the logical hostname of the application resource group and the cluster IP address, for both clusters.

Map the primary logical hostname to the IP address of the secondary cluster and map the secondary logical hostname to the IP address of the primary cluster.

```
> update add lhost-nfsrg-prim ttl A ipaddress2fwd
> update add lhost-nfsrg-sec ttl A ipaddress1fwd
> update add ipaddress2rev.in-addr.arpa ttl PTR lhost-nfsrg-prim
> update add ipaddress1rev.in-addr.arpa ttl PTR lhost-nfsrg-sec
```

`ipaddress2fwd`            The IP address of the secondary cluster, in forward order.

`ipaddress1fwd`            The IP address of the primary cluster, in forward order.



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